

# FROM HOME RUNS TO BASE HITS

## RETHINKING GREEN IMPACT INVESTING IN EMERGING MARKETS

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Entrepreneurs live and breathe the Yogi Berra maxim, “When you come to a fork in the road, take it.” Along with keen business acumen and indefatigable persistence, the process of turning technological innovations into flourishing industries and new markets requires vigorous opportunism. But being opportunistic is only half the game; unless entrepreneurs can quickly find new pathways to profits, the chances of success are slim. That’s a major reason why entrepreneurs flock to Silicon Valley, the innovation hotspot that has produced industry-defining businesses such as Hewlett-Packard, Apple, and Facebook.

In Silicon Valley, getting to Plan B—and then to Plans C, D, and E—is often only a phone call or an informal lunch meeting away. Robust infrastructure, dense social networks, and a rich industry ecosystem supply the opportunities startups need to reframe their value propositions and pivot to new markets.

It is these two elements—the unpredictable nature of startups and the critical supporting role of business ecosystems and infrastructure—that underlie the unique challenge of catalyzing the green entrepreneurship and eco-innovation sectors of developing countries. And in today’s world, cultivating an army of innovators to tackle environmental challenges across the globe is a topic worthy of policymakers’ attention. First, it offers a grassroots alternative to governments that are already pulling all available policy

levers to combat rapidly eroding topsoils, mounting air pollution, and other environmental predicaments. And second, the security and sustainability of the planet depend on it. Increasing affluence and growing populations mean that the developing world will soon surpass the CO<sub>2</sub> emissions levels of industrialized countries, thereby placing an unprecedented burden on the planet’s waste sinks and accelerating climate change.

Policymakers intent on fostering market-based solutions to environmental challenges often look to Silicon Valley for inspiration, given the area’s remarkable success in spinning out transformational IT industries. But it can also be a siren’s call. Mimicking Silicon Valley’s approach to investing for innovation without accounting for the idiosyncrasies of developing country contexts and clean-

technology markets can be a recipe for disaster. Consider E+Co, an organization that over 18 years invested almost \$40 million in more than 260 sustainable energy ventures across the developing world. It provided “patient capital,” which often is cited as the key enabler of entrepreneurship in developing countries. Despite its long-term investment horizon, wide scope, and deep experience base, E+Co was all but shuttered in 2012, writing off 83 percent of its portfolio.

Our goal with this paper is to harvest lessons from pioneering organizations like E+Co to sketch out an investment strategy for driving green innovation in emerging markets. We begin by looking at that global innovation hub, Silicon Valley, and describing its engine and enabling conditions. We then examine the clean-tech industry and the business environment in developing countries to see why the Silicon Valley investment model hasn’t worked in these arenas. We conclude by drawing insights from these analyses to flesh out a green investment approach that is tailored to the constraints and opportunities of developing countries.

## **SILICON VALLEY: AMERICAN IDOL FOR ENTREPRENEURS**

Since the early 1950s, Silicon Valley has been at the forefront of the information technology revolution, accounting for one-third of all venture capital (VC) investment in the U.S. The region has spawned a stunning range of industries, from semiconductors (Intel, Nvidia), computers and smartphones (HP, Apple), and software (Oracle, Electronic Arts) to Internet services (Google, Facebook). The combined output of this ecosystem has profoundly changed the way many people around the globe work and live today.

While countless studies have tried to explain why this entrepreneurial hotbed emerged, our objective is to examine how the model works: how it vets and incubates entrepreneurial opportunities, and then channels resources to those that meet certain parameters while killing off those that don’t.

Think of Silicon Valley as an *American Idol* competition for entrepreneurs: scores of people with talent and ambition vying for the attention of a much smaller pool of people with money and connec-

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Deal flow	Large pool of startups and experienced entrepreneurs from which to select
Managerial ecosystem	Leadership and direction from seasoned investors and managers with deep and wide industry connections
Addressable markets	Large and easily quantifiable market opportunities that address high-impact needs
Scale-up infrastructure	Industries, markets, and technology bases characterized by rapid scalability
Outcome flexibility	Flexibility to rapidly shift and redirect companies toward more promising business models and markets
Active stock markets	Mechanisms for monetizing future cash flows—IPOs

**Table 1.** Silicon Valley’s Enabling Conditions

tions. It’s a “show,” where the winners are few but those who do make it “go platinum.” The judges in this case are the venture capitalists whose goals and strategies dictate the shape and form of the businesses that get chosen. Knowing how VC firms make money is therefore essential to understanding the rules of the game.

VC firms give money to startups in exchange for an ownership stake. Aside from money, VC firms play a key role in helping startups hire experienced talent, identify hot markets, pivot to new business models, and generate prospective sales leads.

Startups, however, are highly uncertain undertakings—a 90 percent failure rate is not unheard of. VC firms invest in multiple startups to spread out their risk; the few ventures that do succeed must “hit a home run” to compensate for all the failures. As a rule of thumb, a startup must demonstrate the potential to yield at least five times the initial investment to be considered for funding.

Venture capitalists readily abandon ventures that no longer show such promise, and redirect their resources to other opportunities. Abandoning the weak and

wounded—the reason venture capitalists are often called vulture capitalists—is critical to the profitability and success of the VC model.

Which raises an important contextual factor: just as having throngs of talented singers vying for a coveted spot in Hollywood improves the quality of the singing on *American Idol*, having a large pool of entrepreneurial talent improves the quality of the business investment opportunities VC firms can choose from. This is critical to improving the likelihood of hitting a home run.

In this regard, Silicon Valley sits in a plum position, as the region has a deep pool of entrepreneurial engineering talent that is continually fed and replenished by premier local universities. The region also attracts scientists and engineers from across the globe, and is home to serial entrepreneurs who have retired from earlier successful ventures and remain in the area looking to jump aboard new startups.

The other critical element of the VC investment strategy is how investors realize their profits. VC firms usually aim to recoup their money five to ten years after making the initial investment. Given that

startups typically lose lots of money early on and are unlikely to generate sufficient profits within this timeframe, venture capitalists aim to convert their ownership shares into real money through “exits”—either an initial public offering of stock (IPO), or the merger and acquisition of the venture by an existing company (M&A). In either case, selling their ownership stakes enables venture capitalists to monetize and capture future cash flows, rather than waiting for annual profits to accumulate.

The need for “home runs” and exit options leads to two key investment parameters for venture capitalists. First, they invest only in businesses that target significant market demand. One of the first questions a VC fund manager asks of a prospective startup is, “What is your total addressable market?”

Second, VC firms choose industries in which ventures can be scaled up quickly with minimal infrastructure build-out, especially those in which information technology (IT) plays a central role. Consider, for example, WhatsApp: the instant messaging service served more than 600 million users with only 55 employees when it was acquired by Facebook for \$19 billion dollars. McDonald’s, by comparison, employs over 1.5 million people in more than 35,000 locations to achieve a market capitalization of about \$100 billion.

In summary, Silicon Valley’s entrepreneurship model is a function of the region’s enabling market and the IT-based technologies that underpin many of the ventures. To understand the applicability of this model to the promotion of green entrepreneurship and innovation in developing countries, we need to cross-check how these market environments and their core technologies stack up against Silicon Valley’s.

## **FROM THE VALLEY TO THE VILLAGE**

Take a drive outside the capital city of any developing country and it’s immediately apparent that doing business in Africa, Asia, and Latin America is to play in a different ballgame than in Silicon Valley and the industrialized world in general. However, beyond the overt difference in living standards, there are several under-the-surface cultural and institutional factors that significantly shape the entrepreneurial sector in the developing world. Having led startup ventures in Kenya, Ghana, India, and Mexico, we’ve experienced many of these issues firsthand.

For one thing, skilled entrepreneurs and talented managers willing to work in startup ventures—particularly those based in rural areas—are in very short supply. The reason for this shortage is largely cultural, because career success means landing a steady job at a large organization, not joining a small startup in a remote village.

The shallow talent pool manifests itself to investors in what the industry calls poor deal flow—there simply aren’t many high-quality startups from which to choose.<sup>1</sup> E+Co, for example, was stretched thin by having to search across the developing world for promising ventures, from subtropical Africa to rural China to Brazil’s *favelas*. Recruiting seasoned management talent for business ideas that do seem promising is an uphill battle because, apart from the status issue, there are few head-hunting firms or other labor-market intermediaries who can help in the search. For example, in a startup led by one of the authors in Mexico, it took four months of intensive recruiting efforts to identify and hire just two team leaders. Locating, recruiting, and mentoring the local talent became the startup’s most time-consuming activity, which detracted from other urgent business development tasks.

Shallow talent pool	Difficulty hiring an experienced and effective startup team
Opaque marketplace	Trouble gauging market size and gaining trustworthy consumer insights for building business models
Disaggregated consumers	Nonexistent economies of scale hinder business growth and expansion
Low economic diversification	Fewer opportunities and pathways for pivoting to emergent or adjacent markets
Illiquid stock markets	Constrained options for initial investors to cash out

**Table 2.** Emerging Market Challenges

To wit, challenges on the consumer side of the emerging market equation make quantifying demand and market potential an arduous task. To start, there is limited consumer research, particularly about the lower income, mass-market segments that constitute most of the population. What does exist, such as World Bank studies on income levels and consumption habits, can be misleading, as it often relies on proxy measures (e.g., the presence of television antennas or cooking utensils). For example, the team of a business effort in Ghana supported by one of the authors discovered that subsistence households (those that grow all their food) that spent on average \$2 per day and petty trading households that spent \$7 per day had, in fact, similar levels of discretionary income. It turned out that the petty-trading households were spending the additional cash they earned to cover their food costs.

Obtaining this kind of critical insight is not easy, as consumers are often distrustful of outsiders or fear that information they divulge about their income—income typically made off the books in the informal sector—could attract government scrutiny. Most importantly, most consumers don't know exactly what they spend their money on.<sup>2</sup> Cutting through the fog of misinformation requires getting

on the ground and building rapport with the local population. In the Ghana case, it took the team two months of various immersion activities to get reliable data.

Extremely poor transportation infrastructure outside the Tier 1 and Tier 2 cities in developing countries also makes it difficult to find opportunities that allow for the significant and rapid scale up targeted by Silicon Valley investors, as businesses are faced with highly disaggregated consumer populations—fragmented clusters of towns and villages that essentially function as self-contained island economies. The most efficient structure for serving disaggregated consumers tends to be a decentralized business model comprised of small operating units that serve small geographic areas.<sup>3</sup> Small operating units don't lend themselves to rapid scaling, as a business can't grow simply by adding central production capacity and sending salespeople out to distant areas. Instead the entire operating unit must be replicated in each new area, much like a franchise. This takes time and capital, as it requires first systematizing all facets of the business. Consider that it took eight years to fully systematize the initial restaurant on which the McDonald's franchise model is based.

Low levels of economic diversification in emerging markets constrain startups'

Material sciences' innovation rate	The invention-to-deployment speed of material science breakthroughs is slow and unpredictable
Biotechnology's specificity	Innovations in biotechnology tend to be application specific and do not enable quick pivots to new markets
New technology adoption rate	It takes considerable time and resources to change consumer behaviors and stimulate demand for new technologies

**Table 3.** Clean Tech Challenges

ability to pivot to new market opportunities and business models.<sup>4</sup> Economies dominated by single commodities (e.g., hydrocarbons) or low-value-adding agricultural commodities lack rich business ecosystems, thus the range of alternate pathways to pursue when Plan A goes awry is very limited.

Finally, the stock and M&A markets in emerging countries are smaller and much less liquid than those in the developed world. For example, there may be no trading in a company stock for extended periods of time in a low-liquidity stock market, which makes investor risk much higher. Mergers and acquisitions pose even greater challenges, as the availability and quality of financial data is often poor, and bringing the acquired companies up to international financial standards can be quite expensive.<sup>5</sup> Therefore, IPOs and company sales are generally not viable exit options for entrepreneurs and investors in emerging markets.

### **FROM SILICON TO SUNLIGHT**

The clean-tech sector—wind power, solar energy, batteries, smart meters, biofuels, carbon sequestration, HVAC efficiency, LED lighting, etc.—centers on the largest market in the world: energy. The immense size of this market, coupled with

growing awareness of climate change, led to a clean-tech investment boom in the mid-2000s. Legendary venture capitalists such as John Doerr and Vinod Khosla jumped into the game, calling attention to the need for disruptive innovations that could fundamentally move society off its collision course with environmental catastrophe, and large bets were placed on a cadre of startups.

That boom, however, quickly turned to bust, as promising startups failed to achieve takeoff speed. There wasn't a single Google-like home run to prove that these industries were, in fact, high growth. To their chagrin, VC firms discovered that the rate at which inventions and discoveries in materials science—one of the two core technology bases for clean tech—are converted to successful market applications is slower and more unpredictable than those of silicon-based technologies, which have followed Moore's Law for more than five decades.<sup>6</sup> The problem is that there is no way to accurately predict when a new material or manufacturing process will be invented.

Consider battery technology: it has taken 30 years for batteries' energy density—that industry's key performance metric—to double. Solar panel efficiency—the rate at which sunlight is converted to electricity—has nudged upward at a snail's pace,

from 11 percent in the 1950s to 22 percent in today's most efficient commercial panels. In contrast, the manufacturing costs of solar panels have seen a whopping 75 percent decrease in the last few years, propelled by subsidies in China that have allowed manufacturers to achieve impressive economies of scale.

Biotechnology, the second clean tech base, has shown performance improvements on a par with silicon in some processes. The cost of DNA sequencing, for example, has decreased by orders of magnitude in just a decade. It cost \$3 billion dollars to sequence the first human genome in 2003; firms can now do it for less than \$1,000. Unfortunately, biotechnology faces a serious lack of output flexibility. The production processes for biological materials are specialized and idiosyncratic to the type of material, so working with biological material constrains a firm's ability to pivot quickly to new products and markets. For example, a firm's R&D efforts to develop a yeast strain that efficiently converts sugarcane into bioethanol cannot easily be used to process saw grass or any other feedstock that may become available. Scaling up biotech processes has also proven devilishly hard and much costlier than anticipated.

The case of Amyris exemplifies this. The company was founded in 2003 to produce biodiesel and other sustainable alternatives to petroleum-based products using a yeast-based synthetic biology platform and a sugarcane feedstock. The startup raised more than \$120 million, set up a demonstration plant in Brazil in 2009, and went public in 2010 to a value of \$610 million. Amyris was in fact considered one of the safest bets in the clean-tech sector because it had already "proven" its technology. However, it was simply unable to ramp up production fast and efficiently enough. By 2012, its share price had dropped from a high of \$30 to less than \$2 as it abandoned scale-up efforts

and pivoted toward low-volume, high-margin markets such as cosmetic ingredients.

A third issue concerns the consumer. Most clean-tech offerings for emerging consumer markets—from clean-burning cook stoves to solar lanterns—require a moderate to significant change in consumer behaviors and routines. However, if there is one constant in this world, it is that consumers do not like change, even when it offers access to affordable products that address pressing unmet needs.<sup>7</sup>

Take the case of clean-burning cook stoves for emerging markets, an industry that has seen hundreds of initiatives over the past decade but only minimal success, despite a value proposition to consumers that seems quite compelling. For a rural family that purchases firewood, the cost of a clean-burning cook stove can be recouped in just seven to ten months; it will reduce indoor air pollution and the accompanying respiratory-related diseases, and it will reduce cooking time.<sup>8</sup> Yet cook stove adoption rates have remained stubbornly slow, topping out at just 10 percent in some markets. The reason for this consumer apathy is that the stove disrupts long-held cooking practices and, along with solar lanterns, water filter straws, bio-digester toilets, and other exotic clean-tech products, the stoves come across to emerging market consumers as a completely new product category that doesn't really improve their lives that much. Given the extensive consumer learning and change that must accompany such products, rapid scale up is very unlikely, as it takes time and money to activate widespread consumer demand.

## **MONEYBALL FOR EMERGING MARKETS**

Unfortunately, the soil in which the Silicon Valley VC model thrives isn't

	Growth-oriented	Efficiency-oriented
Target market	Small and midsize firms in growing markets	Medium and large firms in established markets
Strategy	Finance new assets to target growth opportunities	Restructure operations for greater efficiency
Capabilities	Expertise for managing organizational complexity	Quality control and continuous improvement program implementation
Resources	Access to new networks of finance, customers, suppliers	Access to outsourcing networks, governance and restructuring experts

**Table 4.** Private Equity Investment Approaches

found in emerging markets or in clean-tech industries. Shallow talent pools, poor deal flows, disaggregated consumers, uncertain technology trajectories, and other factors just don't yield enough home runs. And, as E+Co discovered, trying to enrich the soil with only one or two nutrients isn't enough. We instead need to start with a different investment strategy—one that doesn't depend on home runs. And what better place to look for inspiration than the source of the home run metaphor itself: baseball.

In his breakout book *Moneyball*, Michael Lewis describes how the Oakland A's disrupted Major League Baseball by fielding an oddball team on a shoestring budget that outplayed wealthy teams staffed with big-name players. The key to their success was the realization that, as a relatively poor team, they could not afford to compete in the player market for high-profile home run hitters. Instead they signed players with high on-base averages—a proven ability to get on base one way or another, no matter how unglamorously they did it, be it by an infield bunt, taking a walk, or even being hit by a pitch. These players commanded much smaller salaries than home-run heroes and they did not provide spectacular plays. However, each one contributed marginally to the team's overall ability to score

runs, and over time this difference added up to wins. In 2002, despite a budget that was one-third that of other teams, the Oakland A's had a record 20-game winning streak and advanced to the playoffs.

Translated into investment logic, the Oakland A's on-base strategy relied on relatively small, consistent returns from a large percentage of a portfolio's investments, rather than on spectacular returns from one or two breakout ventures. Given what we know about emerging markets, that's an investment logic with legs. The good news is that the investment community already applies this core logic in private equity (PE) investing.

Like venture capitalists, PE investors provide capital in exchange for an equity stake in a company—typically a majority stake—which entitles them to a share in the company's profits and a hand in decisionmaking. A key difference from the VC industry, one that shapes the PE investor's relationship with the investees, is how fast PE investors make money. They have shorter holding periods than venture capitalists and expect returns in three to five years.<sup>9</sup> This reduces risk, but because risk and reward move hand in hand, the expected returns from each investee are considerably lower. Depending on geography and industry,



the average internal hurdle rate—the minimum rate a company expects to earn when investing in a venture—will range from 20 percent to 70 percent.

To capture low-risk opportunities, PE investors target relatively established companies with dependable cash flows. This reduces market uncertainty and downside risk so that, barring a catastrophic event, the companies in a PE portfolio are unlikely to fail and lose the entire investment.

PE investors also make their money very differently than venture capitalists. PE investors get paid directly from the improved cash flows of their investees or through a “trade sale.” In a trade sale, another company buys the PE investor’s equity stake because of long-term synergies and strategic reasons, such as access to a new territory or product market. Valuations for trade sales are typically based on multiples of the investee’s current earnings. In either case, the PE investor’s return depends directly on how much they help improve cash flows by increasing revenues and cutting costs.

We can make a distinction between PE investors focused on growth and those focused on efficiency. PE growth funds invest in smaller companies that have proven their business model in growing industries and want to expand and advance to the “success” stage of business growth.<sup>10</sup> The PE investment is earmarked for specific growth objectives, such as expanding operational capacity, entering a new territory, or developing a new product line. In addition to providing capital, PE investors work in close collaboration with their investees to provide critical managerial know-how in building the formal control systems and organizational structures required for the increased complexity and volume of the decisions that accompany growth. PE investors also facilitate access to new geographic areas and markets, as well as to

networks of suppliers, financiers, and customers.

PE efficiency funds, on the other hand, target midsize to large companies in mostly stable industries that in many cases have enjoyed limited competition. These companies often have inefficient operational processes, outdated technologies, underutilized assets, antiquated branding and marketing strategies, or other legacy systems that create significant drag on performance. PE efficiency funds bring in hardnosed accountants, comptrollers, and seasoned executives to unlock value by restructuring and modernizing operations and imposing financial discipline. Subsequent improvements in product quality may also boost sales and create new market opportunities. Because of the significant changes entailed, efficiency PEs typically acquire 100 percent of a company’s equity to gain full control and unobstructed decision-making.

The appeal of both PE investment strategies for emerging markets is that they overcome several key structural challenges to the VC approach: poor startup deal flow, the lack of new large addressable markets, and weak IPO prospects. For growth PEs, although high-growth startups are in short supply in these markets, small and midsize enterprises are abundant; they account for more than 60 percent of GDP and more than 70 percent of total employment in low-income countries.<sup>11</sup> Many of these enterprises are “stuck,” as they have tapped out local demand and lack the contacts, managerial capacity, and capital to propel growth.

Emerging markets also offer fertile ground for efficiency PEs. These countries’ protectionist pasts and lack of a strong managerial class have generated rich pools of underperforming firms, many of them in control of natural monopolies. Furthermore, investing in firms with established markets obviates

the need to discover large but previously untapped markets.

Lastly, as cash-rich corporations face slow or flat economies in developed countries and increasingly seek to enter emerging markets, the opportunity for trade sales and mergers continues to grow. In fact, the burgeoning M&A sector in emerging countries is a seller's market, as the demand for well-run acquisition targets outstrips the supply.<sup>12</sup>

### **AN ON-BASE INVESTMENT STRATEGY FOR GREEN IMPACT**

A private equity approach provides a compelling format for investing in developing markets, but it can also drive positive environmental impacts. It does so the same way it generates profits: through numerous base hits rather than home runs. Each investment produces small environmental gains, but across an entire portfolio, they add up.

How do these base hits relate to the natural environment? Well, the essence of sustainability is the measured use of natural resources and ecosystem services so that the environment may remain in balance and replenish itself indefinitely—or, as the Brundtland Commission Report put it, “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”<sup>13</sup> The PE investment approach, which seeks to improve the productivity of existing organizational resources, also results in a more efficient use of natural resources.

How a PE fund enables this depends on whether it is oriented towards efficiency or growth. Simply put, PE efficiency funds invest in high-polluting companies and make their operations cleaner, whereas PE growth funds invest in companies with green products and then help them grow, thereby crowding out less

environmentally sound products. The focus of PE efficiency funds is, therefore, on the environmental impacts that happen “upstream” in a company's value chain (activities such as raw material sourcing, manufacturing, warehousing, and distribution), while PE growth funds focus on the impacts that occur “downstream,” once the product is in customers' hands.

Efficiency PE funds look to improve the operational productivity of midsize and large companies in stable industries. The good news is that there is a natural overlap between improving the environmental efficiency of a company and its operational productivity—in other words, “greening” a company's value chain delivers significant cost savings. In fact, the dirtier a firm's current operations, the greater the opportunities for cost reductions. Efficiency PE funds have three powerful eco-tools to simultaneously drive enhanced profitability and environmental performance: green supply chain management, design-for-environment programs, and environmental management systems.

Green supply chain management is a set of practices designed to reduce the greenhouse gas and particulate emissions, physical foot print, and material use associated with the use of raw materials and other inputs. For many firms, the lion's share of their environmental footprint occurs here. Take apparel manufacturers such as Nike, Puma, or Patagonia, for example. When conducting an environmental profit-and-loss statement, Puma famously discovered that the leather used in its shoes had the greatest environmental impact due to the land and water required for cattle production.<sup>14</sup> Similarly, Patagonia realized that pesticide-intensive cotton growing in water-stressed regions was one of its most egregious environmental transgressions.<sup>15</sup> With tools for greening their supply chains, both firms have been able resolve

these issues, thus continuing to grow while using fewer natural resources and ecosystem services to do so.

Design-for-the-environment programs are efforts to reimagine a firm's products and services in ways that minimize overall natural resource use. They are based on four design principles: (1) processing and manufacturing using eco-friendly materials and processes that minimize waste and hazardous by-products, air pollution, and energy use; (2) designing products for disposal or reuse; (3) the use of packaging with environmentally friendly and recycled materials; and (4) designing products to be energy efficient across their life cycle. Products and processes that are designed for the environment often lead to cost reductions, as they tend to use fewer materials, are less complex, and are cheaper to dispose of.

Lastly, efficiency PE funds can deploy complementary environmental management programs such as ISO 14001 or EMAS (Eco-Management and Audit Scheme). These systems—which share the underlying waste-reduction and monitoring philosophies of Total Quality Management and Lean Manufacturing programs such as Six Sigma, HACCP, and the Toyota Production System—help ventures uncover opportunities for diminishing the negative environmental impacts of their operations in a systematic manner. As 3M discovered, these programs not only reduce environmental harm, they produce significant savings. That is why 3M calls its environmental management programs “Pollution Prevention Pays,” which the corporation estimates have prevented over two million tons of waste and saved almost \$2 billion dollars.

Growth PEs generate positive environmental impacts on the opposite end of the spectrum: by growing the sales of young—but proven—companies whose products reduce the overall environmen-

tal impacts of their customers. A product's potential environmental impacts at the customer level are shaped by two factors: (1) the change in environmental impacts of the customer's existing “product routine”; and (2) the size of the “product market.”

A product routine is the pattern of actions, behaviors, social relationships, and physical objects that a consumer activates during the purchase, use, and disposal of a product. For example, the product routine around a Starbucks coffee includes not just the act of drinking the coffee, but may also include driving an extra mile on the way to work to pass by a Starbucks, using unique terms when ordering (like grande, venti, skinny), pouring the coffee into an insulated travel mug that fits the car's small coffee holder, adding two packets of sugar and stirring with a plastic stirrer, steering with one hand while drinking, disposing of the paper cup in the office's recycling bin, and washing out the travel mug with dish liquid and hot water in the office's kitchenette.

A product market is the set of products that—from customers' perspective—provide the same core value proposition. A value proposition is the so-called “job” that a product satisfies for customers. Using the Starbucks example, the core value proposition may be defined as “quick and easy artisanal coffee.” The product market includes obvious competitors, like coffee from the local coffee shop and Dunkin Donuts. But it may also include a Nespresso machine and its system of easy-to-brew pods.

By defining the product routine and the product markets in which a company's product sits, we can calculate the potential change in aggregate environmental impact. As our Starbucks example suggests, the environmental impacts at the customer level can be complex. The environmental impact of a Starbucks product

routine includes not only the obvious environmental impacts of making and landfilling the disposable paper cup and plastic stir stick but also include additional automobile emissions, manufacturing and eventual disposal of the plastic travel mug, the production of the sugar, and the water and energy consumed in washing the mug.

While there are various frameworks for assessing aggregate environmental impact, we suggest using the ecosystems services framework proposed in 2005 by the United Nation's Millenium Ecosystems Report, as it best aligns with a customer-level view of the world and the notion that products satisfy jobs for the user. Ecosystem services are the "jobs" that humans obtain from the planet. The UN report identifies three main types of ecosystem services: (1) provisioning services (material products like lumber, wood for fuel, or minerals); (2) regulating services (benefits from the regulation of ecosystem processes, like carbon sequestration, pest control, and water purification); and (3) cultural services (nonmaterial benefits, like recreation and spiritual enrichment).

Consider the Starbucks product routine described above. The physical goods used in conjunction with the coffee—the paper cup, the plastic stirrer, the sugar, the soap and water to clean the travel mug—impact the earth's provisioning services. The transportation to the store, which generates greenhouse gas emissions, affects the earth's regulating services. An analysis of the product routine may, in fact, conclude that the single greatest impact of gourmet coffee shops is the additional auto emissions created.

Now that we know how to assess a product's environmental impact at the customer level, the key question is where should a green growth PE fund invest? The core logic mirrors that of the green efficiency PE fund, but with a couple of

added wrinkles: target businesses that solve the biggest customer pain points in existing product routines that also have high environmental impact. The logic here is to invest in businesses selling better solutions into established product markets that simultaneously cut out the worst part of the current product routine.

Using the product routine as the basis for identifying high customer and high environmental impact potentially surfaces unique investment opportunities. Consider again the Starbucks example. Driving to Starbucks is arguably the most inconvenient and pain-causing part of the product routine, particularly for those stopping by en route to work. And if emissions are the greatest negative environmental impact of that product routine, then a green PE investment strategy would target businesses that solve the transportation part of the coffee product routine, like Uber Eats, which provides direct-to-office delivery of meals using its Uber network of drivers. Using Uber is arguably a far more efficient way to get coffee to consumers, particularly as office workers often combine their orders. And getting consumers high-quality coffee directly in their place of work saves consumers significant time, hassle, and headache in an already pressure-filled morning routine.

Now consider an example from India, and from a product market that has a high impact on earth's regulating services: agricultural fertilizers. Farmers purchase fertilizer to boost their crop yields. Fertilizers, however, can negatively impact stream and drinking water quality, particularly when rains wash the nitrogen and phosphorous that make up fertilizers into nearby waters.

In developed markets, the product routine around fertilizers is quite knowledge and technology intensive, as fertilizers are expensive and their impacts depend on a range of factors, including soil profile,

crop type, stage of growth, and weather. Soil tests by local agricultural extension offices, consultations with company representatives, weather forecasts, crop nutrition software, and sophisticated dispensing equipment make up the product routine. For the 100 million poor small-holder farmers in India, that routine looks very different: it typically starts with a microcredit loan, then purchasing fertilizer from a village store, toting the sacks out to the farm, and applying the fertilizer when and how their father or mother did. If rains come unexpectedly after application, that precious fertilizer is wasted.

A green PE growth strategy looks to companies that target this part of the fertilizer product routine, as it contributes significantly to fertilizer pollution and is a big pain point for farmers (it costs them money in lost fertilizer and lost yields). That's precisely where fast-growing enterprise Reuters Market Light (RML) sits. RML, a spinout of global mass media and information firm Thomson Reuters, provides a mobile-phone-based agricultural information service to poor Indian farmers. Through SMS texts in the local language, RML provides timely, crop-specific information, localized and personalized weather forecasts, and local crop prices to more than five million farmers. The suite of services helps farmers generate \$4,000 in additional profits annually and savings of \$8,000.

## **CONCLUSION**

There is one downside to the on-base PE approach to green impact in emerging markets that we have outlined: it's not sexy. Implementing ISO-1400 in a local plastics manufacturer or helping expand the sales of a midsize enterprise selling crop and weather information doesn't hold the same cachet as investing in new startups mounting fuel cells in rural villages. Don't get us wrong, there are some opportunities that do feel like break-

through innovations that will catalyze new markets, scale explosively, and transform entire industries.

A prime example is M-Kopa Solar, which in three years reached 50,000 households and was acquiring 1,000 new customers a week with only 200 people on staff. An offshoot of M-Pesa—Kenya's highly developed and widespread mobile payment system—M-Kopa offers a simple, user-installed solar kit that it can meter over its mobile network. Customers pay an up-front fee of around \$10, and then pay for energy when they need it, on a daily basis, through their phone, or via scratch cards. After they have paid off the kit, they own it outright. M-Pesa and M-Kopa are allowing Kenya to leapfrog high-infrastructure industries such as wired electrification and ATMs. But M-Kopa is an exception, not the rule. As we noted, the market conditions of developing countries, coupled with the constraints inherent in clean tech, conspire to make this type of home run exceedingly rare.

But in investing, optics do matter, particularly when it comes to attracting impact investors. Pitching investors—whether private or public—on a green PE efficiency fund pitch isn't easy in today's climate, where flashy green innovation funds like the \$1 billion Breakthrough Energy Ventures backed by celebrities such as Bill Gates, Jeff Bezos, Michael Bloomberg, and Richard Branson capture investor's mindshare and the media's attention with their promise of transformational home runs.

Our goal with this paper, in addition to outlining a new impact investment practice, is to lay the first stone in the construction of a new narrative about green impact investing in emerging markets. We want to redirect investors' attention from flashy, "save the world" moonshots to the wealth of incremental opportunities that are ripe for the plucking in estab-

lished markets. By contrasting the unbounded risk associated with aiming for green home runs in developing countries with the measured risk of the private equity approach, we hope that investors will take a fresh look at existing markets, uncover new opportunities, and better allocate their green investment dollars across a variety of ventures.<sup>16</sup>

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