Revealing Demand for Pro-Poor Innovations

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INTRODUCTION

There are many barriers to the adoption and diffusion of promising innovations in resource-constrained environments. New technologies may be inappropriately designed, unaffordable, or inaccessible due to weak supply chains. While some of these problems require policy reform, others could be remedied if engineers had better information about the needs and preferences of potential users in low-income communities.

Yet remote and low-resource settings often lack the infrastructure required for intensive consumer data collection (including computerized receipts, loyalty cards, utility meters, web traffic logs, and household economic surveys—all of which are common in wealthy countries). Instead, international development practitioners and engineers have traditionally relied on small-scale, infrequent surveys and focus groups to capture households' self-reported preferences. These methods are prone to measurement errors, and can be costly to implement. As a result, designers often lack reliable information on how to tailor technologies to the specific needs of resource-poor communities.

More recently, social scientists and engineers have begun using new techniques to capture user preferences and market information from underserved communities. These include behavioral experiments, sensing devices, big data analytics, participatory data collection methods, and qualitative approaches. This white paper seeks to provide an overview of the many different tools used for unveiling the demand for new products and services in developing countries.

Section 1 focuses on advances in the field of empirical economics, including techniques for estimating people's willingness to pay for new products and services. Sensors and meters are the topic of Section 2, which examines how electronic devices are being applied to monitor the use of new technologies, measure the impacts of interventions, and improve product design. Section 3 lays out pioneering initiatives in the field of Big Data, leveraging the fast expansion of high-frequency data streams to identify areas of unmet demand for innovation. Finally, Sections 4 and 5 review more traditional methods used for revealing demand, and highlight how recent advances—like participatory assessments and textual analysis—have been used to overcome limitations.

The paper also serves as groundwork for a Spring 2014 conference entitled "Revealing Demand for Pro-poor Innovations." The convening is intended to spark discussions among development practitioners, technologists, and researchers about better understanding the needs and desires of low-income communities.

1: Economic Approaches to Measuring Demand

Empirical and experimental economics offers a large set of tools for rigorously measuring demand and willingness to pay (WTP) for new products and services. Some of these techniques are relevant to low-income settings, where poor infrastructure and the lack of traditional market data can constitute major challenges. These include the contingent valuation method, choice experiments, field experiments, the travel cost method, and discrete choice models.

Contingent Valuation

The contingent valuation (CV) method estimates the value that people grant to a certain good, by asking them to directly report their WTP for that product, rather than inferring it from observed behaviors in the market.[1] Examples of development studies that have used the CV method include to measurement of the WTP for private connections to the public water supply system in Nigeria,[2] improved urban sanitation services in Burkina Faso,[3] and a public health program on tse tse fly control in Ethiopia.[4]

One of the main advantages of the CV method is to help estimating the WTP for goods that are not yet available on the market and thus, to help gauge consumer interest for technologies that are still under development.[5]

However, whether credible WTP estimates can be inferred from the CV method has been actively debated in the literature. Critics point to the fact that the format of the survey used with respondents can shape their answers.[6] This is particularly relevant to new technologies, when target populations are unfamiliar with the new goods or services. It is thus critical to carefully explain the product features as well as the possible payment options. Cultural and language differences must also be taken into account in the survey.

Choice Experiments

In Choice Experiments (CEs), respondents are asked to successively choose between different pairs of goods, the attributes of which differ each time.[7] The idea is that an individual's valuation depends on how he or she makes tradeoffs between the different features of a product. Based on this premise, it is then possible to infer how individuals value the marginal attributes of the new technology.[8] CEs have been used to investigate women's demand for particular characteristics of microbicides vs. condoms in South Africa,[9] to estimate farmers' WTP for Bt maize seed in the Philippines,[10] or to examine consumer demand for biofortified sweet potatoes in Uganda.[11]

The main advantage of CEs is to reveal the marginal values of the product features, instead of the value of the good as a whole. Like the CV method, CEs can be used for products that are still under development. To avoid hypothetical and strategic biases, the attributes to be included in the choice set must be selected with careful consideration.[12] This can be done with the

involvement of local experts or policy-makers who have a better knowledge of the local context.[13] Another option is to organize focus groups with intended beneficiaries. For example, a study of the quality of hospital services in Zambia used focus groups to understand which dimensions of quality were most important to individuals.[14]

Field Experiments

Unlike the CV and CE methods, field experiments involve offering the actual product in a real-world setting, and observing individual consumers' behaviors. Two main approaches are worth considering.

Random Variation in Price is an experimental method in which new technologies are offered to consumers at randomly varied prices, through door-to-door marketing or through the use of discount coupons. It is then possible to analyze consumers' purchases at each of the different prices, to obtain an estimate of how price affects demand.[15] Product developers can use these quantitative estimates of willingness to pay to set prices, or to modify design toward affordability.

In the case of door-to-door sales, special attention should be given to how the marketing strategy and survey scripts are designed, since these factors are likely to affect consumer decisions.[16,17] Random Variations in Price have been implemented for water chlorination programs in Zambia,[18] anti-malarial pills, deworming drugs, and insecticide-treated bed nets in Kenya,[19,20] and weather insurance in Ghana.[21]

The Becker-deGroot-Marschak Mechanism (BDM) is another type of field experiment that relies on contract theory. Respondents start by stating their WTP for a specific product, which we might call *b* (for bid). A random number, say *p* (for price), is then drawn from the distribution of possible prices. If $b > p$, the respondent gets the good and pays *p*. In contrast, if $b < p$, the respondent does not get the good and pays nothing.

Compared to other methods, the BDM approach allows for mapping out the entire demand curve, by calculating how many individuals will purchase the item at each price point.[22] It has already been used in the context of water filters in Ghana,[23] weather insurance in India,[24] ceramic filters and water treatment products in Bangladesh and Kenya,[25,26] and improved cook stoves in Uganda.[27]

Travel Cost Method

The Travel Cost Method relies on the time and travel costs that people incur to avail of a product or to visit a particular service provider. A notable example is Kremer et al (2011), who measured household visits to a protected groundwater spring (compared with visits to an unprotected spring) to estimate households' WTP for improved water quality.[28] The advantage of the Travel Cost Method is to rely on actual behaviors, instead of stated preferences (which the CE and CV methods use). This approach has limited applications, however, since not all innovations require travel to a particular site.

Discrete Choice Models

Another approach to uncover the WTP is to use discrete choice models.[29] Recent studies using this method include valuation estimates for safe drinking water[30] and agricultural services.[31] Discrete choice models relate the statistical relationship between the choices made by a person and the attributes of the person as well as the attributes of the alternatives available. It is then possible to predict the probability that a person will opt for a particular item, while facing an alternative.[32]

Factors Other than Price Affecting Demand

Other than price, there are many factors that might affect an individual's demand for new technologies or services. These are briefly outlined here.

Lack of information: Individuals may not demand a product if they do not understand its benefits. In the case of new technologies, the clarity and thoroughness of information provided can have a substantial impact on take-up rates.[33]

Credit constraints: Even if individuals want to purchase a new technology, they may not have the money to do so. To address this issue, several studies have shown that offering a loan together with a new product can significantly increase purchases (e.g. insecticide-treated bed nets in India[34] and home water connection in Morocco).[35]

Risk tolerance: Purchasing a new technology may be risky for people who do not know how to use it properly. Recent research papers have examined whether farmers who have weather insurance (which protects farmers from crop losses during a drought or flood) are more likely to adopt new technologies since they have more room for risky new investments. However, results are still far from conclusive.[36]

Behavioral constraints: It is possible that individuals want to buy a new product, but have behavioral preferences that prevent them to do so. For example, the demand for free fertilizer in Kenya was impacted by the timing of deliveries. Despite having a lot of money at hand immediately after harvest, farmers often procrastinate in the purchase of fertilizers, since these are not required until later in the season.[37]

2: Using Meters and Sensors to Measure Demand

A growing number of recent pro-poor innovations are building in tiny, low-power sensors and meters to measure the actual use and benefits of technologies designed for low-resource communities. When appropriately calibrated and maintained, sensors can provide deep insights into how a new technology is used and hence, help to tailor it better to the needs of its users.

Near Real-Time Information

In resource-constrained settings, technology-intensive infrastructure – like power grids and water systems – are often remotely managed, with weak technical support, limited local expertise, and minimal internet connectivity. This makes it difficult for engineers to access timely and accurate information about the infrastructure's performance, or about consumer use and benefits. Digital sensing devices, if carefully designed, implemented, and maintained, can provide the information needed to better understand consumer preferences.

In recent years, new monitoring tools have been developed to ensure that the data collected via sensors can be sent back to central planners or even to field-based service providers in near real time.[38] These new capabilities offer an opportunity to learn detailed information about user behaviors, and also to incorporate changes in project design on a continuous basis – as opposed to waiting for results from field visits.[39]

Recent examples of pro-poor technologies that have used sensors include high-efficiency cookstoves, rural electrification systems, vaccine deployment programs, and improved water services.[40,41]

Independence, Precision, Timeliness

The main benefit of sensing technology is to provide independent and direct measurement of key variables of interest that are currently inferred or recalled in survey data. Because it is based on direct observation, information collected through sensors often outperforms other data collection methods in terms of precision and reliability. Today, most sensing devices are capable of measuring outcomes at high frequency, including time (in seconds), watts of energy, millimeters of water, and tenths of degrees Celsius.

While traditional surveys are prone to recall or courtesy bias, sensors are much less likely to generate false information.[42] For example, in a study of water collection behaviors in Kenya using both GPS sensor data and qualitative survey data, it was discovered that reported collection times were much longer than direct measurements of time use.[43]

Understanding Technology Demand in Emerging Economies

Monitoring the use of microgrids with smart environmental sensors in rural Rajasthan, India.
Photo by Ken Lee.

A field experiment to measure the demand for improved cook stoves at different price points in Uganda.

Estimating the willingness to pay for chlorine dispensers in Kenya. Photo by Jessica Hoel.

Sensors can be useful even in pilot studies, without full-scale deployment. By providing a detailed characterization of particular behaviors of interest, they can be used to design and validate a survey for use in larger samples. Sensors can also be used in parallel with surveys, focusing on information about user behavior, with demographic or qualitative data gathered via questionnaires and other group collection methods.

Case Study: Cookstove Usage Monitoring

The growth in the popularity of sensing technologies has led to a plethora of off-the-shelf sensing devices, with various connectivity, storage, power, and data processing options. In the case of cookstove usage monitoring, a popular option is the iButton, a stand-alone, unobtrusive sensor that can store temperature data logged once an hour for several months. In practice, the iButton has been used by product developers to detect how many times a day stoves are used by local communities.[44]

Another, more advanced option is the SweetSense Fire monitor, which can provide data for six to eighteen months, depending on the frequency of reporting and local environmental conditions. It can be remotely queried via an internal cellular modem, and can store all of its data on a single SD Card.[45] The SweetSense Fire monitor is composed of multiple sensors capable of measuring temperature, airborne particulate matter, and atmospheric gasses. Stove stacking, which involves the use of both improved and traditional stoves in a single household, can also be detected and quantified, so that biases in data collection due to the simultaneous use of multiple stoves can be avoided. Not surprisingly, the SweetSense Fire monitor is five times more expensive than the iButton, and can be ordered in small quantities only.

Influencing Product Design

Detailed information on consumer usage patterns can highlight limitations in the design or deployment of a new technology, product, or service. In the case of rural microgrids, for instance, a large portion of the operating cost derives from losses in power conversion and low-quality battery materials. Usage data collected through sensors has shown that cost reduction and longer lifespans could be achieved using alternate technologies and infrastructure.[46]

By tracing the usage of a large number of customers, technology designers and engineers can more appropriately size infrastructure for rural, low-resource communities, and can better schedule maintenance interventions. So far, most successful examples of system optimizations

via sensors have been found in industrialized countries, but adaptation to resource-constrained settings is under way.[47]

In summary, what are the advantages of direct observation using meters and sensors? These small digital devices can generate reliable information on how a new product or service is used by its beneficiaries. They can help to overcome the flaws of self-reports, which are prone to measurement errors. Sensor-based methods provide independent and accurate information at high frequency, and in near real time, thereby helping engineers to continuously tailor interventions to the needs and wants of user populations.

3: Revealing Demand with Big Data and Informatics

Big Data refers to the recent explosion in the quantity and diversity of high frequency digital data streams.[48] Examples include credit card and mobile-banking transactions, online user-generated content (such as blog posts and tweets), Google searches, phone call records, or satellite images. It is believed that these large, unstructured datasets could reveal existing yet unmet demands for new or better technologies in developing countries, but how to turn this into practice has proved to be very challenging.

Formalization of Big Data as a Field of Research

The ongoing formalization of Big Data as a field of study – with its emerging norms, tools, and metrics – has resulted in the emergence of numerous subfields. One of these has sought to quantify the welfare derived from the consumption of newly adopted technologies.[49,50] For instance, since the 1990s, Hal Varian has sought to measure how much time the Internet has saved, compared to the methods that were used before it existed.[51] Another noteworthy effort seeks to harness Big Data to better understand global demand shifts.[52] Preliminary insights may be found in a 2001 academic paper entitled *"Revealing Demand for Nature Experience Using Purchase Data of Equipment and Lodging."* [53]

The private sector is heavily invested in related research. U.S. Gas & Electric, for instance, reportedly expects to rely increasingly on *"digital devices that will deliver a steady stream of real-time demand and usage information from customer homes to utility providers* […] *These smart meters will begin streaming usage data to both U.S. Gas & Electric and its customers, which could make consumers much more energy-conscious with more usage data at their disposal."* [54] Another area of active research is the "quantified-self movement"[55], in which users monitor themselves, generating data about their own behavior. Esther Dyson, for instance, praises the emergence of communities that measure the state, health, and activities

of their own people and institutions, with the goal of later improving outcomes.[56] This could be done through the use of sensors that enable people to collect data about themselves, while at home, unveiling some of the issues they face in daily life.

Big Data for Revealing Demand

There is a fast-growing body of evidence that these emerging fields of research can be leveraged to address development challenges – from detecting or modeling the spread of diseases, to analyzing migration, modeling optimal bus routes, tracking inflation, or predicting economic activity.[57,58,59,60] Three main categories of data are particularly relevant to resource-constrained settings.

Digital Breadcrumbs are the electronic markers that we leave behind us when interacting in the wired world. Echoing the pioneering work of John Snow, recent research projects have sought to leverage those breadcrumbs in many different ways.[61] Some have developed algorithms to infer optimal localizations of facilities and technology infrastructure, such as clinics or water pumps. A recent example is an IBM study that used data from millions of cellphone users to model optimal bus routes in Ivory Coast.[62] Another potential application is the use of sensor data of electrical usage to identify underserved areas and forecast local communities' future energy needs.

Open social data, or data that are openly available online, are another promising path for innovation in development. One example is the use of Google searches to infer demand for certain type of products – a technique that has long been used in the private sector.[63] In the realm of public policy, an experience worth mentioning is the collaborative work of the UNDP Post-2015 and UN Global Pulse teams that have analyzed millions of geo-located tweets to unveil which development topics and issues were most discussed across developing countries, so as to influence global development strategies.[64]

Remote sensing, or the acquisition of information without physical contact with an object or a phenomenon, has long been used to study electricity usage or population densities.[65] One application relevant to revealing demand is to rely on near-infrared photography to analyze the use of fertilizers[66] or the health of particular crops[67] across large swathes of agricultural land. This promising topic has recently received a growing attention in the development economics literature.[68]

Another avenue involves studying waiting lines, or the time that people are ready to wait to acquire a certain technology, so as to reveal demand. The rationale behind this approach is that the intensity of the waiting time compared to the level of supply has a revealing effect on the corresponding demand, just as high salaries in certain sectors tend to signal rarity and strong

demand for those skills.

Big Data in Resource-Constrained Environments

While those early-stage projects relying on Big Data to tackle development issues are particularly encouraging, there is still a long way to go before reliable information can be drawn and large-scale impact can be achieved. Indeed, resourced-constrained environments are often characterized by many barriers hindering the collection of Big Data: low technological penetration, informal or hardly accessible data streams, shared ownership of digital devices, ethical and privacy concerns, etc.[69, 70, 71]

In order to overcome these challenges, tools and mechanisms seeking to infer future demand for technology in developing countries through Big Data should embrace the following objectives:

- Strengthening local capacities and institutions rather than bypassing them.
- Forging long-lasting partnerships with local authorities, private corporations, NGOs, and other organizations on the ground in order to ensure sustainability and facilitate scale-up.
- Using Big Data as an opportunity for data emitters not only to have a say in how their data is used, but to be engaged proactively in the decisions that are traditionally made on their behalf.

4: Inferring Demand through Needs Assessments

Needs assessments often constitute the first step in the project cycles of NGOs. Existing information on local populations may be scarce, and collecting additional data helps to better understand the needs and wants of intended beneficiaries. Needs assessments typically involve a team from the NGO or one of its partner organizations spending a specified amount of time in the field with the population of interest. In some cases, NGOs may decide to engage in continuous needs assessments, which can serve ad solid foundations for future interventions.[72]

Data Collection Methods

Needs Assessments often rely on a multitude of data collection methods. Among those are **face-to-face interviews**, which can be structured or unstructured. One advantage of this technique is to minimize the risk of non-response, while increasing the quality of the data collected. Face-to-face interviews are particularly helpful when dealing with illiterate respondents or when soliciting information about complex or sensitive topics.[73] **Key informant interviews** are a particular type of interviews that rely on specific individuals who are

considered experts in a given area, either because of their professional knowledge or their position of influence within a given community.[74]

Questionnaires tend to be more structured than interviews and can in theory be administered via phone, mail, or sometimes even in group settings. Questionnaires might be the most effective way to collect data if the needs assessment only requires the collection of simple facts. Yet, they must be carefully piloted before being administered to respondents. This will ensure that questions are asked in a coherent and logical way, and that the survey can be completed in a timely manner.[75]

Needs Assessment may also rely on a researcher's **personal observations**, either formally or informally. During fieldwork, researchers often see and experience many elements that can prove valuable to understand the needs of the project beneficiaries. Personal observations need to be recorded through notes, photographs, or voice recorder in order to provide complete and accurate data that can be later used for assessing needs.[76] In recent years, some technology companies have started to train their employees on how to conduct ethnographic research, so as to gather reliable observations during the course of their interactions with clients.[77]

The **Delphi Technique** is a combination of qualitative and quantitative processes that draws mainly upon the opinions of identified experts to understand trends in technology innovation and demand. Once the research has identified the class of technologies to be assessed, the stakeholders, data collection methods, and the sample size, a multiple-round questionnaire is administered to a panel of experts in the topic of investigation. Each successive questionnaire narrows the scope of the questions asked, and it is expected that a consensus will emerge among the group by the final round of questionnaires.[78]

Focus groups are another way to collect qualitative data. A group of people from the target population, usually six to eight, are brought together to discuss a common issue for certain period of time. Led by a moderator, the discussion may be recorded and subsequently analyzed to reveal emergent patterns within the group or among different types of groups.[79] **The nominal group method** is a variant of focus groups, which takes the form of a highly structured group meeting where people are asked to answer questions in writing. Responses are then collected and reported on a flipchart, before being ranked collaboratively by the members of the group.[80]

Informal group meetings and other social gatherings, where people may conversationally discuss about their family, the community, or some organizational problems, are another way to collect information during a needs assessment. These informal, unstructured conversations

Using Innovative Methods of Data Collection to Measure Demand

Qualitative methods of data collection brought additional insights to an impact evaluation of a conditional cash transfer (CCT) program in Nicaragua. Photo by Karen Macours.

A GPS tracker attached to a jerry can to measure households visits to protected groundwater springs in Kenya.

can provide deep insights into the needs of a given population, especially when major issues are being discussed among community members.[81]

Broader Scope Approaches

Rapid Rural Assessment (RRA) is a needs assessment approach conducted in the field by a multi-disciplinary team from the NGO in order to collect authentic information about rural life.[82] RRAs typically combine a broad array of research methods:

- Individual, household and key informant interviews.
- Triangulation of collected data across multiple sources.
- Flexible sampling techniques.
- Rapid achievement of quantitative data.
- Group data collection techniques.
- Direct observations.
- Secondary data sources.

Originally, RRAs were a response to the growing miscommunication between outsiders and local communities in development work, as well as the frequent disparity between what outsiders perceived as the main issues, and what they really were.[83,84] The usefulness of RRA in comparison with other needs assessment methods became apparent in a 1981 study of land settlement schemes in Sri Lanka, where the investigators concluded that the research "could have been put across more quickly, cheaply and effectively, with evidence drawn from a smaller, purposively selected and studied sample and with no significant reduction in reliability." [85]

Participatory Rural Appraisals (PRAs) evolved directly from Rapid Rural Appraisals in the 1990s. At that time, it had become evident that inappropriate development strategies were a result of top-down research methodologies that had failed to capture the actual needs of the local populations. In particular, the wisdom of project beneficiaries was often neglected, what had resulted in the poor sustainability of most of the interventions.

Like RRA, PRA involves direct learning from local communities, triangulating information, and seeking diversity in views and perceptions. The stark contrast between the two methods emerges in the way that information is elicited and managed. While RRA relies on outsiders to extract information from project beneficiaries, PRA involves the collection and management of data by the local populations self.[86] The most common research tools used during PRAs are:

- Group formation methods, such as *team contracts* to ensure sound group dynamics, *night halts* to develop the relationship between outsiders and locals through intimate co-location, *work sharing* to reverse the professional roles of outsiders and locals, *rapid*

report writing to encourage the recording of key findings as a group, and *shared presentations* to highlight conclusions to all stakeholders.

- Sampling methods, such *transect walks* – systematic, interactive, and instructive walks through an area of interest – or *wealth rankings* to help determine the stratification of the community according to household income levels.
- Interviewing methods, such as *semi-structured interviews*, where only a set of questions is pre-determined, or *chains of interviews* where those are combined in sequences or chains.
- Visualization methods, such as *seasonal calendars* to generate information on seasonal trends, *daily time use analysis* to provide information on the daily actions of community members, *participatory mapping and modeling* using sticks, chalks, or tree leaves, *Venn diagrams* to show the dynamics between people, groups, and institutions, *timelines* to understand historical events and trends, or *matrix scoring* and *pairwise ranking* to help learn about the local community's categories, criteria, choices, and priorities.[87]

Despite being relatively time-consuming, PRAs have many advantages. They allow the active participation of local communities by providing the space for their own ideas, concerns, and priorities. They also rely on their personal wisdom, and thus help to increase motivation and mobilization with project beneficiaries. Over the years, PRAs have proved to constitute a powerful needs assessment approach that allow local populations to directly influence project design, thereby ensuring that future interventions will meet local necessities.[88]

Best Practices

Irrelevant of the data collection methods chosen, a good needs assessment requires effective coordination, collaboration, and communication among all stakeholders. Some key criteria for effectively revealing demand are that:

- The collection of data and its subsequent analysis are carried out in a timely manner.
- The scope of the assessment and the type of data collected are relevant to the scale and the nature of the issues to be addressed.
- Continuous information is provided throughout the course of the intervention.
- All assumptions, methods, data, and constraints are shared in a transparent manner.[89]

It is important to remember that an actual need can only be identified independently of a prematurely selected solution. Researchers must first determine the state of the present situation, and then articulate how the desired situation would look like. The distance between the two situations is the actual need. Once this need is identified, the solution that can best help to close the gap can then be selected.[90] However, limits on the quality of inferences that can be made through needs assessments and biases in self-reported data have spurred

researchers to look for alternative methods for revealing demand for new products and services in developing countries – as the three previous sections highlighted.

5: Understanding Demand through Qualitative Methods

Qualitative data collection methods are increasingly used alongside other, more quantitative methods to assess consumer demand and preferences in resource-constrained environments. If collected rigorously, qualitative data can provide a rich and detailed source of information that can help to scale up the development of new technologies. Two main instances when qualitative methods are particularly valuable are demand forecasting and impact evaluations.

Demand Forecasting

Prior to bringing a new technology to scale, it is necessary to predict consumer demand for the product or the service. Demand forecasting not only projects demand from a target market, but also provides information on the quantity of the good to be supplied. Here, qualitative methods can be used to gather information when quantitative data is either limited in number or hard to collect due to infrastructural constraints. They can also be useful when future demand patterns are likely to differ from historical or current patterns, or when changes in policy or funding are expected.[91]

A well-established qualitative tool used for forecasting demand is the *Jury of Executive Opinion*, which pools together the opinions of a small group of high-level managers. Another is the *Sales Force Composite Model*, which asks each salesperson to project his or her own sales, and then compiles the results. This method is traditionally more useful when expanding an old product to new markets. Highlighted in the previous section, the *Delphi Method* can also be used for demand forecasting, as the estimate is adjusted until the panel of experts agree. Yet another way to predict demand is to ask consumers about their purchasing behaviors through *consumer market surveys.*[92,93] In practice, however, these techniques may have different levels of applicability in resourced-constrained environments.

Impact Evaluation

Qualitative methods can also be used at different stages of an impact evaluation of a new product or intervention:

- To gain a broad overview of the needs of the beneficiaries when developing the technology to be tested.

- To understand the consumers' perception of the advantages and disadvantages of the new product during the pilot stage.
- To help confirm what type of information should be collected prior to data collection.
- To provide a complement to quantitative data when attempting to understand complex results.

Qualitative research should be seen as a necessary complement to its quantitative counterpart. Qualitative data can help to gain a deeper understanding of the many nuances and intricacies that quantitative data may sometimes not reveal or to better understand certain channels that they cannot explain, such as why a new product did not take up.

In addition, qualitative methods can capture rich information on time use, social norms, community preferences and other critical factors that are difficult to quantify.[94] They also help to clarify which quantitative data should be collected and why. In practice, collecting qualitative data as part of an impact evaluation can take many forms, as highlighted in the previous section: interviews, focus group discussions, participant observations, or field visits.[95]

The Added Value of Qualitative Data

In an impact evaluation of the Bangladesh Integrated Nutrition Program, which aimed to encourage mothers of stunted or malnourished children to receive nutritional counseling, the authors used focus group discussions to assess how much the recently acquired knowledge on nutrition was put into practice. In this case, the discussions reinforced and confirmed the quantitative findings, i.e. that the program had limited impact on married mothers who lived with their mother-in-law, the latter being the sole responsible for food purchases.[96]

In an examination of a Conditional Cash Transfer (CCT) program in Nicaragua, qualitative research helped to explain why iron supplementation to young children did not translate into anemia reduction. Extensive residential fieldwork, semi-structured interviews, and observations helped to uncover what the quantitative study had failed to understand: in some cases, the taste of the supplements did not please the young children, while in others the iron bars were taken by their older siblings.[97,98]

These examples highlight the variety of additional insights that qualitative data can provide. In some cases, qualitative data support quantitative results, providing additional support for the findings, while in others, they can contradict them. In practice, failure to collect necessary qualitative data can jeopardize the future of an innovation or technology.[99] For instance, the Daraja mobile messaging system, which sought to make Tanzanian local governments more responsive to their constituent communities, only had limited success. While a mix of political, gender-related, and infrastructure issues might explain the low impact, prior collection of

qualitative data would have certainly helped distributors to gain a better understanding of the potential challenges ahead.[100]

Ultimately, qualitative research is an effective way to obtain information about demand where traditional data collection methods may fail. Qualitative tools exist to both forecast demand for a product before bringing it to scale, and to more deeply investigate causal channels as part of an impact evaluation or research study. The different examples discussed above highlight the potential benefits of their use, which can prove extremely valuable in fostering the deployment of pro-poor technologies.

CONCLUSIONS

The various methods and techniques described in this paper will be at the center of a Spring 2014 conference entitled "Revealing the Demand for Pro-poor Innovations". The convening aims to create a forum for engineers, social scientists, NGOs, funders, and policy-makers to discuss new approaches to more accurately capture the preferences, demands, and needs of consumers in low and middle-income countries.

The conference will include presentations of some of the most recent tools developed for revealing demand; critical reviews of the design and deployment strategies of promising technology innovations; and case-specific breakout sessions fostering inter-disciplinary networking and partnership opportunities.

Ultimately, we hope that project ideas will emerge from this dialogue, enabling new technologies to rapidly evolve to meet the demand of consumers at the base of the economic pyramid, in turn facilitating the adoption, diffusion, and scale-up of high-impact, pro-poor innovations.

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ABOUT THE DEVELOPMENT IMPACT LAB

The Development Impact Lab (DIL) is a global consortium of research institutes, non-governmental organizations (NGOs), and industry partners committed to advancing international development through science and technology innovations.

With the support of U.S. Agency for International Development (USAID) and in collaboration with the Agency's Office of Science and Technology, DIL is formalizing the application of academic science and engineering disciplines to social and economic development. This approach is embodied in a new field called Development Engineering. This system of inquiry and practice combines engineering and the natural sciences with insights from economics and the social sciences to generate sustainable, technology-based solutions to development challenges.

The Lab is headquartered at the University of California (UC) Berkeley, where it draws upon the innovative work and leadership of the Blum Center for Developing Economies and the Center for Effective Global Action (CEGA). It is closely allied with the Lawrence Berkeley National Laboratory, an unparalleled scientific research facility supported by the U.S. Department of Energy. Other core university affiliates include UC San Diego, IIT Bombay, and Makerere University.

The DIL consortium is part of a constellation of seven Development Labs that comprise USAID's Higher Education Solutions Network (HESN). These unique research centers "harness the intellectual power of great American and international academic institutions and catalyze the development and application of new science, technology, and engineering approaches and tools to solve some of the world's most challenging development problems."

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