

Better by Design

How Empathy Can Lead to More Successful Technologies and Services for the Poor

Professional training becomes a lens through which we see the world. You can imagine a dentist who finds it impossible to concentrate on an opera because the singer has bad teeth. The writer Annie Dillard imagined that the happiest people are constantly surrounded by opportunities to apply their expertise—for example, those who study rocks or clouds. Designers are a pretty happy bunch because opportunities to improve the human condition through design are everywhere. It becomes an obsession. For example, after 10,000 years of post-Ice Age development as a tool-using species, I find it amazing that human beings are still creating uncomfortable chairs (such as the succession of airplane seats where I wrote this article).

My goal in this article is to discuss the accompanying case studies: the Rickshaw Bank of Pradip Sarmah, the Solar Tuki of Anil Chitrakar and Babu Raj Shrestha, and the FGN pump of Gustavo Gennuso. I look at them in the context of design for developing countries, and from my perspective as the founder of Design that Matters (DtM), a nonprofit design consultancy for social enterprise. “Design” is a term used so broadly as to be almost meaningless. In this article, I will discuss design in terms of a problem-solving methodology that uses empathy to identify and contextualize needs, and then translates those needs into a set of specifications to guide the development of new products and services.

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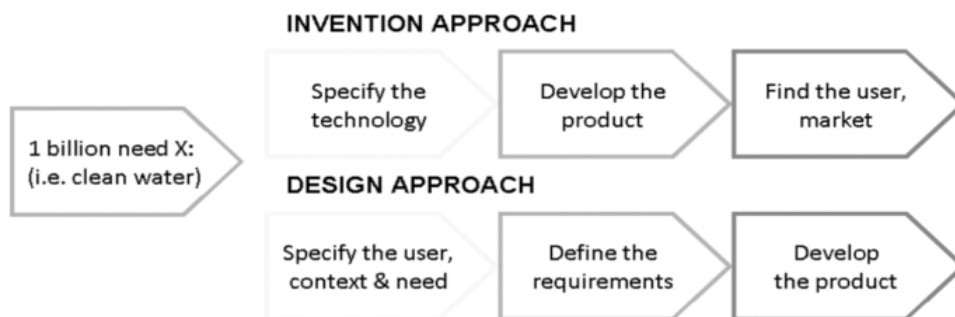


Figure 1. Product Development Processes.

DESIGN AND INVENTION: TWO APPROACHES TO SOLVING PROBLEMS

Every problem-solving effort begins by defining a general problem and a general approach to solving that problem. In the context of the developing world, the general problem could be summarized as “One billion people need X,” where X could be defined as access to clean water, electricity, education, and health care. One example of a general problem-solving approach is the development of new technology. In my work, I see two distinct approaches to problem-solving with technical innovation: the invention approach and the design approach. Figure 1 summarizes and compares the two.

In the invention-centric approach, the inventor begins by specifying the technology that they think will solve the problem. The inventor then attempts to fit the technology to the problem through an iterative series of design refinements. Finally, having tweaked and changed the product into what the inventor hopes will be a useful tool, they then go in search of a specific user group or market segment for which the product is a match. This approach is also described as a technology “push.”

It is not uncommon for product development efforts targeting the poor to begin with the technology, for example by setting the goal of adapting light-emitting diodes (LEDs) to rural lighting, or vapor-phase water purification to providing clean water in rural communities. With the technology approach in hand, the tinkering and refinement process begins—often without the inventor ever having visited the places where the final product is intended to be used.

Our experience and the history of international development suggest that invention—specifying the technology before identifying the market—is a very risky approach to product development. An analogy is the tailor who makes a closet full of lime-green size 56 swallow-tail tuxedos. When customers with that preference walk in the door the tailor is going to make money—but what if they never arrive?

To anyone surveying the landscape of new products and services, “survivor bias” can create the impression that product development is simply a matter of having a great idea.¹ It is possible to look at the success of the Solar Tuki and conclude that there is a tremendous market for LED-based, solar-powered lanterns. The reality is that there have been many solar lantern projects, even in Nepal, and most have failed to achieve significant scale. Similarly, consider the many unsuccessful attempts to scale technologies like the solar cooker and the improved wood-burning stove.

Despite enormous budgets for R&D and marketing, most new products and new technologies created for the commercial market in the industrialized world fail to achieve scale.² In poor countries, the statistics are even worse: we find very few examples of successful appropriate technologies.

The design approach is an alternative to invention. The most basic difference is that where invention often leads to a technology in search of a user (or a solution in search of someone who has that problem), design starts with the user and then goes in search of the technology. In design, specifying the user involves conducting direct and indirect research to define who the user is and what they want—sometimes described as “consumer pull.” A combination of the user’s statement of need and the constraints imposed by their environment creates the product requirements, statements, and metrics that define the “victory conditions” for product features and performance. Developing the product also involves design iterations, but the direction of the refinements is dictated by the user requirements.

Tolstoy wrote that “happy families are all alike; every unhappy family is unhappy in its own way.”³ Successful products are all alike in that they represent a happy marriage between product function and the user’s needs and circumstances. Products that fail do so for a million different reasons.

A common failure of defining the technology before we have defined the user is that the approach puts the burden of adaptation on the user. Who is to blame if they refuse?

In the case of the Rickshaw Bank, the initial production run of the improved rickshaw had a problem with the bicycle chain repeatedly falling off the cog. The team could have satisfied themselves by blaming the problem on user behavior—perhaps the rickshaw-pullers were riding over too many bumps and that was causing the rickshaw frame to flex and the chain to fall off. They could have argued that the rickshaw pullers simply needed to adapt to the technology: ride more slowly, take fewer passengers, or avoid bumps. Instead, the project succeeded because the team listened to the user and adapted their design.

Another common failure is that many inventors attempt to create a “one-size-fits-all” solution to a general global problem: a new product that will solve the problem in any context. First, the “all-in-one” technology often requires that every single user pay for features they don’t need and will never use. Second, given that context is so important, “one-size-fits-all” rarely works. In the case of the FGN pump, based on their experience in Patagonia, the team assumed that a wooden frame was a universal solution to the problem. In Patagonia, this was certainly

true—wood parts are easy to find and inexpensive. But when the team installed the pump in La Puna, where wood is scarce and the local building material is made from cactus, their assumptions did not hold.

Product development is a relatively straightforward process if the inventor is the only customer. This helps to explain the success of the open source software movement and the Linux operating system. Every volunteer programmer is also a system user, so in a sense they are all simply solving their own problems. The slow adoption of Linux outside of the developer community is in part a consequence of non-programmers finding the system to be anything but intuitive.⁴

EMPATHY IN DESIGN, OR WHY KIDS HATE GETTING CLOTHES FOR THEIR BIRTHDAY

The principal difference between the examples of design and invention described above is the demand for empathy: the ability to imagine the world from someone else's perspective. If we want to make a child happy at their birthday party, the approach may not be to give them what we think they need (a new sweater), but rather what they think they want (a new toy).

The first component of empathy is the understanding that there are no “dumb users,” only dumb products. For example, my cell phone, which was clearly developed by a bunch of engineers, contains dozens of amazing features that after two years I have yet to figure out. Hearing this, the cell phone engineer might reply that I am merely lazy—that all of the clever features buried in multiple sub-menus and behind cryptic key combinations would be intuitive if only I would bother to read and memorize the 45-page product manual. In great design, the burden is on the innovator, not the user, to justify every quality and feature of a product.

The second component of empathy in design is the appreciation of context. Again, an engineer might complain when a user shorts out his cell phone in the rain, arguing that the device was only intended for use in dry weather (however absurd that claim). The qualities that define a product or service become either virtues or liabilities as a function of context. Many products are developed with embedded cultural assumptions that prove to be crippling liabilities in the context of a developing country. Examples include general assumptions about the availability of spare parts and trained maintenance, or very specific assumptions about a user's familiarity with the standard iconography of consumer electronics.

The Rickshaw Bank case presents a series of excellent examples of applied design. Although a veterinarian, Pradip Sarmah was not moved by the plight of rickshaw-pullers to offer them free veterinarian services. His approach was dictated by empathy rather than the resources he had at hand. The bank's business model is based on the insight that the rickshaw-puller's lack of access to capital kept him from owning the tools of his trade. Several of the bank's practices—the daily loan payments that match the puller's cash flow, the provision of a uniform to increase dignity and brand identification, and the identity card that allows bank customers to secure gas connections to their homes—are based on direct observations of, and

empathy for, the rickshaw-puller's point of view.

The Rickshaw Bank also illustrates how good design includes non-technological considerations, such as matching loan payments to cash flow. The same is true for the Solar Tuki. The Solar Tuki may be technologically superior to kerosene lanterns, but Chitrakar and Shrestha understood that the kerosene lantern was a better match for consumer budgets. A key innovation was the design of a financial product: a loan for the Solar Tuki whose payment schedule and terms were roughly equivalent to the intended user's daily expense of kerosene for home lighting. By including a five-year warranty for after-sales service on the two-year loan, they could effectively market the Solar Tuki as offering three years of "free" lighting.

DESIGN CAN'T SAVE THE WORLD (ON ITS OWN)

Like financial planning and weight loss, the principles of good design are much easier to describe than to follow. Furthermore, having illustrated the virtues of the design approach, I must now report the bad news: slavish attention to the details of user and context does not guarantee success. Even in the industrialized market, most new products fail. What makes good design so difficult?

In reality, a bewildering number of variables affect product success. The cost of developing an understanding of user behavior and context follows the 80/20 rule:⁵ although it is possible to uncover critical insights very early on in the research process, full knowledge of the constraints imposed by the user, setting, product supply chain, and product lifecycle would require an infinite and therefore impossible investment. From the perspective of design research, the hard part of the 80/20 rule is that we can't control the 20 percent of the insights that we miss. In the worst case, these missing insights, a combination of what Donald Rumsfeld called the "known unknowns" and "unknown unknowns," are the most important ones.

In my experience, the following four user and context constraints have proven particularly difficult to characterize.

Alignment of Incentives

One of DtM's most important and painful lessons is that needs do not necessarily equal markets. We have learned the hard way that altruism is an excellent motivation for someone to do something once. What allows a program to scale is its ability to repeat success over and over again; if that is to happen, all the stakeholders must be motivated as much by self-interest as by the desire to do good. It must be clear from the beginning who will make money selling and/or maintaining the intervention, and how everyone else involved in development and implementation will benefit from the product's success.

Furthermore, user enthusiasm for a great design does not necessarily guarantee that it will be possible to solve the problems of product financing, manufacture, and distribution. As Michael Free at the global health nonprofit PATH says, it is necessary to identify, as early as possible, who will "choose, use, and pay the dues."

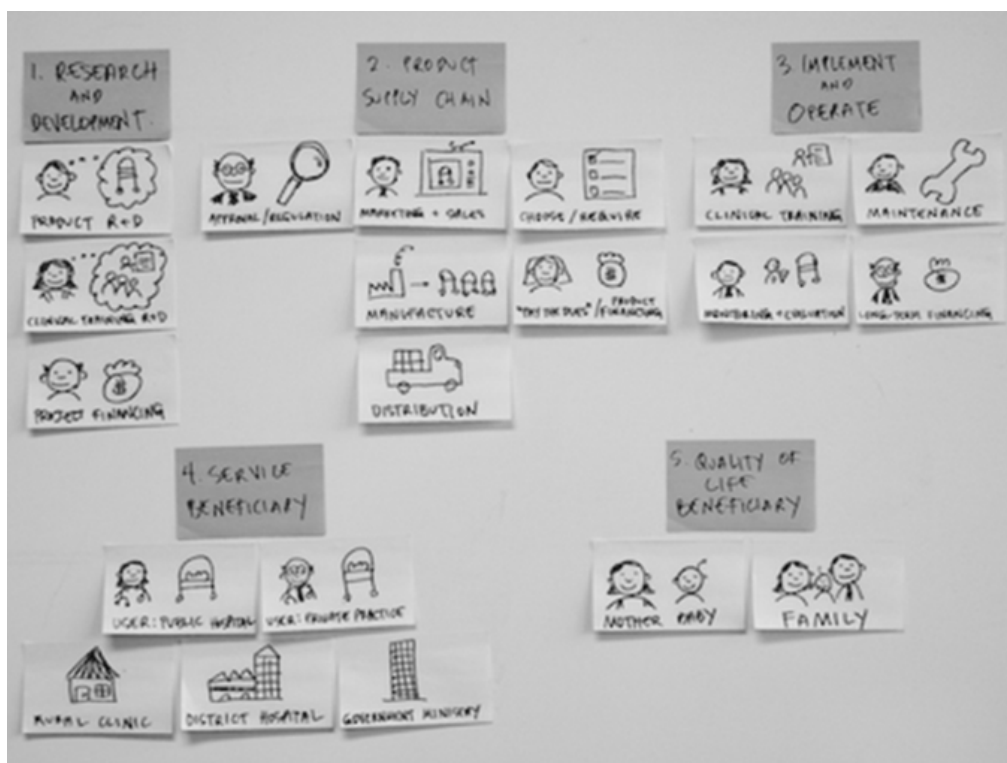


Figure 2. Stakeholders in Product Development and Implementation.

Figure 2 shows all of the stakeholders involved in the development, distribution, and use of a medical device targeting infant and maternal health. Notice that the designer is the stakeholder in the top-left corner. Given the huge scope of product development, manufacture, and implementation, design may be the “least hard” part of the process. The challenge is that any one stakeholder in the process can say no and effectively kill the project. In other words, every stakeholder is necessary; no single stakeholder is sufficient.

In the Rickshaw Bank case, after many unsuccessful attempts to raise project financing through bank loans, the team hit on the innovation of raising capital by selling advertising space on the backs of their improved rickshaws. Similarly, the bank realized that the individual rickshaw puller’s financial success depended on their ability to attract more business, which led to key innovations like the rickshaw puller’s uniform and the redesigned rickshaw’s improved ergonomics, safety, and aesthetics.

The Solar Tuki program faced stiff competition from the existing supply chain for kerosene lanterns and fuel. Rather than competing with kerosene, the team convinced existing kerosene vendors to sell the Solar Tuki as well. This gave vendors a home lighting product to sell during the frequent interruptions of the country’s kerosene supply. Because the Solar Tuki diversified and strengthened their

business, kerosene vendors—potentially their biggest competitors—became their marketing ally.

Another excellent example of design elements informed by stakeholder context is the way Solar Tuki is distributed to students through the program developed by Ashoka Fellow Mahabir Pun. The team changed the distribution pattern so that each student received a light of their own, but the school owned the collective solar-powered charging station. This created a natural alignment of incentives between the goal of Solar Tuki, to distribute lights, and the goal of the school, to increase student attendance. The key was that students had to return to school every day to charge their lights for the evening.

In the FGN case, Gennuso describes the challenge of partnering with NGOs to distribute his products in regions far from the FGN production centers. Although the partnership had many advantages on paper, providing water was not central to the mission of these partner NGOs. This led to disappointing performance in terms of product marketing, sales, and distribution.

Cultural Expectations: We See a Problem, but Do They?

A product or intervention intended to improve a user's quality of life will not necessarily change a culture's view of what's "normal." For example, people in poor countries have adapted in many ways to high infant mortality rates: hospital staff in rural Indonesia have developed low expectations for the survival rates of at-risk newborns, and many parents do not name their infants until their first birthday. It is not that doctors and parents in Indonesia care less about newborns, but rather that within the constraints of the local context they perceive few opportunities to improve infant survival rates. In the FGN case, Gennuso describes the risk of focusing on the extraction of clean drinking water for the home when their customers are more concerned about irrigating their crops.

Sometimes "No Change" Looks Pretty Good

A common misconception in appropriate technology development is that any intervention will automatically be an improvement on existing conditions. In some cases, products intended to generate better health outcomes in clinical care require already overworked hospital staff to take on more responsibilities without any improvement in resources or rewards. Similarly, elaborate water-purification processes can be a hassle when it's hot and we're thirsty—especially if we don't have a clear understanding of the connection between dirty water and disease. In the case of the FGN pump, compelling technical arguments favored a metal frame for the device, but conservative user expectations forced FGN to use a wooden frame.

The Challenge of Understanding Real Costs: What to do When "Free" Isn't

There is an important distinction between a product's "cost to buy" and "cost to own." If I won the Formula One Ferrari in the Changi Airport raffle (free car!), I'd probably have one absolutely wonderful day tearing around the streets of

Singapore—but then, when it came time to pay the thousands of dollars necessary to refill the gas tank and replace the worn tires, joy would turn to sadness and the car would go up on blocks. To extend the metaphor, after the raffle committee delivered the Ferrari to my house, I might not even be able to figure out how to start the motor, let alone drive it safely. International development efforts are full of free “Ferrari giveaways.”

Technology donations are rarely accompanied by grants for ongoing product maintenance and effective user training. As a result, after the ribbon-cutting ceremony, the donor, in Schopenhauer’s words, “hastens to let the curtain fall.”⁶ All too often, organizations misinterpret their delivery of free equipment as the finish line, rather than the starting point, of an aid program.

Meulaboh, a city of 120,000 in West Aceh, Indonesia, was among the areas hardest hit by the 2004 Indian Ocean tsunami. By November 2005, the local referral hospital had received eight high-tech infant incubators, donated by various international donors. By the time I visited this hospital in late 2008, all eight incubators were broken—primarily for want of simple maintenance and inexpensive spare parts, and in part as a consequence of Meulaboh’s high humidity, frequent power surges, and limited support staff. During the same visit, I found in the hospital maintenance office a brand new, unopened incubator diagnostic and calibration tool. The staff explained that they had never received training on how to use the repair device, nor could they read the English-language manual. This situation is common—according to a study conducted by the Engineering World Health group at Duke University, up to 98 percent of donated medical equipment in developing countries is broken within five years.⁷

Lack of maintenance and training is not the only high cost of “free.” The developers of Solar Tuki and the FGN pump both found that competition with donated equipment led to market distortions. “Free” products created unrealistic expectations for product pricing and undermined incentives for change. In many cases, customers in a region receiving donations have no interest in credit schemes, preferring instead to wait for the next round of handouts.

DESIGN LESSONS LEARNED

At DtM we have learned that in product design, unlike academia, there is no such thing as partial credit. To paraphrase Paul Hudnut, social entrepreneurship isn’t Olympic gymnastics—there are no points for difficulty.⁸ Regardless of whether the project we’ve chosen is extremely challenging, like addressing the 1.8 million annual preventable newborn deaths from hypothermia, or relatively “easy,” like maintaining the rural cold chain for tuberculosis drugs in a single country—in the end, the social impact is the only thing that matters. A good designer is an existentialist: either the design is a match for the user need and people use it, or they don’t, and the design effort has had no positive effect.

The good news is that our experience with the 80/20 rule tells us that even a relatively small up-front investment in researching user needs and product context



Ashoka fellow Souleymane Sarr (L), the author, DtM volunteer Martin Tolliver and literacy teacher Amadou Traore during early user testing with the Kinkajou Microfilm Projector. The beta prototype is in pieces on the table.

Photo by Design that Matters.

can pay enormous dividends in the development of appropriate product requirements and the alignment of stakeholder incentives. Below are some lessons learned from the three cases and from DtM's work.

Marry in Haste, Repent at Your Leisure

“Marrying” the wrong set of assumptions early in the product design process can lead to expensive course-corrections at later stages. Assumptions are risky and don’t travel well between countries and cultures. New data has a tendency to demolish old assumptions, but only if we’re paying attention. We have learned to ignore our fear of asking dumb questions in the pursuit of a solid understanding of user needs.

In 2004, we were in the prototyping stage of developing the Kinkajou Microfilm Projector, a portable tool for nighttime adult literacy education in rural Africa. After we received the client’s approval of the basic design, our engineering team produced a concept for a beautiful, rounded projector housing that used an aluminum extrusion. At a design review, MIT Professor Woodie Flowers was unimpressed. “Why don’t you just put the Kinkajou in a lunch box?” he asked. Imagining life from the perspective of a poorly-equipped teacher in rural Africa,



DtM Fellow Matt Eckelman interviewing NICU nurses at the Kanti Children's Hospital, Kathmandu. Having already conducted research at American hospitals, our goal here was to compare standards and practices in the context of extreme financial constraints..

Photo by Design that Matters.

he assumed that aesthetic appeal was far less important than product cost—and subsequent user testing proved him right. The final design is very much like a lunchbox, at a significant cost savings in production.

Alternatives to the Direct Approach

The process of collecting user feedback more resembles psychotherapy than administering a multiple-choice exam. We have learned that the direct approach, asking specific questions based on a survey form, is rarely reliable. In response, we have developed techniques to more fully understand the user and the context.

For example, in our observations and interviews, we have learned to “trust but verify.” We listen carefully to what people say and watch very carefully what they do. We ask the same question many times, in different ways and in different contexts, and with different people at different levels within the organization. We look for variance, disagreement, inconsistency. For example, during early user interviews on our infant incubator project, Nepali nurses in a Kathmandu NICU claimed that they weighed the newborns every 12 to 24 hours, exactly according to protocol. When we asked one nurse to demonstrate the weighing procedure with a doll, she struggled for a couple minutes with an apparatus that resembled a gro-

cery scale combined with a baby hammock before admitting, “Actually, this scale is a hassle and we never use it.” Until this conversation, we never considered adding a scale to the mattress of the incubator.

We have also established some general rules in the process of conducting stakeholder interviews:

- Ask open-ended questions, nothing that could be answered with a yes or no. For example, “Tell me what you think about X.” Rather than interrupting to clarify a question, we will wait and let the interview subject finish. Often people who veer off-topic are answering the question they wish we asked—a great source of unexpected insights.
- People in general are polite, and no one wants to insult us or our product. We try to frame interview questions so that there are no obvious “right” answers.
- Rather than asking directly if a user is having a good experience, we prefer to take an indirect approach: “Could your friends figure this out?” The individual user is, of course, a genius, but most are willing to detail the failings of people in general: “I wouldn’t have any trouble using this, but the other nurses here would never figure it out.”
- Create opportunities for serendipity. We’ve used questions like, “What’s the coolest thing in this hospital?” or “What did I forget to ask?” The answers may provide unexpected insights into local values and constraints.

These are only a few methods for generating insights into the user’s needs and context. The commercial design firm IDEO has developed a Human-Centered Design Toolkit, available on-line, which provides a framework for applying design specifically to the needs of social enterprise.⁹

The Customer Isn’t Always Right

When asked directly what they want, users will typically suggest incremental improvements to what they already have: more of this, less of that. This kind of evolutionary approach to the development of new products and services often represents a failure of imagination.

We have found that in order to create revolutionary product ideas, we have to carefully interpret the user feedback and identify the underlying needs. If a user says they wish a button were red, they could be saying that they wish it was more visible, or that the current color is somehow offensive or inappropriate. In initial interviews for our Kinkajou Microfilm Projector, our client focused on the limitations of their program financing. Although fundraising is not a DtM service, in observing the nighttime adult literacy classrooms in rural Mali we realized that there were significant opportunities to improve the effectiveness of the client’s use of funds. The two most significant obstacles to education in the rural classrooms were access to books and lighting. Limiting ourselves to only these two constraints during brainstorming, we came up with the idea for the portable, battery-powered microfilm projector, a design that overcame the problems of a shortage of books and a lack of classroom lighting in a single product.



DtM Fellow Tom Weis user-testing our infant incubator prototype with Childrens Hospital NICU nurses Maria Davila and Lori Boa. Seeing them accidentally launch a baby doll out of the bassinet and onto the floor gave us the idea to incorporate an infant seatbelt for hand-transport.

Photo by Design that Matters.

Avoiding “Mission: Impossible”

The best products are designed to do one or two things very well, rather than many things poorly. Given that the cost of maximization—finding the optimal compromise between the various requirements—is high in both time and capital, we are typically forced to employ “satisficing,” an approach that attempts to identify the best fit in the least time.¹⁰

At the same time, in early user interviews, it is easy to generate a list of impossible requirements: works perfectly, costs nothing, and lasts forever. Attempting to satisfy every user demand easily leads to “feature creep,” and it becomes exponentially more difficult to optimize the product. This is the real reason for my uncomfortable airplane seat: the airline demands a seat that weighs as little as possible and allows them to pack many passengers into a small space, while the designer aims to provide a comfortable chair. All three of the cases here serve as good examples of first doing one thing well—providing pumps or solar lights or credit to rickshaw peddlers—before adding complexity.

Failure Is, in Fact, an Option

At DtM, our goal in every product development process is the contrarian mantra: “Fail as fast as possible.” Product development is an expensive process and fraught with risk. It is critical to get products in front of users at the earliest possible stages of design. As Diego Rodriguez wrote, “Prototype as if you are right. Listen as if you are wrong.”¹¹ Frequent user course corrections increase the efficiency of the product optimization process.

I have already mentioned the Rickshaw Bank’s problem with the falling bicycle chain. The solution to the problem eluded the bank staff and their partners at IIT Guwahati, until a perceptive rickshaw puller suggested that they replace a section of the rickshaw chassis with a solid iron bar to keep the frame from bending. Fortunately, the bank could quickly implement this change on the first 100 rickshaws in its pilot program. But imagine their difficulties if they had waited to start user testing until they had built thousands of rickshaws using the flawed design.

DtM’s strength as a product design company is not that we have amazing ideas for products. In fact, most of our ideas are terrible. Our strength comes through our collaboration with hundreds of volunteers who provide us with lots and lots of ideas, and the efficient process we have created for vetting our ideas with users and experts to find and develop the winners.

Doing good is no reason to run a bad business.

We have learned to be wary of any project assumptions that depend on the “special case” of social benefit. Product design is an expensive and risky process, and should be considered an intervention of last resort. In the end, the most important question to ask in our due diligence research on new projects is not “Can we do it?” but “Should we?”

One common example of special-case thinking relates to donor-subsidized research and development. The social sector lacks a universal performance metric to serve as the equivalent to profit in the commercial sector. Many social enterprise programs are small, and it is possible that the most cost-effective solution to a specific problem involves the use of existing, off-the-shelf technologies, even if they aren’t perfectly suited to the context. In evaluating a recent program to develop vaccine coolers for a cold chain application in Cambodia, we realized that we could buy each of the 40 clinics a thermo-electric cooler from Wal-Mart, along with a Chinese gas-powered electric generator and a supply of fuel for less than it would cost us to design a prototype cooler that was perfectly suited to the client’s needs, context, and budget.

Another example is the choice of production strategy. As in all design efforts, the trade-off is typically between doing one thing well and a few things poorly. In other words, local production is often assumed to be the best manufacturing strategy for appropriate technologies, in that it creates local jobs—but this approach also introduces significant constraints on product cost and performance, and ultimately limits the potential social impact. Had local production or user assembly

been required initially, I doubt that cell phones would have ever become a global technology. The challenge for each product is to identify the appropriate point on the continuum between the high efficiency of a capital-intensive mass production process and the ultimate local production methodology of having every user build for themselves what Gennuso, thinking about pumps, very appropriately describes as a prototype.

Conclusion

An invention approach to problem-solving is, and will remain, popular among those developing new technologies for the poor. The challenge is that good design is neither necessary nor sufficient for a product to succeed. The oft-cited example is the enormous difference in usability between the Microsoft and Apple Macintosh operating systems of the 1990s. Apple's superior user interface design was not enough to guarantee commercial success in the face of competition from Microsoft's marketing savvy and existing user base.

Saying that we don't need great design insights to launch a successful product or service is similar to saying that we don't need great market insights to make money trading on the stock market. Great success requires luck, and in advocating for the design methodology, I side with those like the authors of the three cases, who clearly define luck as "opportunity meets preparation."

Neil Postman wrote that the early success of "Sesame Street," which is now a global phenomenon, was based on children's familiarity with television commercials, "which they intuitively knew were the most carefully crafted entertainments on television."¹² The same observation applies to product design. We live in a world where luxury goods and consumer electronics represent some of the most carefully crafted products available. It is exciting to have the opportunity to address real human needs as opposed to simply creating consumer desire, and to take the same skills and insights that make a product like the iPod so irresistible and apply them to the creation of new and useful tools for the poor.

Acknowledgements

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1. Survivor bias: the tendency to draw conclusions from a sample set that includes only successes. Although the oldest woman in the world reportedly eats sweets and drinks a glass of sherry every day, it does not follow that those same dietary habits will lead to the same results for everyone.
 2. "Among history-making innovations, those based on new knowledge—whether scientific, technical, or social—rank high. . . . Knowledge-based innovations differ from all others in the time they take, in their casualty rates, and in their predictability, as well as in the challenges they pose to entrepreneurs. Like most superstars, they can be temperamental, capricious, and hard to direct. They have, for instance, the longest lead time of all innovations."from Drucker, P., "The Discipline of Innovation," *Peter Drucker on the Profession of Management*, Boston, MA: Harvard Business School Publishing, 2003. 60.
 3. Tolstoy, L., *Anna Karenina*, Constance Garnett trans., New York: P.F. Collier & Son, 1917. 1.

4. A popular joke in the early days of the open source movement was, “Why do in ten minutes with Windows what you can do in four hours with Linux?” Ubuntu Linux’s success outside the developer community has much to do with their focus on user experience.
5. Also called the Pareto principle, this a rule of thumb that states that, with a given initiative, it is possible to achieve 80% of the benefits with the first 20% of the investment, and, conversely, that realizing the last 20% of the benefits requires the remaining 80% of the effort.
6. Schopenhauer, A., *The World as Will and Idea*, R.B. Haldane trans., Boston: Ticknor and Co., 1888, 1:413.
7. Malkin, R.A., “Technologies for clinically relevant physiological measurements in developing countries.” *Physiological Measurement* 28 (2007): R57-R63.
8. Hudnut, P., “Radical, Transformative, Unreasonable, Extreme, Leap Frog, Super-Bad Social Entrepreneur.” Next Billion blog, 04 June 2008. <<http://www.nextbillion.net/blog/2008/06/04/guest-post-radical-transformative-unreasonable-extreme-leap-frog>>.
9. <[http:// www.ideo.com/work/item/human-centered-design-toolkit/](http://www.ideo.com/work/item/human-centered-design-toolkit/)>.
10. A portmanteau of “satisfy” and “suffice” coined by economist and psychologist Herbert Simon. See also Bordley R. and Kirkwood C., “Multiattribute Preference Analysis with Multiattribute Performance Targets.” *Operations Research* 52 (6), (2004): 823–835.
11. Garcia, D., “Prototype as if you are right, listen as if you are wrong.” Metacool blog, April 14, 2009. <<http://metacool.typepad.com/metacool/2009/04/4-prototype-as-if-you-are-right-listen-as-if-you-are-wrong.html>>.
12. Postman, N., *Amusing Ourselves to Death*, New York: Penguin, 1985. 142.