I, Noel Gauthier, hereby submit this original work as part of the requirements for the degree of Master of Design in Design.

It is entitled:
Designing for Disruption: Preparing Product Designers for the Next Billion

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Committee chair: Steven Doehler,
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Designing for Disruption: Preparing Product Designers for the Next Billion

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Abstract:

The Industrial Designer's role in Social Construction has always been evidenced by the outputs of the Design function. Now the question is being raised in the Design Community whether the inputs of the Design Function can have a primary leading role in effecting Social Construction. The exhibition “Design for the Other 90%” and the organization Project H, for example, have moved these designers from artificers to instigators. Should Design be involved in these challenges? There are examples showing that in some situations long term growth can occur by jump-starting stalled markets. There is growing thought that social business concepts that develop humanitarian products can be the spark necessary to restore momentum and opportunity to these markets. If we are going to do that, however, we must fundamentally understand not only what people in these situations most need, but what they find valuable in order to create meaningful products that are motivating enough to create transactions. This thesis looks at programs that have been successful in deploying enabling products that are both profitable and address a social need in an economic demographic making under $5 a day, often referred to as the “Bottom of the Pyramid.” It analyzes them using traditional Industrial Design techniques for determining value, and then suggests the possibility of a new model focusing on Risk and Flow. It proposes that Industrial Design can play a primary role in these areas of Social Construction by aligning products with the values of the world’s poorest customers, and doing so in a way that creates stronger markets that empower their people.
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1.0 Introduction

In 2007 the Cooper-Hewitt hosted “Design for the Other 90%”, the first major exhibition of Product Design work focused on serving the needs of the world’s poor. Products ranging from ceramic water filters to low cost laptops to solar-charged light emitting textiles promised an exciting possibility for the field of design to make an impact for the greater good. Solutions for agriculture, housing, education, health, and transportation were all present. The message was that there was a role for Design and all that was needed was more awareness.

Since then high profile projects like One Laptop Per Child, Tom’s Shoes, and Project H have brought the spotlight to many of these design-centric philanthropies. More and more designers have shifted their academic focus to projects and principles that aim to be more inclusive of the world’s poor. In only five years this movement changed much of the pedagogy and language within the world of design, even to where the venerable IDEO has launched a spinoff focused only on humanitarian efforts called IDEO.org (Blinn, 2011).

In a field of World Bank economists, Rockefeller trained philanthropists, and a history of colonialism, what possible role do designers have at the table? In the mature markets that Industrial Designers are trained for, a bad product simply fails to make it into production or fizzles out in the marketplace. In the fragile economies of the developing world, however, a badly placed product can destroy endemic industries, create dependency, and leave the area worse off than before.

The reality is that designers are trained to operate in the rich world of mature markets and the tools they are given do not operate accurately outside that 10% of the world, the 90% C.K. Prahalad calls the “Bottom of the Pyramid” (BoP). The economic background, development practices, and cultural challenges required for working in emerging markets are simply not part of their training.

Many Companies and organizations both public and private see the needs of this population as both a humanitarian and profit opportunity. Many see it as both. While much of this activity will go on
between world economists and policy makers, there is contingency in the Design world that says designers should be at the table as well. As products are sought to fill needs and wants, product designers are trained to align them with consumer's values. The values at the BoP, however, require more care and different techniques than typical designers are trained for.

This thesis proposes that if designers are to transition from a secondary role of fulfillment to a primary role in the process of Social Construction, the tools they use to gauge value must be adjusted. It theorizes that a method of gauging using risk and flow could be a successful tool in developing highly adoptable products that encourage commerce and empower people to leave the BoP.
2.0 Seeking Impact

2.1 Two Hundred Years Ago

Jeffery Sachs, Director of the Earth Institute and previous director of the Millennium Project, summarizes in his book that two hundred years ago we were all poor. We all died young. We all had large families. We were all quickly and unpredictably wiped out by disease, and for the most part we had little to no say in our governments. (Sachs, 2005). He writes “China, India, Europe, and and Japan all had similar income levels at the time of the European discoveries of the sea routes to Asia” (Sachs, 2005, p. 26). For the most part, the planet had similar per capita incomes and per capita GDPs (Sachs, 2005, p. 28).

The longer lived generations made it to about 40 (Sachs, 2005, p. 26), and we had large families in order to maintain a workforce for our farms. Disease and epidemics wiped out massive populations with little impediment. Our Governments were not that much different either. For the most part our leaders owned the resources and used them how they wished with little to no say from their populations (Collier, 2007).

2.2 Today is Good

Regarding the last two hundred years, however, Sachs writes “The US per capita income increased almost twenty-five fold during this period” (Sachs, 2005, p. 28). Our food production skyrocketed. Advancements in technology have changed nearly every aspect of our lives. We have small highly educated families that in many countries are getting smaller than their previous generations. Those same children are vaccinated against diseases that used to wipe out whole communities. Our leaders see their popularity rankings changed daily as we vote them in and out of office. Our concept of food scarcity
has reversed to the point where half of our population now struggles with obesity and related diseases (CDC, 2011).

2.3 But Not For Everyone

This increase in prosperity did not equally effect everyone. Depending on the version of the numbers, this increase only lifted about 20% of the world’s population. According to Jaqueline Novogratz from the social venture Acumen Fund; the future is here, just not for everyone (Novogratz, 2009). In the end, after two hundred years of the fastest technological advancements the world has ever seen, the vast majority of the population lives as though those advancements never happened (Sachs, 2005).

2.4 What is Poverty?

The New Oxford American Dictionary defines “poverty” as “the state of being extremely poor” (Stevenson & Lindberg, 2010). The UN defines “Absolute Poverty” as “a condition characterised by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services” (Gordon, n.d., p. 14). The World Bank’s definition is a bit more truncated, defining poverty as “pronounced deprivation in well-being” (Haughton & Khandker, 2009). Paul Polak’s is even more direct “most poor people are poor is because they don't have enough money” (Polak, 2008, p. 53). Countries, however, can establish their own thresholds and indicators for poverty. Simply referring to “poverty” then, becomes a moving target with varying definitions.
2.4.1 The “Bottom of the Pyramid” (BoP)

C.K.Prahalad describes the global distribution of global wealth as such: “At the top of the pyramid are the wealthy, with numerous opportunities for generating high levels of income. More than 4 billion people live at the BoP on less than $2 per day” (Prahalad, 2008). This definition does not include indicators for quality of life, access to education, health, powerlessness, or many of the other qualifiers of poverty (Haughton & Khandker, 2009). This thesis will focus on applications for this group.

![Illustration of the “Bottom of the Pyramid” (Prahalad, 2008, 129)]

2.5 A Desire to React

As the awareness of this gap grows, so has the number of people seeking to address them (Leviner, Crutchfield, & Wells, 2010). David Bornstein writes in his book How to Change the World, “To sum up, more people today have the freedom, time, wealth, health, exposure, social mobility, and confidence to address social problems in bold new ways.” (Bornstein, 2007, p. 7).

This time we have a cheat sheet. We have the advantage of tackling these problems with the help of current technology and understanding, not to mention the understanding of what we tried that didn’t work (Collier, 2007). Collier writes “The problem of the bottom billion is serious, but it is fixable. It is much less daunting than the dramatic problems that were overcome in the twentieth century: disease, fascism, and communism.” (Collier, 2007, p. 12).
2.6 The Role of Design

As Designers, what is our role in the change we want to create? This thesis focuses on the role of “Industrial”, or “Product” Designers specifically. This thesis will refer to Industrial Design and Product Design interchangeably as “Design.” This thesis also does not differentiate between designers brought in to a region to solve a problem or designers local to the area, but seeks to develop a method to be used by either and focuses on the necessity of local empowerment in either case.

Design carries much of the weight of our consumerist culture, after all we promoted the practice of purposefully designing products to become obsolete- known as “planned obsolescence” (Stenquist, 2011). We are in the business of helping to convince people to buy things. Yes, we may do that by authentically making a better product, or a safer product, or a more beautiful product (Norman, 2002), or a product that solves a need people were not even aware they had (Norman, 2009). But in it’s simplest essence, our role is to align a product with the values of a customer so that a transaction may take place (Cagan & Vogel, 2002). What possible role can we play in the global alleviation of Poverty?

2.7 Growing Awareness

Clearly we are not alone in this desire to help. Proof of this awareness is in the organizations we start, the academic programs we attend, and the aid we give. Growth in these areas are measurable and impressive, often times outgrowing traditional enterprises (Austin & Stevenson, 2006). The money given can be staggering.

It is estimated that non-profit organizations are catching up quickly with the productivity levels of for-profit industries (Drayton, 2006). At times, formation of these organizations outgrew traditional business formation (Austin & Stevenson, 2006). This growth is not limited to the United States either, Bornstein writes, “Twenty years ago, for example, Indonesia had only one independent environmental organization. Today it has more than 2,000. In Bangladesh, most of the country’s development work is handled by 20,000 NGOs” (Bornstein, 2007, p. 4).
This increase in socially minded employment has impacted the academic paths open to students. The list of business schools hosting such programs grows continually (Dorado, 2006). In his book *Out of Poverty*, Paul Polak describes the large draw of the growing programs has helped run (Polak, 2008, p. 197). He goes on to call for nothing short of a revolution in the way we teach Design (Polak, 2008) in order to “embrace design for the other 90% of the world’s population” (Polak, 2008, p. 74)

### 2.8 Seeking the Impact

So what has the impact been of this attention and effort? Has it been effective at enabling the BoP?

### 3.0 Observing Impact

#### 3.1 Aid

Perhaps the easiest case to single out has been that of Africa. After 50 years and roughly 1 Trillion Dollars the result has been that many countries are not much worse than they were before the aid began. The business of Aid has become a self-perpetuating engine that leaves populations as the best product their political leaders have to offer up to giving organizations (Moyo, 2009). Aid instills corruption. It choking commerce. It wastes infrastructure. It starts wars (Collier, 2007). Currently in Africa the easiest indicator for success is if a country even so much as decides in doesn’t want aid anymore (Moyo, 2009).

In her book *Dead Aid*, Dambisa Moyo finishes her explanation of aid with this summary:

So there we have it: sixty years, over US$1 trillion dollars of African aid, and not much good to show for it. Were aid simply innocuous – just not doing what it claimed it would do – this book would not have been written. The problem is that aid is not benign – it’s malignant. No longer
part of the potential solution, it’s part of the problem – in fact aid is the problem. (Moyo, 2009, p. 47).

Collier continues similarly, pointing out that when looked at as a windfall infusion of cash, oil can be seen as a analogous of the effect of aid. This influx has done little to help the populations of these countries or lead to long term growth (Collier, 2007), in fact, most often it does the opposite.

Much of this failure has to do with the seeming meddling of outsiders who believe they knew what is best (Moyo, 2009, p. 225). Novogratz recalls:

We saw countless examples of well-intentioned projects gone wrong: Hundreds of maize mills, an important labor-saving device, lay in disrepair because the locals weren't trained to fix them. Or the mills would lay idle because the village lacked access to the proper fuel to run them. Good-hearted people would build schools without thinking about the costs of hiring and supporting a teacher-not for months but for years-and the schools would stand empty. Women would be encouraged to make crafts though there was no market for them, and so we'd visit homes piled to the ceilings with unsold sisal baskets.(Novogratz, 2009).

Polak points out that most often he finds these aid workers and distributors have little understanding as to how to make money, a skill set he finds critical to the population they are there to help (Polak, 2008, p. 195).

There is also a self-perpetuation that aid can create in countries. Often times aid simply never makes it to the programs it is meant to- In Uganda during the 1990’s it was estimated that roughly 20 cents of each US $1 actually made it to it’s purpose (Moyo, 2009, p. 52), thusly requiring more aid for the same goal. Corruption is not enough to stop a country from developing though, some do quite well under it (Collier, 2007, p. 65). Distributing this aid requires and industry itself. Moyo accounts how there are at least 500,000 people in the western world who are “in the business of aid” (Moyo, 2009, p. 54). The larger issue becomes that when a country’s easiest source of income becomes the poor welfare of their
people, and the engine created around that is to dispense aid for those people (Moyo, 2009), the most lucrative path for those in power is to simply keep their people poor (Moyo, 2009).

3.2 Social Enterprise

What of our organizations then? In recent years, studies have shown that the mystique of the citizen sector has grown. Particularly around the movement by those like Bill Drayton and Muhammad Yunus. Their idea in principle is simple, use the same market behaviors that are responsible for our own three hundred year ascent in a pointed and purposeful way to create self-sustaining enterprises and businesses that solve social issues (Austin & Stevenson, 2006).

William “Bill” Drayton is widely credited with coining the term “Social Entrepreneur” (Davis, 2002, p. 6) several decades ago. He founded Ashoka in 1981 with the goal of supporting individuals solving social needs using the same tools and skill sets as profit based entrepreneurs (Bornstein, 2007). The basic principle was to find people who were already impacting their community, often times by conducting extensive interviews with the population, and give them the tools they needed to extend their reach. With the stated goal of promoting adoptable change, their track record is quite good. According to a study conducted by Leviner, Crutchfield, and Wells, 56% of these elected entrepreneurs known as “Ashoka Fellows” impacted policy change on the national level 5 years after they had been elected to the program (Leviner et al., 2010). That number grows to 71% after 10 years. Equally impressive is the rate of replication. The same study points that that after 5 and 10 years, 82% and 93% of Ashoka fellows reported their cause being taken up by other independent groups.

In 2006, Mohammad Yunus and Grameen Bank received the Nobel Peace Prize for pioneering the concept of micro-credit (Bornstein, 2007, p. 14). While in recent years micro-credit is no longer seen as solve-all solution for poverty, and can be as poorly or properly run as any institution, it is still regarded that access to credit is the lifeblood to the small businesses operating at the BoP (Prahalad, 2010). Bornstein goes on to call it a “global movement” that is “reaching 82 Million of the world’s poorest

### 3.3 Social Market Equilibrium

As with any market based approach, the goal is to find inefficiencies that can be filled to reach an equilibrium. The in-equilibrium here being the gap in what people need and what is available to them (Austin & Stevenson, 2006). The challenge being that these are individuals making under $2 a day and the needs are as basic as water and shelter (Polak, 2008).

In a recent talk by Paul Polak, an audience member asked if it wasn’t an over-simplification to describe the world’s poor in “Western” terms of spending and earning. Polak responded by pointing out that the difference between a one-acre farmer making $1 a day versus $3 a day was the difference between his family regularly growing hungry and 1 of his five children dying, or being able to afford to feed and school his family (Polak, 2011b). Prahalad describes that in many cases markets at the BoP are so hindered by inefficiencies that they cease to work (Prahalad, 2010). At times it is not that the areas are as capital poor as they appear, it is that the systems in place tend to be unorganized (Moyo, 2009) and inefficient monopolies (Prahalad, 2010). It is these market gaps that will attract solutions under the premise of Social Entrepreneurship (Austin & Stevenson, 2006, p. 3). If these gaps can be crossed, and either costs lowered or profits heightened, it has been Polak’s experience that the poor used this extra income to invest “in improvements in their nutrition, health, housing, education, and agriculture-the very things the lack of which many development experts regard as the root causes of poverty” (Polak, 2008, p. 169). After working for 25 years interviewing thirty thousand poor farmers Polak has come to the conclusion that with a little extra income families at the BoP “invest in many of the things development experts believe are important, but they do it following their own family's priorities” (Polak, 2008, p. 171).
Polak concluded his response by noting that it was the avoidance of clear money making enterprises by development organizations that was the “Western” idea, not the inclusion of it (Polak, 2011b).

It is Polak’s premise that “creating new markets that serve poor customers increases the incomes of poor people by producing and marketing their high-value, labor-intensive products and services” (Polak, 2008, p. 155). In that way inefficiencies and hinderances can begin to be tackled using market behaviors (Toor, 2011). In some cases this requires products that allow people to produce more, sometimes it is a product that allows people to sell more (Polak, 2008, p. 146). It is through this mechanism of low-cost, market appropriate solutions that allows us to see that “the conversion of the BOP into an active market is essentially a developmental activity” (Prahalad, 2008, p. 47). While clearly no single activity can solve poverty, there are areas of the world where “our goal should be to build capacity for people to escape poverty and deprivation through self-sustaining market-based systems (Prahalad, 2008, p. 77).

3.4 Small Transaction, Big Market

While the individual transaction amounts are extremely small, they are countered by the massive size of the potential markets. This has gotten the attention of companies who see these people not necessarily as too poor to be considered, but as the next billion consumers (Townsend, 2011). Unfortunately these new customers often have absolutely no interest in the products these companies typically sell (Prahalad, 2008).

Prahalad writes “There is a clear recognition that four billion micro consumers and micro producers constitute a significant market and represent an engine of innovation, vitality, and growth” (Prahalad, 2008, p. 73). And if coaxing these markets out of stagnation by providing needed products is a way that companies can “do well by doing good” (Prahalad, 2008, p. 126), it seems as though this would be an easy opportunity for companies wanting to expand. And many have, like Coca-Cola who often times finding ways into countries before even the development experts.
3.5 The Aspirational Product

The question then, is of what relevance does a 25 cent Coca-Cola have to a dollar a day farmer suffering from malnutrition and diarrhea (Polak, 2011b)? We’ve seen that giving away food and medications in the form of aid has proven an expensive if not ineffective strategy. Yet Coca-Cola has had a far broader distribution than the medications did. What then, if the fizzy sugar water contained the nutrients and antidiarrheal medications the farmer needs could be sold for 5 cents (Polak, 2011)? Products like this that address a critical need yet meet a market desire have inspired both small organizations and multinational corporations to venture into this challenging kind of development, to varying levels of success.

4.0 Design at the Bottom of the Pyramid

4.1 Little Information

One could venture to say that learning how to design for the world’s 10% has prepared us with 10% of what we need to know for designing for the other 90%. Especially when we aim to enable these same customers to leave the poverty (Bhan, 2010). There are ground rules that have been uncovered by these early products. These principles should be researched heavily for a full understanding, the following is a summary of some of the emerging attributes.

4.2 Ground Rules

We know from examples that the products have to be cheap, really cheap. We know they must operate without the infrastructural support we so often assume. We know they will be used by people who
are often illiterate and math-illiterate. We know that the product must be scalable. We know that decisions requiring someone to come out of their cultural or societal norm are more difficult than we often anticipate. We know that the technology is far easier to solve than the distribution, and that the distribution is a problem far more complicated than the mature markets prepare us for.

4.2.1 Affordability

Polak summarizes the important role that cost plays at the BoP as “Affordability isn't everything. It's the only thing” (Polak, 2008, p. 65). He even calls a class he teaches with Jim Patell and David Kelly at Stanford simply “Extreme Affordability” (Polak, 2008, p. 197). Prahalad also describes it as one of the single-most important factors (Prahalad, 2010) and Jaqueline Novogratz from Acumen Fund has sent her colleagues and students out into the city with only $5 in their pockets to see how they fair (Novogratz, 2009, p. 248).

4.2.2 Infrastructure

Being that a chief issue to the BoP is the lack of infrastructure, particularly lack of roads and power distribution, it is a massive issue regarding distribution and trade. Moyo writes that “no profit seeking company can afford to bet on Africa’s unreliable power and erratic telecommunications as the source of manufactured inputs” (Moyo, 2009, p. 121).

4.2.3 Scale

As part of his “Don’t Bother” trilogy, Polak states “If you don't think you can sell at least a million units at an unsubsidized price to poor customers after the design process is completed, don't bother” (Polak, 2008, p. 75). This consistently comes up as a theme in both the development and funding
aspect of such ventures (Novogratz, 2009). The Gates foundation has it as one of its main stipulations (Polak, 2008, p. 189).

4.2.4 Social Awareness

The issue of societal appropriateness is of course pivotal and not to be over simplified. While every culture and community can have its own idiosyncrasies that must be accounted for, there is a competing requirement to develop a product that must appeal to a massive market. Jan Chipcase, former head of Nokia research summarizes this delicate balance:

Whilst convenience is certainly valued, it is not necessary in every instance. Practices driven by more social motivations are stickier simply because the decision to opt out of using the technology becomes one of whether to opt out of society (Chipchase, 2009, p. 10).

4.2.5 Distribution

Given the infrastructure, often difficult environments, and low density, it comes to no surprise that one of the largest issues concerning markets in the BoP is crossing the “Last Mile.” A term coined by the telecommunications industry (Polak, 2011a), the last mile refers to the exponential cost increase of bringing a service the “last mile” to a customer. Polak has focused on this specifically, referring to it in the BoP as the “Last 500 feet” (Polak, 2011a).

4.3 Co-creation

We’ve also come to understand that a greater degree of co-creation is necessary for working in the BoP, in many ways it becomes a pre-requisite. Polak describes this process of working in rural workshops to produce working prototypes with the people there, then packing up and going through the
same process at the next village, seeking input and talking with people (Polak, 2008, p. 79). The reasons for this stem not only from the complexity involved in developing such systems and products, but also the requirement that the communities be left more self-sustaining and independent than when the effort began (Ford, 2009). *If the goal is to repair or even build a market to the point where it is strong and vibrant then the participants in that market must be given the skill sets and awareness to truly participate, otherwise the result will simply be a new set of monopolies.*

Bruce Nussbaum ponders whether or not we should even be meddling in his article “Is Humanitarian Design the New Imperialism?” (Nussbaum, 2010) Practically any book on development recounts stories of infrastructure built and wasted, irrelevant programs soaking up donor funds, and rock-star philanthropists sweeping in to save the world. There is such a potential for asymmetry when corporations or organizations come into “help” and such a history of failed attempts that in many countries US influence is regarded by most as negative (Moyo, 2009, p. 109). The West are not the only ones involved in development though. Moyo documents the radically different approach China has had in Africa. Seeing Africa as an investment opportunity, China has aggressively partnered with many countries on the continent (Moyo, 2009). She writes “China’s African role is wider, more sophisticated and more businesslike than any other country’s at any time in the post-war period” (Moyo, 2009).

In his book *Small Change: Why business Won’t Save the World*, Michael Edwards takes on an even more critical view asking “Can we compete ourselves into a more cooperative future, or consume our way to conserve the planet’s scarce resources, or grow our way out of deep-rooted poverty and oppression, or fight our way to peace? Such ideas are disingenuous at best and dishonest at worst” (Edwards, 2010, p. xi). He goes on to say that no great social movement in the United States has ever been mobilized by the market (Edwards, 2010, p. 14). Not only that, but the “profit vs social good” line is so thin and easy to cross that “a survey of 25 joint ventures in the United States showed that 22 ‘had significant conflicts between mission and the demands of corporate stakeholders’” (Edwards, 2010, p. 45). He points out the hubris in the trend of “philanthrocapitalism” pointing that business leaders are often “not willing to believe that poverty reduction is a far more complicated matter than the idea of
eBay” (Edwards, 2010, p. 73). By no means is he stating that these issues cannot be solved, however, but that “doing so requires the empowerment of those closest to the problems, as well as the transformation of the systems, structures, values, and relationships that prevent most of the world's population from participating equally in the fruits of global progress” (Edwards, 2010, p. 10).

It is clear from these examples that the risks in the BoP are high, and their complexities not to be over simplified. Prahalad describes it as a “kaleidoscope” with every twist pointing out a new challenge or opportunity (Prahalad, 2008, p. 74).

The questions of whether or not we should even be involved and what right we have to “hand down solutions” are difficult. Collier discusses this in terms of economic development referencing the challenge of appointing directors for countries whom “wanted someone from within” when there was simply no one from that country with the necessary skills (Collier, 2007). He also points out that when technical assistance was given before the state had itself begun to implement changes itself it “becomes useless or counterproductive” (Collier, 2007, p. 116). The result is a delicate “donut hole” where the country must first begin to implement change, outside help can effectively fund and assist the transition, and then the country must train its own professional capital in order to maintain growth (Collier, 2007, p. 116).

It is for this reason, that co-creation and empowerment be at the core of any program seeking to impact the world’s poor. In his thesis “Design and Empowerment: Learning from Community Organizing” Ramsey Ford goes to the extent of outlining a new kind of hybrid design process mixing traditional Industrial Design techniques with that of Community Organizing (Ford, 2009). Paul Polak makes a point of personally interviewing 100 BoP farmers every year, “and those who work for me have to do more” (Polak, 2011b). Novogratz opens a chapter with a quote from Lao Tzu-

Go to the people: live with them, learn from them love them start with what they know build with what they have. But of the best leaders, when the job is done, the task accomplished, the people will say: “We have done it ourselves.” (Novogratz, 2009, p. 209).
4.4 Focusing the Role of Design

It becomes necessary again to focus our efforts, to understand that if the role of the Industrial Designer is to lower the hurdles to adoption, than that is still our role in the case of emerging markets. And as is the same in mature markets, in order to understand the hurdles that must lowered, we must understand what makes a product valuable to the the customers at the Bottom of the Pyramid.

4.5 Defining Success

There is an abundance of literature on focusing Design to solve social issues, but how many of those studies focus on objects that meet the criteria necessary for leaving lasting growth for those willing to undertake it?

The following case studies have been chosen based on their ability to provide a beneficial or needed service to customers previously considered unreachable by market forces. While they fit under the category of “Social Design” they have the added characteristic of being financially independent due to their market correct price points. These case studies are not reliant on outside aid, but operate on their own income. While not exhaustive they give a sense of the programs under operation. The following table gives a brief description of these programs as well as how they fulfill the two requirements of profitability and social value.
## 5.0 Case Studies

Table 1. Case Studies with Profitability and Social Value

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<tr>
<th>Profitability</th>
<th>Social Value</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quiron</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Units were designed to meet a price point reachable by the farmers. The increase in farmer output paid off the units quickly and paid for additional units.</td>
<td>Increasing productivity made it easier to leave poverty levels. Combine with the program was assistance with managed grazing and resource conservation.</td>
<td>Impacted 7,000 poor families in Brazil by bringing in solar power units to small acreage farmers.</td>
</tr>
<tr>
<td><strong>ToughStuff</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kiosk style setup allows entrepreneurs to charge mobile phones and radios</td>
<td>maintains consistent communication in areas where electrical power is scarce and inconsistent.</td>
<td>$30 small scale highly durable solar panels.</td>
</tr>
<tr>
<td><strong>Chotu Kool</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vendors and families reduce waste, lowering food costs.</td>
<td>less food waste and longer sell times, resulting in less time transporting and more profitable growing.</td>
<td>A refrigerator for India that can cool power free, uses one-tenth the parts of a conventional fridge and half the power.</td>
</tr>
<tr>
<td><strong>Saiban</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By establishing a presence with which municipalities can deal with, actual land ownership can be established, giving value to squatted tracts.</td>
<td>Home and land ownership allows families to maintain a sense of permanence with encourages investment and improvement.</td>
<td>Provides home-ownership and land to low income groups in Pakistan.</td>
</tr>
<tr>
<td><strong>CEMEX</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By selling concrete to families previously unable to afford home improvement, CEMEX massively grew their market.</td>
<td>Gave people a vehicle with which to save and pay incrementally and improve their homes.</td>
<td>Allows families to add onto their home in both construction and payment installments, also giving them a vehicle with which to save in order to make payments.</td>
</tr>
<tr>
<td><strong>Aravind</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By creating a highly efficient and structured surgery process, Aravind was able control and minimize costs and vastly grow their market.</td>
<td>Providing eye not only increases quality of life for the affected but increases their capacity for work and independence.</td>
<td>Innovative business and care model providing high quality eye surgery in India.</td>
</tr>
<tr>
<td><strong>BRAC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By establishing an effective distribution model, BRAC was able to deliver products previously not profitably reachable.</td>
<td>Provided products like iodized salts and and antibiotics where previously unavailable.</td>
<td>Organization enlisting over 1,800 Bangladeshi women who distribute basic medical supplies.</td>
</tr>
<tr>
<td><strong>Living Goods</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By establishing an effective distribution model, Living Goods delivers critical medicines not consistently available.</td>
<td>Medications for illnesses like malaria, diarrhea, worms, and tuberculosis are made available.</td>
<td>Has trained over 600 women to distribute basic medical supplies in Uganda, often making more than $100 a week.</td>
</tr>
<tr>
<td>Profitability</td>
<td>Social Value</td>
<td>Summary</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Spring Health</strong></td>
<td>Provides profitable business model to village shopkeepers. Established independent brand establishes credibility village to village.</td>
<td>Provides clean water alleviates water borne diarrhea and countless other water borne diseases.</td>
</tr>
<tr>
<td><strong>Tata Swach Bulb</strong></td>
<td>Sacrificial bulb reached a price point attainable my a much larger market then previous models.</td>
<td>In home clean water reduced water borne illnesses.</td>
</tr>
<tr>
<td><strong>Grameen Bank</strong></td>
<td>Many reports show a 98% repayment rate insuring a return on even the small amounts, again multiplied by a large market.</td>
<td>Investment allowed households to increase incomes through small business ventures.</td>
</tr>
<tr>
<td><strong>Sente</strong></td>
<td>Allowed money transfer in areas either inaccessible or monopolized by local moneylender. Increases income streams for cell vendors.</td>
<td>From remittances to simple money transfer cash liquidity and mobility keeps people from traps from local moneylenders and increases commerce.</td>
</tr>
<tr>
<td><strong>Charging Busses</strong></td>
<td>Gives bus operators a clear market differentiator.</td>
<td>Unattended phone charging is often not possible in fringe markets, allowing customers to charge while traveling is a safe advantage.</td>
</tr>
<tr>
<td><strong>Nokia 1100</strong></td>
<td>By creating a highly durable and inexpensive phone, Nokia was able to access a massive and previously unreached market.</td>
<td>While leapfrogging existing communication infrastructures, the phone is also credited with sparking BoP mobile banking.</td>
</tr>
<tr>
<td><strong>Drishtee</strong></td>
<td>Village entrepreneurs are aided in setting up a business around an internet enabled kiosk. Village farmers and ranchers can then check prices regarding when to sell.</td>
<td>Being that farmers and ranchers now have more information they can then choose when to sell, no longer subject to the whim of the closest buyer.</td>
</tr>
<tr>
<td><strong>IDE Donkey Cart</strong></td>
<td>Given a failure in infrastructural transportation, cart owners were able to earn $200 a month.</td>
<td>Being able to transport food to and from markets is key for both fulfillment and production.</td>
</tr>
<tr>
<td><strong>Tata dealership</strong></td>
<td>By reducing the time to profit, Tata was able to increase the market area.</td>
<td>Customers had access to newer more reliable vehicles, and dealers were able to sell them.</td>
</tr>
</tbody>
</table>
Bicycle delivery companies were able to increase payloads. Lower cost for transported items. Extended bicycle frame allowing increased load for human powered transport.

**IDE Treadle Pump**

Allowed farmers to grow out of season and high value produce for significant profit. Increased income allows families more stability and a path out of poverty. Human powered pumps allowing low-cost irrigated farming.

**Vegetable Collection Centers**

By pooling their crops, farmers are able to have more negotiating power and more consistent sales. Increased stability and earnings aids willingness of families to invest in growth and education. Program in Nepal allowing small farmers to pool their produce to sell to larger buyers.

### 6.0 Evaluation

#### 6.1 Measuring Success

How do these align when charted on tools developed for mature markets that help us determine value?

In their book *Creating Breakthrough Products*, Jonathan Cagan and Craig M. Vogel outline a thorough process for identifying product opportunities and executing them in a way that maximizes value. While not written specifically for BoP applications many of its tenants for design requirements hold true, most notably that if “a product does not connect with the values of consumers, it will fail” (Cagan & Vogel, 2002, p. 4). The book also contains case studies of products that have been highly successful by aligning themselves with these values. The pattern they find is that these products maximize style and technology while adding value.

They theorize that “the Upper Right, with integrated style and technology and the only place with significant value, is the place to which a company must move and be positioned in order to best differentiate itself from the competition and to succeed” (Cagan & Vogel, 2002, p. 5). In order to help visualize this classification, they developed a 2x2 matrix using these indicators. They also point out that products cannot simply mix high style and technology, but must “climb the Sheer Cliff of Value” (Cagan
& Vogel, 2002, p. 51) in order to align their products with their customers desires and lifestyle in order to create something of high value.

![2x2 Position Map](image)

Figure 2. Illustration of the 2x2 “Position Map”(Cagan & Vogel, 2002, p. 59)

While the concepts of “Technology” and “Style” are broad and somewhat vague, they can be used to pinpoint differences in our perceptions of products. Technology can be understood by the mastery of manufacturing process, range of features, or general complexity of the object. Style is understood by the aesthetic sense, design cohesiveness, and consistency with brand. The third dimension, that of Value, is accomplished by creating products that fit in line with the customers aspirations and lifestyle. In order to achieve maximum profit and differentiation companies must develop products that can excel in these areas (Cagan & Vogel, 2002, p. 34).

One of their key case studies is the OXO Goodgrips peeler. They discuss how OXO was able to develop a new technology in order mold their handle in a material not used before in the kitchen accessory category. A strong design language was used in order create a unique and identifiable object. Focusing on users struggling with arthritis allowed them to identify the need of customers with limited hand desiring a tool easier to hold. The combination of this allowed them to develop a premium product that gave a sense of quality and aligned with customer’s values (Cagan & Vogel, 2002).
This model is consistent with the paradigm in which many designers are trained. Typically products are focused on harnessing a new advancement, aligning with a new trend, or identifying with a new desire. Products such as an iPad or Prius are easily categorized as combining a high level of technology with a purposeful use of style while aligning themselves with the aspirational values of their target customers. How do products that have been successful in the BoP align within this matrix?

The following is a qualitative analysis rating the case studies on their conglomerated attributes of technology and style. This is done by using Cagan and Vogul’s method of rating lifestyle impact, ergonomics, and features (Cagan & Vogel, 2002). More tangibly- attributes such as level of complexity, degree of scientific advancement, novel technologies, will gain a higher technology score. Items with a refined aesthetic, consistent branding, and ergonomic refinement will fetch a higher style score.

6.1.1 Outside Evaluation

In order to gauge these products along these criteria, a scoping survey was created to gather insight as to how designers would rate these products along Cagan and Vogul’s scale. Twenty participants were given descriptions of the projects as well as images of the good or service. Their answers were averaged, and the results are shown in Table 2. The complete survey can be found in the Appendix.
### 6.2 Technology vs. Style

Table 2. Survey results using methods from Cagan & Vogel’s *Creating Breakthrough Products*.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Explanation</th>
<th>Technology</th>
<th>Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Quiron</td>
<td>mostly a conglomeration of parts, focus on repairability and durability</td>
<td>3.2</td>
<td>1.2</td>
</tr>
<tr>
<td>2 Green Light</td>
<td>cohesive unit in designed enclosure</td>
<td>3.4</td>
<td>4.1</td>
</tr>
<tr>
<td>3 ToughStuff</td>
<td>cohesive unit in designed enclosure and consistent branding across line</td>
<td>3.4</td>
<td>5.1</td>
</tr>
<tr>
<td>4 Chotu Kool</td>
<td>cohesive unit in designed enclosure</td>
<td>4.9</td>
<td>6.0</td>
</tr>
<tr>
<td>5 Saiban</td>
<td>basic structures designed for simple construction</td>
<td>1.9</td>
<td>2.1</td>
</tr>
<tr>
<td>6 CEMEX</td>
<td>basic structures designed for simple construction</td>
<td>1.8</td>
<td>2.3</td>
</tr>
<tr>
<td>7 Aravind</td>
<td>highly developed system to ensure consistent, relatively consistent branding</td>
<td>8.2</td>
<td>5.0</td>
</tr>
<tr>
<td>8 BRAC</td>
<td>plain clothes distributors focus on individual relationships for basic medical supplies</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>9 Living Goods</td>
<td>Uniformed distributors carry a range of medicines</td>
<td>1.3</td>
<td>2.2</td>
</tr>
<tr>
<td>10 Spring Health</td>
<td>Consistent branding distributing low-tech water cleaning methods</td>
<td>3.3</td>
<td>3.5</td>
</tr>
<tr>
<td>11 Tata Swach Bulb</td>
<td>well branded rice husk filter</td>
<td>4.6</td>
<td>7.2</td>
</tr>
<tr>
<td>12 Grameen Bank</td>
<td>primarily focusing on interpersonal risk analysis, the brand has been carried well into other ventures though</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td>13 Sente</td>
<td>Informal system incorporated into pre-pay cell time business</td>
<td>4.3</td>
<td>2.7</td>
</tr>
<tr>
<td>14 Charging Busses</td>
<td>primarily informal system</td>
<td>1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>15 Nokia 1100</td>
<td>specifically designed for harsh environment</td>
<td>7.2</td>
<td>6.8</td>
</tr>
<tr>
<td>16 Drishtee</td>
<td>various low-cost computers in possibly branded building.</td>
<td>3.6</td>
<td>2.6</td>
</tr>
<tr>
<td>17 IDE Donkey Cart</td>
<td>specifically designed for simple welding and repair</td>
<td>1.3</td>
<td>1.1</td>
</tr>
<tr>
<td>18 Tata dealership</td>
<td>purposefully low-tech vehicles to often informal dealers</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>19 Big Boda</td>
<td>designed for simple welding and repair, yellow color consistent</td>
<td>1.6</td>
<td>1.3</td>
</tr>
<tr>
<td>20 IDE Treadle Pump</td>
<td>heavily engineered for robustness and ease of repair, innovative marketing</td>
<td>2.1</td>
<td>1.0</td>
</tr>
<tr>
<td>21 Vegetable Collection Centers</td>
<td>informal system creates cohesive face to buyers</td>
<td>1.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>
6.3 TvS Chart

Chart 1. Data from Table 2 into a 2x2 matrix.

6.4 Re-evaluating

Several products do fall within the Upper Right, but it is clear that it does not indicate success as well as it did in mature markets. While much of this is clearly due to the targeted price point of these products, it also indicates the differing kinds of competition these products are facing. While the Technology Vs. Style Positioning Map is designed to show how products can move ahead in a competitive market of saturation, this thesis proposes that successful products in the BoP must operate in a stalled market of scarcity.
What is clearly in line, however, is the requirement that products align with the value systems of their customers. Cagan points this out stating that “Value in its true sense is lifestyle-driven, not cost-driven” (Cagan & Vogel, 2002, p. 52). That clearly holds up in the BoP markets (Prahalad, 2010). Cagan also writes, however, that the greatest opportunity for adding high value resides within the “Upper Right” quadrant (Cagan & Vogel, 2002, p. 51). In the BoP analysis, however, products proving themselves to be highly valued occur all over the chart.

It is evident then that the quadrants must be re-evaluated to be more accurate in the BoP markets. If the fundamental contexts of high competition in high saturation markets for which the “Technology Vs. Style” method was designed for is adjusted for highly stalled markets of high scarcity, it makes sense to adjust the quadrants to those indicators. This thesis proposes that in order to combat a market that has ceased to move, products that encourage motion and transactions are necessary to spark those markets into motion. It is also clear, however, those those products must operate in an environment without the resources to gracefully accept failure. This thesis proposes that this is because successful products in the BoP must be able to operate in scarcity by reducing the risk of their opportunity costs.

How then will these case studies align when categorized by their abilities to increase Flow while reducing Risk?

7.0 Re-evaluation

The following table re-analyzes the case studies qualitatively based on the results of the scoping survey looking at Risk and Flow. Risk was explained as the degree of opportunity cost taken on by the main actor in the transaction. Items requiring a high purchase price, illiquidity, high degree of trust, or high contrast with social norm were to receive a higher risk score. Flow was explained in a classical Systems Thinking approach in that it is the movement of some thing to another place influence of a causal variable (Meadows & Wright, 2008). Items that increase the ability operate, transport, communicate, and so on were to receive a higher score in flow.
7.1 Risk vs. Flow

Table 3. Survey results of case studies isolating Risk and Flow.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Explanation</th>
<th>Flow</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Quiron</td>
<td>installment payment and modular system allows farmers to grow system while modernizing their production</td>
<td>7.5</td>
<td>3.0</td>
</tr>
<tr>
<td>2 Green Light</td>
<td>low price first market while replacing kerosene costs</td>
<td>7.3</td>
<td>3.8</td>
</tr>
<tr>
<td>3 ToughStuff</td>
<td>low upfront cost allows entrepreneurs to start a high need lucrative business</td>
<td>7.3</td>
<td>5.1</td>
</tr>
<tr>
<td>4 Chotu Kool</td>
<td>low cost unit allows less waste and increased profit</td>
<td>7.2</td>
<td>4.4</td>
</tr>
<tr>
<td>5 Saiban</td>
<td>gives a previously unattainable path to ownership</td>
<td>6.3</td>
<td>3.4</td>
</tr>
<tr>
<td>6 CEMEX</td>
<td>gives a previously unattainable path to home building</td>
<td>6.0</td>
<td>3.2</td>
</tr>
<tr>
<td>7 Aravind</td>
<td>sliding pay scale, increased productivity</td>
<td>8.9</td>
<td>5.1</td>
</tr>
<tr>
<td>8 BRAC</td>
<td>low cost medicine previously unavailable or requiring long trips, increasing productivity or time away</td>
<td>5.7</td>
<td>2.2</td>
</tr>
<tr>
<td>9 Living Goods</td>
<td>critical medicine previously unavailable or requiring long trips, increasing productivity or time away</td>
<td>5.8</td>
<td>2.0</td>
</tr>
<tr>
<td>10 Spring Health</td>
<td>massive time lost due to illness alleviated, very low cost to customer and retailer</td>
<td>6.9</td>
<td>2.8</td>
</tr>
<tr>
<td>11 Tata Swatch Bulb</td>
<td>massive time lost due to illness alleviated, low cost to customer and retailer</td>
<td>6.7</td>
<td>4.3</td>
</tr>
<tr>
<td>12 Grameen Bank</td>
<td>access to capital reduces the risks of the moneylender and allows a path to growth</td>
<td>8.3</td>
<td>3.6</td>
</tr>
<tr>
<td>13 Sente</td>
<td>massively lowers the cost and risk of transferring money</td>
<td>7.3</td>
<td>3.5</td>
</tr>
<tr>
<td>14 Charging Busses</td>
<td>allows monitored charging while traveling</td>
<td>5.3</td>
<td>1.3</td>
</tr>
<tr>
<td>15 Nokia 1100</td>
<td>attainable price allowed a new level of communication</td>
<td>8.8</td>
<td>4.9</td>
</tr>
<tr>
<td>16 Drishtee</td>
<td>growers could decide when they sold, and to whom</td>
<td>7.3</td>
<td>1.7</td>
</tr>
<tr>
<td>17 IDE Donkey Cart</td>
<td>allowed an exponential increase in the amount that individuals we able to move and sell</td>
<td>6.7</td>
<td>2.2</td>
</tr>
<tr>
<td>18 Tata dealership</td>
<td>dealers are able mitigate the risk of inventory</td>
<td>8.3</td>
<td>5.1</td>
</tr>
<tr>
<td>19 Big Boda</td>
<td>allowed an exponential increase in the amount that individuals we able to move and sell</td>
<td>6.0</td>
<td>2.2</td>
</tr>
<tr>
<td>20 IDE Treadle Pump</td>
<td>in most cases doubled income from small farms</td>
<td>7.8</td>
<td>2.6</td>
</tr>
<tr>
<td>21 Vegetable Collection Centers</td>
<td>increased ability to invest in expanding farms</td>
<td>6.6</td>
<td>1.7</td>
</tr>
</tbody>
</table>
7.2 RvF Chart

Chart 2. Data from Table 3 into a 2x2 matrix.

7.3 Double Check

When these products are compared by their ability to increase Flow while requiring the least amount of Risk a clear pattern arises. In sharp contrast to the mature market system of pursuing high technology, high style items, the ability to reflect customer’s desire for low cost highly impactful objects defines the value set. It comes to no surprise though that in an environment operating under extreme scarcity and inefficiency, products that can make the most of resources while requiring minimal resources would be highly valued. *What is encouraging is that, according to this research, these products fit into the value structure of the customers at the BoP enough for a transaction to occur.*
7.4 A New Strategy

C.K. Prahalad argues that developing markets in the BoP should be synonymous with development activity (Prahalad, 2010). This should this be done with products that fit within the constraints of the current markets while addressing a social need (Polak, 2008). This research indicates that the successful products addressing these requirements consistently do this by addressing inefficiencies in markets of scarcity by increasing flow and lowering risk. It also shows that the value structures of the customers BoP are in line with the development goals hoping to be achieved. This thesis proposes that products designed to jump start markets by offering increased efficiency and maximizing scarcity are valid development tools that align with the values of their intended populations and customers, however, the design guidelines must be re-calibrated for this market in order to accurately do so.

7.5 Attacking Key Hurdles

If Industrial Design is to carry a primary role in Social Construction in the BoP in a sustaining and enabling way, based on this research, it should focus on lowering the adoption hurdles for profitable products that address social needs, this thesis proposes that the most consistent way to do that is to maximize the flow and minimize the risk for products that align with the values of the intended population.

8.0 Understanding Risk
8.1 Risk

In his book *Out of Poverty*, Paul Polak recounts a story where he asked a one-acre farmer why he did not plant the more efficient “green revolution” rice that could triple his yields. The farmer replied that in his region, a 10 year flood would wipe out his crop and the year would be a loss. He could afford a loss of the regular seeds. The slightly increased cost of the high-tech seeds, however, would be too much for him to bear, and his home would be lost to the local moneylender and his family homeless (Polak, 2008). It is under this mindset that understanding the importance of Risk be understood. Risk can be defined and mitigated in a number of ways. These case studies exemplify methods ranging from modular purchasing, group purchasing, shared use, word of mouth marketing, single-use sizing, and many more.

8.2 Reducing Risk

Most of these case studies reduce risk by developing the product for maximum affordability. This is exemplified by many of the products from Paul Polak’s non-profit firm International Development Enterprises. These products are relentlessly refined for every cost savings available (Polak, 2008). In developing their Drip Irrigation system, they reduced the thickness of the walls of the tube to the absolute minimum, replaced the bucket used to hold the water with a plastic bag, and replaced the filter with instructions on how to flick the tubes to dislodge debris. This kind of aggressive cost cutting allowed them to reach a price point that millions could afford (Polak, 2008).

Another key attribute is the amount of risk in trusting the source of the purchase. Word of mouth has been a powerful element in BoP marketing. Programs from IDE’s low-cost treadle pumps to Green Lights high tech solar lanterns all incorporate local knowledgable individuals. By recruiting respected individuals in their communities, these programs are able to relay their message through a medium that is relevant and directed.
8.3 Sharing Risk

Another effective method has been sharing the risk with a group of individuals. In some cases the sharing has been a purposeful part of the design, such as in the lending strategy of Grameen Bank. By lending to groups of women, not only does the bank spread out its own risk, but the individual lendees are able to spread out the risk of the loan as well (Bornstein, 2007). Other times it is a more informal activity such has been observed of cell phone owners. By maintaining their own SIM cards but sharing the cost of the phone, users are able to share the cost (Chipchase, 2009). This is also demonstrated in the Vegetable Collection Centers in Nepal. In this case the collected farmers are able to sell to larger buyers by selling as a unit, lowering the risk of the buyer seeking out individual farmers (Polak, 2011a).

8.4 Spacing out Risk

Spacing out risk has also been a process successful in the BoP. According to some, installment plans can revolutionize these economies (Bornstein, 2007, p. 39). Buying pieces of a whole has been successfully used in instances ranging from the explosion of single-serving size personal care products from Unilever to slowly building entire homes with CEMEX (Prahalad, 2008). Another successful method has been designing systems to be modular. By allowing customers to buy small independently working parts that can be combined into a larger whole, people are able to space out the risk at their own pace while enjoying the benefits of each individual piece. This can be exemplified by IDE’s drip irrigation system which can scale from a small kitchen garden to an entire acre. Polak refers to this intense modularity by asking “How many ants does it take to make a horse?” (Polak, 2008, p. 66).

8.5 Risk Attributes

Table 4. Comparison of case studies showing risk reduction methods.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Main Attribute</th>
<th>Reduction</th>
<th>Sharing</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiron</td>
<td>low cost</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green Light</td>
<td>low cost</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ToughStuff</td>
<td>low cost</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Studies</td>
<td>Main Attribute</td>
<td>Reduction</td>
<td>Sharing</td>
<td>Spacing</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Chotu Kool</td>
<td>low cost</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saiban</td>
<td>increment payment, low cost construction</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>CEMEX</td>
<td>increment payment, low cost construction</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Aravind</td>
<td>sliding scale payment</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>BRAC</td>
<td>long trips to supply removed, continual risk of illness mitigated</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Living Goods</td>
<td>long trips to supply removed, continual risk of illness mitigated</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Spring Health</td>
<td>long trips to supply removed, continual risk of water borne illness mitigated</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Tata Swach Bulb</td>
<td>continual risk of water borne illness mitigated</td>
<td>x</td>
<td></td>
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<tr>
<td>Grameen Bank</td>
<td>better terms than typical endemic systems, group loans, shared repayment</td>
<td>x</td>
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<tr>
<td>Sente</td>
<td>better terms than typical endemic systems</td>
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<td></td>
<td>x</td>
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<tr>
<td>Charging Busses</td>
<td>observed charging, shared cost</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Nokia 1100</td>
<td>low cost, often shared</td>
<td>x</td>
<td></td>
<td></td>
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<tr>
<td>Drishtee</td>
<td>long trip to buyer controlled, prices shared</td>
<td>x</td>
<td></td>
<td>x</td>
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<tr>
<td>IDE Donkey Cart</td>
<td>drastically reduced costs to transport</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Tata dealership</td>
<td>spacing allows risk of inventory to be mitigated</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Big Boda</td>
<td>reduced costs to transport</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>IDE Treadle Pump</td>
<td>typically paired with micro-credit drastically reduces cost of irrigation</td>
<td></td>
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<tr>
<td>Vegetable Collection Centers</td>
<td>allows farmers to share bargaining power</td>
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</table>

9.0 Understanding Flow

9.1 Flow

If we look at poverty caused by the failing and stagnation of markets (Haughton & Khandker, 2009), it becomes clear why products that increase flow and movement are so critical. Case Studies demonstrate this as being the improved movement of a product to a market, the movement of money into a financial tool, the movement of price information to a farmer, the movement of a communication, or as simple of the movement of water to plants, and many more. In short, products that operate well in an environment of scarcity brought to a halt through inefficiencies.
9.2 Adding Capacity

One way to increase flow is to add or create a capacity that was previously not there. The most outstanding examples of this has been the explosive growth of the mobile phone and subsequent mobile money services. These products and programs literally introduced communication and financial capacity where there had been none before (Chipchase, 2009). The internet kiosks from Drishtee also added such a capacity. Previously, farmers and ranchers would have to transport their product to a buyer in order to find a price. This placed tremendous advantage to the buyer as the seller would have to transport the product home and to market again another day unless a deal was made. By being able to check prices from various buyers from a Drishtee kiosk the seller can now decide when they leave and to what buyer they go (Novogratz, 2009).

9.3 Reducing Resistance

By reducing the resistance in flow of systems already in place, additional capacity can be added. An example of this is IDE’s very successful treadle pump. Limited to a draw of only a few feet, the pump is by no means transporting water over great distances, but maximizing the water already there (Polak, 2008). The Big Boda is another key example. Designed to be retrofit onto an already popular bicycle, the extended cargo capacity drastically increases the carrying loads per rider and route. This also applies to many of the solar projects like Green Light and Quiron. By no longer being limited by the unavailability or inconstancy of infrastructural grid power, customers can reliably increase their access to power independently and modularly.
9.4 Increasing Distance

Key to solving the problem of the “Last 500 Feet,” increasing distance is critical to bringing increased flow to where it was previously unavailable (Polak, 2011a). Distribution systems like BRAC and Living Goods exemplify this well. By offering in income source to people already in the area, they are also able to make the most of that persons local knowledge and relationships. An inspiring example of this is Spring Health’s model. By offering a water cleaning solution that takes place at the point of sale, they are able deliver clean water to villages far beyond the range of traditional treatment plants.

9.5 Flow Attributes

Table 5. Comparison of case studies showing methods to increase Flow.

<table>
<thead>
<tr>
<th>Studies</th>
<th>Main Attribute</th>
<th>↑Capacity</th>
<th>↓Resistance</th>
<th>↑Distance</th>
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<tbody>
<tr>
<td>Quiron</td>
<td>longer day, easier interior lighting</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>Green Light</td>
<td>longer day, easier interior lighting</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>ToughStuff</td>
<td>key commodity, no infrastructure</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Chotu Kool</td>
<td>less spoilage</td>
<td>x</td>
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<td>Saiban</td>
<td>easier path to home</td>
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<tr>
<td>CEMEX</td>
<td>easier path to home</td>
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<td>x</td>
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<td>Aravind</td>
<td>better sight vastly improves productivity</td>
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<tr>
<td>BRAC</td>
<td>increases range and availability of needed goods</td>
<td>x</td>
<td></td>
<td>x</td>
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<tr>
<td>Living Goods</td>
<td>increases range and availability of needed goods</td>
<td>x</td>
<td></td>
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<tr>
<td>Spring Health</td>
<td>key commodity, farther range</td>
<td></td>
<td></td>
<td>x</td>
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<tr>
<td>Tata Swatch Bulb</td>
<td>highly inexpensive bulb increases water availability</td>
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<td></td>
<td>x</td>
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<tr>
<td>Grameen Bank</td>
<td>rural location loan to women previously unable to receive loans</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Sente</td>
<td>highly mobile system works without infrastructure or endemic systems</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Charging Busses</td>
<td>allows easier use of mobile devices</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>Nokia 1100</td>
<td>leapfrogged communication infrastructure</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Drishtee</td>
<td>allows farmers to increase production with better price control</td>
<td>x</td>
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<tr>
<td>IDE Donkey Cart</td>
<td>increased both the distance and amount to be sold</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Studies</td>
<td>Main Attribute</td>
<td>↑Capacity</td>
<td>↓Resistance</td>
<td>↑Distance</td>
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<tr>
<td>Tata dealership</td>
<td>increases number of cars available in more rural areas</td>
<td>x</td>
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<tr>
<td>Big Boda</td>
<td>increases loads on routes</td>
<td></td>
<td>x</td>
<td></td>
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<tr>
<td>IDE Treadle Pump</td>
<td>moves already available water more efficiently</td>
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<tr>
<td>Vegetable Collection Centers</td>
<td>increases both the market and access to the market</td>
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10.0 From Adoption to Disruption

10.1 Moving from Adoption to Disruption

In the end, products that meet the criteria of being not only profitable and addressing a social need, but do so in a way that increases flow and reduces risk, result in products that have remarkably high ease of adoption. Such potential ease to spread through large populations and supplant the previously entrenched methods fulfill various requirements to fit Clayton Christensen’s definition of a disruptive technology, most specifically that of creating entirely new markets and value sets (Christensen, 2006). This is of course that the due diligence is made in the remaining factors regarding the technology, business model, marketing, distribution, et al.

Looking through the previous tables, there are projects which score highly in both reducing risk and increasing flow, and do so using multiple methods. Projects such as Grameen Bank, the Nokia 1100, IDE’s Treadle Pump, Sente, and Drishtee all have multi-modal ways of accomplishing this. Not surprisingly, these are some of the most successful programs in terms of impact and numbers reached. *Can the same charts be used to identify ways for a product to increase its reach?*
10.1.1 A Bigger Boda

The Big Boda is a cargo carrying extension added to traditional bike frame. It lengthens the wheelbase of the bike while providing cargo area and centering the load over the rear wheel. It was designed to augment the very popular Chinese bikes already ubiquitous in certain regions (Smith & Cooper-Hewitt, 2007).

It scored a 6 in Flow for drastically increasing the amount of cargo capable of an already in place system. It scored a 2.2 in Risk as the systems are already in place and the cheap welded kits require little in terms of explanation or cost. Its primary method of reducing Risk is that it is far cheaper than a dedicated cargo bicycle, if one could be found, or a motorbike. Its primary method of increasing Flow is increased capacity. How could the Boda be made bigger?

Already being a modular system, it makes sense to follow Polak’s advice and see how many more ants it would take to make this a horse. If the next competitor is a motorbike, it could increase in that direction. There could be brackets and tabs on the extended frame that allow a small gasoline or diesel motor to be added, essentially turning the bike into a cargo moped. This could increase distance by assisting the rider with the heavier load. The cargo frame could be modified again to use two rear wheels. Keeping within the ecosystem of the bikes already at hand, additional stability and increased load capacity could be achieved without adding foreign parts. Additional revenue could be achieved by loading bikes not currently on deliveries onto generators to produce power and charge the ubiquitous car batteries used when power fails (Chipchase, 2009) or charge the rider’s phones so delivery changes could be made en route.

Further steps to reduce risk could involve chartering out bikes for individuals to use. An installment plan could be used to purchase bikes as single-use renters pay a bit each time for eventual ownership. Being that the bikes can expand to near the operational value of a motorbike, the financial
leap required to upgrade is now smaller, giving a higher value to the bikes that make it though the upgrade cycle.

This “Bigger Boda” would provide a purchase path all the way from single use to eventual sale. It would provide a low-risk opportunity for motivated entrepreneurs, and could lower the cost of transportation. Endemic modifications are easily adapted to the system, and it requires little outside resources. It gives multiple modes of income and use, and asks little cultural change. It creates a new market while increasing economic activity and enabling those who engage it.

10.2 Disrupting Mature Markets

In his book The Innovator’s Dilemma, Clayton Christensen seeks out why good companies that listen well to their customers can be broadsided by new technologies that seemingly under-perform their current offering. Could it be possible then, that Christensen’s concept of disruption could see these same simple and highly adoptable BoP technologies undercut, underperform, but outsell products in mature markets? Some mature market products inspired by BoP products have done just that.

In his article “Emerging Markets as a Source of Disruptive Innovation: 5 Case Studies” Niti Bhan answers this question in an analysis that tracks several of those products (Bhan, 2010). One of his case studies traces the roots of the highly successful EEE PC to the MIT project One Laptop Per Child. While the original implementation of the highly inexpensive laptop has fallen short of its original goals (Nussbaum, 2010), the “underperforming” technologies found their way into a product that created a new market segment. He also references the Tata Swach Bulb, a water purifier sold in India based on technology developed for BoP customers. Perhaps one of the most intriguing has been the development of portable solar systems designed for markets without infrastructure. These have reached price points that the stumbling demand in more mature markets have thus been unable to inspire. He concludes “Product design and development for these challenging markets show all the signs of being a form of disruptive technology or innovation” (Bhan, 2010).
11.0 Designing for Disruption

11.1 Conclusion

Superficially it is easy to see solutions for the world’s poor. We are accustomed to living in a world of clean water, good infrastructure, and easy access to information that we are surrounded by simple and effective means of accomplishing them. Combine that with our desire to do good and it is no surprise that there is so much momentum given and attention paid to projects that address the needs of the poor.

It is also no surprise that the actual complications of the environments these products must operate in has contributed to an inconsistent track-record of success in either alleviating poverty or achieving economic success. Every program and product must integrate its own distribution system while acknowledging local customs but on a scale of millions all while fitting in the budget of a customer making $1 a day, as well as empowering the individual and addressing a social need that heretofore has not been solved efficiently.

Fortunately there are examples to study that have addressed these concerns, and their successes have shown that profitable products with social benefits can work. In the end it is the technology that is the simple part, and the adoption hurdles that are challenging. It is in this role of lowering adoption hurdles that the field of Industrial Design can assist the economic independence of the BoP. By focusing on lowering risk and maximizing flow, designers can create products that empower customers.

This thesis proposes further study into the variables of Risk and Flow as effective indicators for successful products designed for enabling the BoP. The literature presented in this study indicates that appropriately designed market appropriate products can act as an effective development activity. The analysis indicates that there is a role for Industrial Design to be an active participant in Social
Construction by lowering adoption hurdles for beneficial products that enable people to jump-start markets and empower them escape the BoP. The scoping study indicates that more accurate and specific design guidelines could be developed to create these products.

In order for companies to successfully do this, however, they must understand that they are inevitably designing for disruption, whether that be destructive or constructive depends on their ability to correctly identify accurate guidelines for their process. This thesis proposes that there is a great opportunity for research in understanding the design attributes of successful products in the BoP in order to build a model that can create predictable outputs.
Bibliography


Examining Humanitarian Design

Quiron

Profitability:
Units were designed to meet a price point reachable by the farmers. The increase in farmer output paid off the units quickly and paid for additional units.

Social Value:
Increasing productivity made it easier to leave poverty levels. Combine with the program was assistance with managed grazing and resource conservation.

Impact:
7,000 poor families in Brazil by bringing in solar power units to small acreage farmers.

Technology: mastery of manufacturing process, range of features, general complexity of the object
Style: aesthetic sense, design cohesiveness, consistency with brand
Risk: opportunity costs of purchase, probability of failure, consequence of failure
Flow: capability to increase inputs or outputs

Appendix- Survey for Case Studies
Green Light
Profitability:
Electric light does not require constant kerosene purchases. Provided income stream to entrepreneur distributors.
Social Value:
Interior kerosene lamps increases indoor particulates and fire hazards.
Impact:
Indian company enlists villagers to sell $18 solar lanterns to replace dangerous indoor kerosene lamps.

Technology | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10
Style | | | | | | | | | |
Risk | | | | | | | | | |
Flow | | | | | | | | | |

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Examining Humanitarian Design

ToughStuff

**Profitability:**
Kiosk style setup allows entrepreneurs to charge mobile phones and radios

**Social Value:**
maintains consistent communication in areas where electrical power is scarce and inconsistent.

**Impact:**
$30 small scale highly durable solar panels.

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Examining Humanitarian Design

Chotu Kool

**Profitability:**
Vendors and families reduce waste, lowering food costs.

**Social Value:**
less food waste and longer sell times, resulting in less time transporting and more profitable growing.

**Impact:**
A refrigerator for India that can cool power free, uses one-tenth the parts of a conventional fridge and half the power.

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Saiban
Profitability:
By establishing a presence with which municipalities can deal with, actual land ownership can be established, giving value to squatted tracts.

Social Value:
Home and land ownership allows families to maintain a sense permanence with encourages investment and improvement.

Impact:
Provides home-ownership and land to low income groups in Pakistan.

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Flow: capability to increase inputs or outputs
Examining Humanitarian Design

CEMEX
Profitability:
By selling concrete to families previously unable to afford home improvement, CEMEX massively grew their market.

Social Value:
Gives people a vehicle with which to save and pay incrementally and improve their homes.

Impact:
Allows families to add onto their home in both construction and payment installments.

Technology: mastery of manufacturing process, range of features, general complexity of the object
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Examining Humanitarian Design

Aravind

Profitability:
By creating a highly efficient and structured surgery process, Aravind was able to control and minimize costs and vastly grow their market.

Social Value:
Providing eye care not only increases quality of life for the affected but increases their capacity for work and independence.

Impact:
Innovative business and care model providing high-quality eye surgery in India.

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**Brac**

**Profitability:**
By establishing an effective distribution model, BRAC was able to deliver products previously not profitably reachable.

**Social Value:**
Provided products like iodized salts and antibiotics where previously unavailable.

**Impact:**
Organization enlisting over 1,800 Bangladeshi women who distribute basic medical supplies.

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Examining Humanitarian Design

Living Goods

Profitability:
By establishing an effective distribution model, Living Goods delivers critical medicines not consistently available.

Social Value:
Medications for illnesses like malaria, diarrhea, worms, and tuberculosis are made available.

Impact:
Has trained over 600 women to distribute basic medical supplies in Uganda, often making more than $100 a week.

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Examining Humanitarian Design

Spring Health
Profitability:
Provides profitable business model to village shopkeepers. Established independent brand establishes credibility village to village.

Social Value:
Providing clean water alleviates water borne diarrhea and countless other water borne diseases.

Impact:
Clean water system designed for village shopkeepers.

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Examining Humanitarian Design

Tata Swach

**Profitability:**
Sacrificial bulb reached a price point attainable by a much larger market than previous models.

**Social Value:**
In-home clean water reduced waterborne illnesses.

**Impact:**
Ultra low cost water filtration system.

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### Tata Swach

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Next
Examining Humanitarian Design

Grameen Bank

Profitability:
Many reports show a 98% repayment rate insuring a return on even the small amounts, again multiplied by a large market.  

Social Value:
Investment allowed households to increase incomes through small business ventures.  

Impact:
Offers small loans to groups of women in order to invest in new enterprises.

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Sente

Profitability:
Allowed money transfer in areas either inaccessible or monopolized by local moneylender. Increases income streams for cell vendors.

Social Value:
From remittances to simple money transfer cash liquidity and mobility keeps people from traps from local moneylenders and increases commerce.

Impact:
Informal banking system allowing users to transfer money via phone kiosk vendors.

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Charging Busses

Profitability:
Gives bus operators a clear market differentiator.

Social Value:
Unattended phone charging is often not possible in fringe markets, allowing customers to charge while traveling is a safe advantage.

Impact:
In India it is not uncommon for longer distance buses to offer cell phone charging.

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Nokia 1100

Profitability:
By creating a highly durable and inexpensive phone, Nokia was able to access a massive and previously unreached market.

Social Value:
While leapfrogging existing communication infrastructures, the phone is also credited with sparking BoP mobile banking.

Impact:
Highest selling mobile phone in history, typically credited with sparking the African telecommunication revolution.

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Drishtee

**Profitability:**
Village entrepreneurs are aided in setting up a business around an internet enabled kiosk. Village farmers and ranchers can then check prices regarding when to sell.

**Social Value:**
Being that farmers and ranchers now have more information they can then choose when to sell, no longer subject to the whim of the closest buyer.

**Impact:**
Internet communication kiosks for Indian villages.

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Examining Humanitarian Design

IDE Donkey Cart

Profitability:
Given a failure in infrastructural transportation, cart owners were able to earn $200 a month.

Social Value:
Being able to transport food to and from markets is key for both fulfillment and production.

Impact:
Re-engineered carts to increase Somalian transportation options.

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Tata Dealerships

**Profitability:**
By reducing the time to profit, Tata was able to increase the market area.

**Social Value:**
Customers had access to newer more reliable vehicles, and dealers were able to sell them.

**Impact:**
Redesigned compensation program allowing dealers to make profit from every third truck sold.

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**Big Boda**

**Profitability:**
Delivery companies were able to increase payloads.

**Social Value:**
Lower cost for transported items.

**Impact:**
Extended bicycle frame allowing increased load for human powered transport.

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IDE Treadle Pump

Profitability:
Allowed farmers to grow out of season and high value produce for significant profit.

Social Value:
Increased income allows families more stability and a path out of poverty.

Impact:
Human powered pumps allowing low-cost irrigated farming.

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Vegetable Collection Centers

Profitability:
By pooling their crops, farmers are able to have more negotiating power and more consistent sales.

Social Value:
Increased stability and earnings aids willingness of families to invest in growth and education.

Impact:
Program in Nepal allowing small farmers to pool their produce to sell to larger buyers.

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