

Appendix D - UNIVERSITY HONORS PROGRAM
SENIOR PROJECT - APPROVAL

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PROJECT TITLE: Infrastructure Development Research
in The Third World: A Methodology

I have reviewed this completed senior honors thesis with this student and certify that it is a project commensurate with honors level undergraduate research in this field.

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Date: 5/4/2000

Comments (Optional):

Infrastructure Development Research
In The Third World:
A Methodology

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Infrastructure Development Research in the Third World: A Methodology

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May 1, 2000
Abstract

A new approach to infrastructure development research in the 3rd world is needed that focuses on local, private ownership and administration of projects. Such a statement implies that the currently dominant attitude among development organizations that emphasizes centralized, top-down and public projects is not the most appropriate. If this is true, then research goals and methods should focus on meeting the needs of that party directly responsible for the project's success: The local, private investor or investor group.

A NEW WAY OF THINKING ABOUT INFRASTRUCTURE DEVELOPMENT

Local, private ownership and administration of decentralized, small-scale infrastructure projects is a better alternative to centralized, top-down and public efforts in the third world. Centralized infrastructure is not appropriate in the third world because of its regrettable side effects. Its principle justification, economies of scale, is being weakened by new technology that makes small-scale projects surprisingly cost-effective. Decentralized infrastructure projects funded from above and abroad turned over upon completion to locals for administration and maintenance promotes a welfare mentality and fails to involve locals as stakeholders in the project's success. Involving community leaders and service benefactors directly in the planning, design, and the financing of local projects may be very important to sustainable development. In addition, the information needs are different for the bureaucratic model and the community model, with the concern of research practicality on the side of the latter. The argument for public ownership and administration of infrastructure services such as water, electricity, telecommunications and transportation in largely informal economies is weak, and such an arrangement too often has harmful consequences. On the other hand, technology has made such services profitable in the private sector, and the typical rural village wealth structure makes variations on private ownership possible and equitable. Private ownership and management of the local infrastructure service sector still allows, perhaps even encourages creative government intervention.

IMPLICATIONS FOR DEVELOPMENT GROUPS AND RESEARCH METHODOLOGY

If this local, private, decentralized preference for viewing infrastructure development is adopted, the role of the development industry should shift from planner to facilitator. As the technology that makes such an approach feasible is new, somewhat complicated and rapidly changing, efforts must be made to sell the idea to rural community leaders; to explain how such ventures could be profitable. Outside, expert encouragement will be necessary to initiate a process that will hopefully be carried forward by its own success. The new role of development agencies and enterprises will be to identify ideal sites to target, to help the prospective local owner/operator design a project, eventually to assist with the procurement of loans and equipment, then to provide continued support and advice throughout the life of the project. The most sensitive and fuzzy aspect of this new role is that of project design consulting, especially in the area of demand assessment. The discussion below will propose a methodology for the development organization as consultant to the local, private potential investor. Finally, an appropriate demand study design will be presented in detail.

Designing the project, the most important questions that the owner/operator needs answered include: What service-distribution mix promises the greatest financial and social returns to himself and the community? At what level of production and at what price will revenues most likely be maximized, and what revenues can be expected at different price-quantity choices? How might demand change over time, considering seasonal impacts and long term growth? Who are the "key players" critical to the success of the project, and what are their thoughts and feelings?

Methods by which relevant information may be gathered include (1) the reduction of existing macro-economic statistics, (2) "cut-and-paste," (3) participant observations and (4) local market surveys. An appropriate transferable survey framework centers on widely measurable, relevant data whose relationship to demand is easily explainable and can be presented in a professional, business manner.

A new approach to infrastructure development research in the third world is needed that focuses on local, private ownership and administration of projects. Such a statement implies that the currently dominant attitude among development organizations that emphasizes centralized, top-down and public projects is not the most appropriate. If this is true, then research goals and methods should focus on meeting the needs of that party directly responsible for the project's success: The local, private investor or investor group.

A NEW WAY OF THINKING ABOUT INFRASTRUCTURE DEVELOPMENT

Local, private ownership and administration of decentralized, small-scale infrastructure projects is a better alternative to centralized, top-down and public efforts in the third world. Centralized infrastructure is not appropriate in the third world because of its regrettable side effects. Its principle justification, economies of scale, is being weakened by new technology that makes small-scale projects surprisingly cost-effective. Decentralized infrastructure projects funded from above and abroad turned over upon completion to locals for administration and maintenance promotes a welfare mentality and fails to involve locals as stakeholders in the project's success. Involving community leaders and service benefactors directly in the planning, design, and the financing of local projects may be very important to sustainable development. In addition, the information needs are different for the bureaucratic model and the community model, with the concern of research practicality on the side of the latter. The argument for public ownership and administration of infrastructure services such as water, electricity, telecommunications and transportation in largely informal economies is weak, and such an arrangement too often has harmful consequences. On the other hand, technology has made such services profitable in the private sector, and the typical rural village wealth structure makes variations on private ownership possible and equitable. Private ownership and management of the local infrastructure service sector still allows, perhaps even encourages creative government intervention. Each of these points will be expanded in the sections below.

The case against centralized infrastructure in developing countries

Centralized infrastructure carries with it the force of historical inertia, but is largely responsible for much of the regrettable conditions and trends in developing countries. In the 18th and 19th centuries, Western powers initiated infrastructure development in their overseas territories in a fashion that would facilitate administration and integrate colonies into the their larger economic empires. Economic considerations had priority when existing feudal or village structures were not consistent with the grander scheme. As this grander scheme generally involved specialization of the territorial economy on one or a few basic export products, infrastructure resources tended to be strategically focused. The former colonies have been granted a greater degree of autonomy, but the backbone of their infrastructure is firmly established and momentum is hard to resist. Certain cities, regions and productive sectors that were favored

by the priorities of their former colonizers are reluctant to give up the spotlight. Besides, a centralized infrastructure administration is convenient for large international companies who have to negotiate with governing bodies for utilities, telecommunications, etc. in each country. Also, centralized infrastructure administrations, private or public, that are prone to mistakes promise easy, "one-stop shopping" prey for powerful, expansionist overseas telecom and utilities companies. This new imperialism may be no less interested in centralized administration than was its predecessor.

But in countries where access to infrastructure is limited, opportunities are where the telephones are, where the electricity is, where all roads lead, and where clean water is available. Those cities that have been made infrastructure oasis in the third world are consequently under the tremendous pressure of immigration. For example, in the 1950s, Latin America was a continent of rural dwellers with more than half the population living in the countryside and the majority of the workforce consisting of peasants and farm workers. By 1990, three out of four Latin Americans lived in cities, with the majority in large urban centers. Overall, Latin America has achieved levels of urbanization equal to those of the developed world despite much lower per capita incomes (Portes 1996). This irresistible and predictable urbanization places considerable environmental and cultural strains on a developing country. In addition to this urban pull-factor impact of centralized infrastructure in developing countries, there is also a complementary push factor: Certain industries and companies continue to enjoy VIP access to infrastructure services and get more resources. One nasty result is that smaller enterprises cannot compete and are either consumed by larger companies or forced to move to the cities for informal work. Another consequence of the institutional favoritism inherent in third world centralized infrastructure is that it contributes to continued specialization in export production of a few basic goods, which makes the entire economy vulnerable to variations in a few key world markets, like coffee and bananas for Honduras. A decentralized infrastructure could act to reverse the trend of urbanization, strengthen rural communities, and ameliorate the plight of small and medium sized enterprises.

The principle justification for large, centrally administered infrastructure monopolies, be they state owned or private -- apart from the ability for a single body to control an entire country's economic structure -- is the idea of increasing returns to scale. When an industry requires a very large investment in capital equipment and/or a high degree of expertise *and* a small variable cost associated with each additional unit produced, the average cost per unit produced declines as the scale of production increases. For example, in a single city, two or more competing utilities companies would each be forced to charge higher prices, and some equipment would be redundant, such as power lines.

In the underdeveloped world, however, infrastructure monopolies cannot be justified with economies of scale arguments. Infrastructure companies there are almost by definition incapable of serving the entire market in which they are protected from competition. The companies cannot afford to string lines out to remote, isolated rural villages. The principle of 'the larger the market, the cheaper the cost of production' does not hold in countries characterized by scattered, small villages because the equipment and maintenance required to extend the grid is not practical.

Meanwhile, technology is reducing the size of the required initial investment. Better rechargeable batteries and satellite and cellular telecommunications technology reduces the need for wires. Integrated projects, whereby electricity, drinking water and telephone services share equipment and a single administration can bring down unit costs considerably. Technological advances in alternative, reusable and hybrid energy sources are making small-scale projects increasingly affordable and efficient, and increasing demand for such equipment will push technological development even further.

Project sustainability: Local leadership vs. “the bureaucratic model”

Decentralized infrastructure projects funded from above and abroad turned over upon completion to locals for administration and maintenance promote a welfare mentality in underdeveloped communities, and could create a relationship of dependence and expectation that is impossible to maintain. The third world landscape is littered with failed infrastructure projects funded by external and national level agencies and the admitted cause is that such efforts do not involve locals as stakeholders in the project’s success. Trojes, Honduras, is a small, rural town of roughly 5,000 on the Nicaraguan border at the end of a difficult 62km dirt road from the nearest city, Danlí. Less than a year ago, the Honduran Ministry of Health, funded by the Spanish Red Cross, constructed a sewer and drinking water system for the town and promptly turned them over to the local government, gracefully bowing off the scene. Today, residents claim that the drinking water is poisonous, and it is muddy following outages and storms – an indicator of broken pipes. As for the sewer system, the tanks are empty because the city wastewater drains visibly into a field, right up to the porch of a household. Quite frankly, the residents found themselves with a sewer and piped drinking water, but they had not paid for it, and were not sure they wanted to pay for its maintenance; so the project has fallen into a state of disrepair and neglect. The local government is blamed for poor service and wasted user fees, and locals wonder why foreign development groups have yet to return and fix the broken system.

Unfortunately, this is the standard model by which rural, third world communities are currently being “developed.” Typically, a rich country funds and directs a study that discovers exactly what it expected: A massive project is needed. To finance the project, a western country offers an aid package, complete with rules that require that the equipment and consulting for the project be purchased from the donor country. The system is installed and handed over to a local government, and there is hardly ever any follow-up after that point. After all, the political horizon for national-level politicians in developing countries is only about 3 years, and the standard tour-of-duty of western development workers is about 2-4 years in a particular region. The system seems to support itself: The economic development research industry justifies its existence, donor countries gain access to third world governments which are indebted to them, donor countries also get good humanitarian PR and get their money back indirectly through construction and consulting contracts. Third world politicians also tend to be content with the arrangement, but irresistible opportunities to divert funds can seriously damage the legitimacy of their governments.

Involving community leaders and local service benefactors directly in the planning, design, and financing of local projects may be very important to sustainable development. Education, so critical to

sustainable economic growth, occurs simultaneously with infrastructure development, rather than after or before. Being involved in the project from its conception through its realization, people are pushed to learn about productive applications as the service develops by a desire to fully realize the potential returns to *their* investment.

A critical assumption underlying the top-down bureaucratic development model is that an economy is best viewed from above and by experts. However, in an economy that is largely informal, the information necessary for efficient resource allocation and to secure good financing and insurance may be practically impossible for the outsider to obtain. Specifically, the planner must have a good idea of service demand in order to allocate his resources according to need and potential and at what scale of production costs can be lowest. The planner needs information about the community's attitudes, culture and traditions, its informal relationships, its most wealthy sectors and its largest employing sectors. The planner must also understand key players in the community that will determine the success or failure of the project such as the municipal government, potential resisters whose business may be negatively affected by the introduction of infrastructure services, complementary businesses, suppliers of materials critical to the project, and owners of land that may be affected by the project.

Local leaders, in contrast to experts above and abroad, are already well-integrated in the community and what they don't already understand about the community's unique economic and social structure, they are in a position to find out quickly and cheaply. Superstitions and customs that may be impossible for a local resident to articulate to a visiting researcher enter subconsciously into the decisions of the local potential investors.

An appropriate domain of private enterprise

One major reason for public ownership and administration of infrastructure services is the redistribution of wealth; the rich are more heavily taxed than the poor while both enjoy the same public infrastructure services. However, efforts to redistribute wealth can quickly go wrong if taxation is perceived to be unfair. Whether the injustice is deliberate due to corruption or the result of misinformation – both rampant in most developing countries – it leads to resentment and disinterest among the citizenry. Unjust tax policies create opportunities for corruption, and wastefulness. This is may be less of a concern in societies with a high “tax morality” and a legitimate, representative government, but economies with large informal sectors tend to be short on both of these.

Another reason that a particular service should be publicly owned is that exclusion from its consumption is impractical, so either everyone pays or no one will. However, technology has arrived that makes it much easier to exclude people from consumption of water, electricity, roads, and telephone lines. Particularly promising is the application of pre-paid electronic cards. The development of this technology makes infrastructure profitable in the private sector.

In many third world rural communities, wealth is concentrated in the hands of a few, large, hereditary landowners or businessmen, who are genuinely interested in the welfare of their community.

Often they have money to invest in foreign financial markets or in some other appreciating good, such as cattle, depending on their level of sophistication. These community leaders are often respected by the poorer villagers; they represent the community to visitors and mediate disputes. In Trojes, the mayor was none other than the daughter of the wealthiest farmer, and respect for the local government issued from this relationship. This wealth structure makes variations on private ownership in rural communities more appropriate than local government ownership. These variations range from a sole proprietorship to an inter-industry cooperative.

There is still room for government intervention in this model. Appropriate public intervention could include direct purchases for public use (such as street lighting), and utility consumption subsidies to disadvantaged households and enterprises (distribution of pre-paid electricity cards, for example).

IMPLICATIONS FOR DEVELOPMENT GROUPS AND RESEARCH METHODOLOGY

The role of infrastructure development organizations

If this local, private, decentralized preference for viewing infrastructure development is adopted, the role of the development industry should shift from planner to facilitator. As the technology that makes such an approach feasible is new, somewhat complicated and rapidly changing, efforts must be made to sell the idea to rural community leaders; to explain how such ventures could be profitable. Outside, expert encouragement will be necessary to initiate a process that will hopefully be carried forward by its own success. The new role of development agencies and enterprises will be to identify sites to target, to help the prospective local owner/operator design a project, eventually to assist with the procurement of loans and equipment, then to provide continued support and advice throughout the life of the project. The most sensitive and fuzzy aspect of this new role is that of project design consulting, especially in the area of demand assessment. The discussion below will propose a methodology for the development organization as consultant to the local, private potential investor. Finally, an appropriate demand study design will be presented in detail.

Site selection

The sufficient condition for a site is an interested party. Following efforts to market the idea in a region, development advisors should be invited to a particular site. If there is an interested investor, then the other necessary conditions can be assumed: A currently unsatisfied market for small-scale infrastructure services; a minimal cash economy; a couple large potential clients; and a skewed wealth distribution that creates one or several concerned, disproportionately wealthy community leaders, at least one of which displays entrepreneurial spirit and business competency.

Cost study

First, engineers must visit the site to see what equipment is necessary and what the options are possible. The cost study should come up with three rough options that detail the range of output and the total cost of operation and equipment: (1) A limited investment option; (2) a conservative option; and (3) a bold investment option. The output levels should be described in terms appropriate to the service and understandable to the investor. If substantial learning curve advantages are expected and/or significant capital depreciation and/or maintenance requirements are anticipated, then a cost-per-unit output schedule over time should be proposed for each option. Once the cost information is in place, the questions of profitability and optimum service mix may be answered by introducing complementary data predicting initial demand as well as demand growth and the resultant revenue stream.

Research objectives of demand-study

Designing the project, the most important questions that the owner/operator needs answered are: What service-distribution mix promises the greatest financial and social returns to himself and the community? At what level of production and at what price will revenues most likely be maximized, and what revenues can be expected at different price-quantity choices? How might demand change over time, considering seasonal impacts and long term growth? Who are the “key players” critical to the success of the project, and what are their thoughts and feelings?

The research team must never forget that the primary audience of the study results should be the local prospective investor. Results should not be destined for scholarly journals, newspaper or magazine articles or government archives. In consideration of the sophistication of the typical potential investor, the report should avoid graphs, maps and percentages as much as possible. Additive quantitative data is most appropriate.

Seeking to encourage the development of sound business practice in these communities, we should encourage sound judgment based on numbers. On the other hand, anecdotal information proves a very effective selling tool. Generally speaking, the larger the population under examination, the more appropriate are statistical methods and models; the smaller and more homogeneous, the greater the emphasis on controlled experiments. Our situation falls in-between, so we must be careful not to rely too heavily on either. A report too heavy on value judgements will not effectively guide the planner in optimizing decisions, and too much emphasis on statistical extrapolation could cause an assessment team to miss critical “common sense” clues.

Sources of data

Methods by which relevant information may be gathered include (1) the reduction of existing macro-economic statistics, (2) “cut-and-paste,” (3) participant observations and (4) local market surveys.

One very common, but problematic, method of describing a rural community is through the statistical reduction of existing national-level statistics. The chief reasons why this method should not form the core of the research are (1) large informal sectors cause severe distortion in macro statistics, (2) reduction is complicated, and (3) there is wide variation in data collection and analysis methods between countries. The informal sector refers to those transactions that are unreported and unrecorded in official statistics. The informal economy in the US has been estimated at anywhere from 2-3% of GDP to 28%, but economists agree that the US’s informal sector in relation to its formal economy is the smallest in the world. The informal sector in Honduras is probably upwards of 50% of that country’s GDP. Any criticisms (and there are many) of US stat-guided economic policy must be amplified considerably for Honduras and other countries with less developed statistical methods, lower “tax morality” and less sophisticated business practices than the US. Methods of statistical reduction from the national level to a local area are quite complicated and potential local investors may be reluctant to accept the idea that infrastructure service demand in their isolated community is in any way related to the national economy. Finally, a methodology

that relies heavily on existing macro data could not be easily stream-lined and transferrable, as the type and quality of studies varies widely among countries. Besides, micro level studies, mentioned below, are generally considered more accurate, and sometimes contradict results generated through reduction. All the same, published macroeconomic statistics may be useful prior to the actual study, in order to know what to expect in the field.

The “Cut and paste” method of predicting the impact of infrastructure service availability in a particular site involves finding an existing before-and-after study in a similar site, then adjusting the variables to arrive at a reasonable “before” picture of the new site and its corresponding “after” situation. This approach is as good as the similarity between the sites and the pains taken to manipulate the old to reflect the new. Currently, there is a shortage of existing, obtainable studies aimed at local private investor information needs and integrated infrastructure projects.

Participant observation (live-in) studies are the most thorough and complete but also the most expensive and lengthy. Here, data takers actually observe and note the size and direction of transactions, time spent by the subject in household chores, and other relevant information. The significant cost of such an in-depth study must be weighed carefully against the likely usefulness of the information obtained. Even with perfect information there is much room for error in the analysis.

Local market surveys should form the centerpiece of the demand study. To be cost efficient, they must be based on a streamlined, transferable framework, not redesigned for every site. The team should aim to hit the ground running and publish a report within a few days. The more studies done, the more efficient the process becomes. Repeated use of a single framework can also help build the basis for cut-and-paste analysis later.

A TRANSFERRABLE DEMAND-STUDY DESIGN

An appropriate transferable survey framework must facilitate the gathering, analysis and presentation of widely measurable, relevant data whose relationship to demand is easily explainable. The framework proposed here makes use of Microsoft Access, Excel and Word – Microsoft Office database, spreadsheet and word-processing applications respectively. It allows for extreme flexibility in the number and type of services to be considered, the types of enterprises to be highlighted, and specific information sought, while maintaining a clear structure.

The program is designed to produce reports almost automatically that meet the investor's primary information needs. "Demand schedules" by sector and service indicate the total quantity demanded and total revenue expected at several possible unit prices, and also include the regression equation and the average flexible income of an entity in the sector. Combined with the cost study reports, this will indicate the output size and price necessary to maximize profits. A "Current Service" report summarizes how much the town inhabitants consume and spend on each existing service, their familiarity with each service, satisfaction and reasons for dissatisfaction. "City Stats" is a report that summarizes the market's age, education, isolation, integration, sophistication, confidence, etc. The items featured in this report constitute the major factors affecting the demand growth rate; however, several follow-up studies will have to be conducted before we can determine the relationships. Initially, the "city stats" report may just indicate that demand growth rate will be about the same, slightly faster than or much faster than the population growth rate of the site. "Calendar Trend" lists every month of the year and associates with each one a figure that indicates whether the local market feels that it is a period of normal, below normal, or above normal cash flows. This should help the prospective investor visualize how the ability to pay will fluctuate over the calendar year.

A new, blank copy of the program templates should be made for each particular site, and as problems arise, alterations can be made to the template itself. The following methodology is intended for the directors of the demand study. It is primarily based on the experience of two demand studies carried out in Honduras in March 2000, incorporating successes and proposing specific improvements to the original design.

1. Budgeting the study

Like a shoe salesman, the organization marketing infrastructure equipment must focus on helping the potential investor/administrator (owner/operator henceforth referred to as O/O) determine the best-fitting option. The O/O should be assured of this in the initial meeting, and thus of the objectivity – the absence of conflicting interest -- of any forthcoming demand study. It should be planned and financed by the O/O. In the initial contact, present the O/O with sample reports, and indicate that similar reports could be generated for the site in question if the O/O so desires. The practice demand studies in Honduras were not budgeted, nor were they guided by efficiency goals. It was never quite clear how much the study results

would influence the O/O decision. However, with these experiences under our belt, we can move confidently toward goal-oriented plans that incorporate the expectations of the O/O.

The Excel spreadsheet named “design” will help budget the study. First, enter the estimated population of the site and the estimated number of residents per household and workers per enterprise. This will yield the total number of surveys needed for 100% coverage (N). Next, determine with the O/O the desired level of confidence, choosing a Z-score associated with 80%, 90%, 95%, 98% or 99% confidence. The *error* value entered will represent the acceptable + or – range around the results of the most important statistic (the average quantity of service demanded in units for each price in each sector). The *stdev* (standard deviation) represents the number of units above or below the average within which 67% of observations are expected to fall, and half the range within which 90-95% of observations are expected to fall. From this information will be calculated the number of surveys to conduct in the study (n). Obviously, this information will be very difficult to estimate, but remember, it is only a marketing, budgeting tool and an indicator of the demand study’s importance to the O/O’s.

Once the desired number of surveys is computed, estimate the total cost per day per data taker (dt/day), the total cost per survey, including materials and incentives for respondents if deemed necessary ($cost/surv$), the fixed cost per day independent of the number of data takers and number of surveys ($fixed/day$), and the flat consulting fee for the survey, including the travel and other expenses of team leaders ($flat$). Also estimate the expected number of hours spent surveying per data-taker per day (h/day), and the number of surveys per data-taker per hour ($surv/dt/h$). In Honduras, the cost per data taker per day was roughly \$20, the number of hours spent surveying per data-taker per day was about 4 but could have easily been pushed to 6, and the average number of interviews conducted per data-taker per hour was 3.

Now play with the scheduled number of data-takers (dt) and number of days ($days$) until the number of surveys anticipated (n^*) equals the number of surveys desired (n). At this point, the estimated cost of the study ($cost$), the number of data-takers (dt) and days of surveying needed ($days$), and the desired number of surveys ($n=n^*$) are clear. As a reference, in Honduras, we employed 8 data-takers and spent roughly 1.5 days interviewing in each site, completing roughly 140 interviews (enterprises and households) at each site ($8 \times 1.5 \times 4 \times 3 = 144$). To help fine-tune the budget, the spreadsheet features a column describing the relationship (*pos* or *neg*) between the adjustable entry and both study cost and number of surveys. When the O/O has agreed to the cost, length and quality of the study, it is time to hire the data-takers.

[see *design* spreadsheet attachment]

2. The data-takers and study customization

In many developing countries, the large amount of studies by NGO’s, private investors and government agencies has given rise to a close-nit group of professional data-takers. This was certainly the case in Honduras: We were referred to our ladies by an economic development organization with a long-established presence in Honduras. All of our data-takers had at least two years of experience, had been

formally trained in research methods seminars, and several were contracted to help conduct a participant observation study directed by the Honduran government's child and family development agency upon the completion of our own research. Through our experience in Honduras, especially the feedback from interviewees, the ideal data-taker is a national but not a local. Ideally, the data taker is from another small town, already familiar with the services offered, but able to identify with the interviewees – to understand their expressions, verbal and nonverbal, and to respect their customs. Interviewees in Honduras actually commented that they were more comfortable responding to other nationals than to foreigners.

Most importantly, the outsider who selects and works with the team of data-takers should strive to make friends. The team leaders (outsiders) must constantly be guided by the thought that by the end of the project, the interviewers and their directors should want to exchange addresses just to stay in friendly contact. This is important for several reasons. First, the data-takers will represent the project to the households and enterprises of the site. Their performance as salespeople/ambassadors in the field will generate interest or disinterest, actually expanding or shrinking the potential market for the proposed services. It is highly desirable, therefore, that the data-takers exhibit sincerity and contagious enthusiasm when conducting interviews. The source of this good-will is not the data-takers' understanding of the actual project as much as it is their esteem for the project's directors. Second, the more the data-takers like their directors, the more they will contribute to the study results. In Honduras, there seemed to be a direct relationship between the data-taker's relationship with the team leaders and the legibility and consistency of their completed questionnaires and their anecdotal contribution. Those who tended to be more aloof in after hours also tended to produce less useful survey results and fewer "stories from the field." I feel that interviewers' efforts to contribute above and beyond the call of duty produced important footnotes in Honduras. Efforts should be made to create an atmosphere in which the data-takers feel that the success of the project depends on the quality of their work, and in which they want the project to succeed not only because it promises material benefits to the community, but also because they want to help their directors realize their goals. Needless to say, this atmosphere will also enable the study to survive uncomfortable financial or logistic misunderstandings. Finally, since the success of a project in one location will spark interest in the surrounding area, and since follow-up studies should be a standing option for the O/O after the project's installation, the data-takers' services will very likely be needed again later.

Likely it will suffice to contact only one data-taker initially with the dates of the study, the proposed compensation, and the number of data-takers needed. If the task of filling the other positions with qualified workers is left to this initial contact, there is a good chance that the team will already have experience working together. Arrange to meet the entire team of data-takers in an accessible location outside the site itself. First, the director should meet each individually and enter into the database (*Forms!dt*) their name, address, contract details and background notes or a picture. If the team will participate in studies at more than one site, the data-taker table (*dt*) can be easily copied to the relevant databases. [see *data takers* form]

The project directors should introduce themselves to the group, then ask each data-taker to stand as their name is called, at which point they are introduced to the group by the director, and individually thanked for agreeing to help with the project. The history of the organization, the nature of the infrastructure projects in question, and the objectives of the demand research should be presented. Then, the data-takers themselves should design the questionnaires according to the data needed. Each of the five survey data entry forms should be considered, and a question derived for each field. The basic questions to ask are obvious to the foreign director, but the data-takers are more attuned to the exact, appropriate wording and order of questions. They will take more pride in their work if they have helped design the tool, and since they would likely modify the questions to make them more comfortable and conversational anyway, there should be a consensus on how the questions are modified from the beginning.

Study directors should help them produce a standard introductory statement to preface each interview. In most cases, this standard introduction will seek to familiarize respondents with the purpose of the study and thank them for their participation. Interviewers should ask to speak with the person most responsible for the house or enterprise budget (this will not always be the head of the household or owner of the enterprise!). The intro should also alleviate “tax-collector” fears, by asserting that while the study does have the support and encouragement of their government, it is not intended for government purposes; and as further comfort, neither name nor address is requested of the respondent. Also to consider, Should a monetary incentive be offered in order to elicit thoughtful responses?

The survey instruments

There are five survey data entry forms on which the questionnaires will be based: Four versions of “page 1,” for (1) households, (2) enterprises, (3) key players, and (4) the man-on-the-street, that provide information about the demand study respondent; and one “page 2,” centered on the service demand bidding game (though it will be reproduced for each service/distribution type offered).

Classifier fields:

All four versions have “classifier fields” that identify the data source.

- A version field, labeled “**mots**,” “**players**,” “**ent**,” and “**hh**” for the man-on-the-street, key players, enterprises and households versions, respectively. This field enters the appropriate version type as a default automatically and should not be overwritten.
- **ID**: An autonumber field; the so-called “key” that identifies the record and cannot be duplicated. If records are deleted, their ID numbers are retired.
- **date**: Programmed to automatically enter the current date as a default in month-day-year format.
- **dt**: A combo box from which may be selected the names of data takers entered into the *dt* table. From this field, the *datataker* report can determine how many surveys each data taker conducted.

- **num:** The survey number by which the data taker identifies the particular survey. Not used in any queries, this field will only be needed if an inconsistency discovered later requires the data taker to recover the original hand-written questionnaire form.
 - **Note** The *players* form does not have fields for data taker name or data taker survey number. Normally, interviews with key players will be conducted by the study directors themselves.
- **nh:** A combo box from which may be selected a neighborhood name from those entered into the *nh* form.
- **size:** Only appearing on the *hh* and *ent* versions, this check box should be checked if the distinguishing characteristic criteria (not necessarily “size”) is met.
 - **Note** The neighborhood and size information is, in the current design, used only in the strategic deployment of forces (see step 4 below), and presently not required in the survey forms. However, this will be useful information when multiple variable regression analysis of demand responses is desired, and to identify significant outliers.
- **party:** Only appearing on the *players* version, this combo box allows the survey form to be connected to a contact person entered in the *contacts* form, and cannot be left blank. All key player “parties” must have a designated contact person.

City stats fields:

These fields are considered to be the factors that most affect infrastructure service demand growth, are found on all four versions and are summarized in the *city stats* report.

- **age:** Age in years of the respondent at nearest birthday. The summary report will present the average age in the city. A site population with a relatively high average age will have a lower service demand growth rate than a similar site with a relatively low average age. Older residents will be less inclined to abandon traditional ways and to adopt new technology.
- **edu:** Years of formal education of respondent. A response of 0 will be interpreted as “no formal education but literate,” whereas a –1 will mean that the respondent has “no formal education and is illiterate.” The summary report will present the average number of years of formal education of the site’s residents, pulled down by illiteracy. A relatively educated population will be quicker to learn about and adopt new technology and therefore to positively affect the service demand growth rate.
 - **Note** The *hh* version has fields for the ages and years of education of up to 9 residents in addition to the respondent. If the household has fewer than 10 residents, unused fields will be left blank.
- **integ:** The respondent’s perceived integration in the community serves as an indicator of informal structure and community cohesiveness. In a relatively integrated site, neighbors are ready with favors and accustomed to sharing; rumors, ideas and new techniques spread rapidly in a close-knit social environment, and this is conducive to a rapid popular adoption of new products and services – pushing

the infrastructure service demand growth rate higher. The field is a list box from which the scores “1” “0” and “-1” , or a blank field for “no response” can be selected. “1” means the respondent felt tightly integrated into the community, “0” is neither integrated nor isolated, “-1” identifies a respondent that feels somewhat socially isolated in the community. The summary report will average all the scores, so the site score will also fall between -1 and 1. Remember! In all list boxes, the selected response is white on a black background!

- **purchlocal:** This check box should be checked if the respondent makes *most* purchases locally.
- **inclocal:** Check this box if *most* of the respondent’s income is from local sources. These two fields, presented in the summary report as “percent of site residents making most purchases/earning most income locally” indicate the sites commercial openness or contact with the external economy. All other things equal, a relatively open local economy will feel pressure to seek and adopt more productive methods. These percentages and the demand growth rate will be inversely related. Also, a comparison of these two statistics could indicate whether the community wealth suffers from a net exodus or benefits from a net influx.
- **confid:** This “confidence” list box offers 1, 0, and -1 as possible responses. “1” means that the respondent feels that their material well-being (for households and m.o.t.s.) or business (for enterprises and key players) is improving and will continue to improve over the next year. “0” means that things are staying about the same. “-1” means that things are getting worse and will continue to get worse. The summary statistic is the average of all responses, so the site’s confidence score may be interpreted according to the range from “very confident” (approaching 1) to “very insecure” (approaching -1). A high confidence score will boost the demand growth rate significantly, as confident people feel that they have room to take risks and allow anticipated future incomes to influence present day purchase decisions.
- **trav:** Select from the list box an integer from 0 to 4; “0” if respondent does not travel beyond the limits of the site; “1” if respondent travels neither far nor often; “2” if respondent travels far, but not often; “3” if respondent travels often but not far; “4” if respondent travels far and often. The definitions of 2 and 3 may be switched, depending on which seems to represent a greater likelihood of external influence. The terms “often” and “far” are site specific, but questions should be in terms of “trips per year (or month)” and “to what typical destinations.” “Far” should be defined as “far enough to come into contact with good infrastructure service” and “often” as “often enough to affect one’s perceptions and tastes.” The positive relationship between travel propensity and infrastructure service demand growth is evident. The summary statistic is the average of all responses and could therefore range from 0 to 4.
- **save:** A 0 to 4 list box indicating the respondent’s propensity to plan for future purchases. “0” means no income is set aside for future expenses/purchases; “1” means the respondent saves for purchases less than 3 months away; “2” for purchases less than 1 year away; “3” for purchases a year or more

away; “4” for expenses/purchases 3 or more years in the future. The summary statistic is the average response. The savings score and the demand growth rate will be directly related.

- **wr:** Does respondent keep written records of cash flows? Check this box if the answer is “yes.” This field, summarized as “percent of site residents keeping written records,” is an indicator of economic sophistication. Households and enterprises that do not keep records – and many do not in informal economies – tend to operate on a day-to-day survival basis and do not plan their activities according to reason and optimization. A relatively sophisticated population will take greater advantage of infrastructure services.

Calendar fields

For each month, respondent should be asked whether the cash flow is (1) better than normal, (0) normal, or (-1) worse than normal. In the report *calendartrend* the responses for each month are averaged to give an idea of how the community’s overall cash flow varies throughout the year.

Income fields

Of the 6 fields concerning income and expense data, only the **nsource1**, **ntotalin** and **nnesc** fields are important in the current program. However, if it is possible to obtain responses for the **nsource1in**, **nsource2**, and **nsource2in** fields, a report could easily be prepared that shows what percentage of the site’s economic agents are involved in various work types and how much of the site’s wealth is derived from each work type. **nsource1** (required) and **nsource2** (not required) refer to the respondent’s primary and secondary sources of income in a normal month, and in all but the *players* version are combo boxes that associate the household, enterprise or man-on-the-street with one of the work type groups in the *list* report. **nsource1in** (not required) and **nsource2in** (not required) are the estimated monthly incomes from the primary and secondary sources in local currency units. **ntotalin** (required) is the estimated total income in a normal month from all sources, and **nnesc** (required) is the estimated percentage of total monthly income that is earmarked for necessary expenses during a normal month – the part of every dollar earned that is required to meet the respondent’s basic needs. **nnesc** is a list box from which the following choices are available: 0.00, 0.25, 0.50, 0.75, and 1.00. $(1 - nnesc) * ntotalin$ = flexible monthly income, or, the maximum monthly amount that could be spent on infrastructure services without serious budget alterations. A work type group’s average flexible monthly income will serve as an indicator of the group’s ability to pay for infrastructure services in the short-term.

To illustrate the difficulty of obtaining accurate income and expense data, consider this: A series of questions that asked some 200 local businesspersons in two Honduran villages to very roughly estimate the value of their sales in a typical day, in a particularly good day, and in what they would consider to be a bad day; the value of gross revenues in a typical, a particularly good and particularly bad month; and net earnings in a typical, good and bad day and in a typical, good and bad month proved very frustrating. Often, the monthly sales estimates offered by the respondent were only a few dollars higher or actually

equaled the reported daily sales figures. Monthly sales figures were hardly ever greater than 10 times the daily sales figures. Often, a particularly good month's sales would be less than the reported gross revenues of one week of bad days. Net earnings responses were equally discouraging. For example, one shop having reported a good month's sales as HL900, proceeded to estimate net earnings of HL1500 in a good month. In several cases, the days' net earnings were equal to the corresponding days' gross revenues. The response rate to the typical day's sales question was 62%; 35% of businesses interviewed responded to the typical month's sales question; and the typical month's net earnings question had a response rate of only 31%. In contrast, when asked to estimate the number of clients per day, 72% of those interviewed were able to venture a figure. The data takers' anecdotes indicated that interviewees had been as frustrated by these questions as the survey designers were with their responses. According to them, most small businesspersons in these two rural Honduran towns manage their cash out of a box: If there is money in the box when a supply truck stops at their doorstep, they restock; if there is no money in the box, they do not. Many managers have no concept of their budget or cash flow and do not keep written records. It is reasonable to conclude that a large portion of the Honduran economy is not guided as much at the micro level by rational optimization strategies and planning as by a day-to-day survival mentality.

Respondents who are unsure about their monthly income and expenses should be encouraged to estimate, round to the nearest hundred or thousand, or give it their best guess. In informal, irrational economies guided more by survival than optimization, perceived cash flows and budget constraints influence the agent's demand function more than actual cash flows and budget constraints. For this reason, we can be comfortable with the respondent's "best guess" as a proxy for the real thing; a seriously attempted estimate is perhaps even more valuable information than would be the actual figures if they were obtainable.

On each form, a macro button labeled "demand" opens the *demand* form. A complete survey includes one of the four versions of "page 1" and as many demand forms as there are service/distribution options.

Referral fields

The first field in the *demand* survey form, **ID**, is an autonumber that identifies the record.

The second and third fields, **from** and **fromID**, link the demand record to the respondent's "page 1" information. **from** can only be "ent," "hh," "mots," or "players"; all other entries will be rejected. This field must be the version of the corresponding "page 1." **fromID** must match the autonumber **ID** field of the corresponding "page 1." It is crucial that these two fields are correct in order to link demand responses with income, work type and other responses on "page 1."

serv/dist: Select from the combo box the service/distribution in question.

Current situation fields

- **familiarity:** Select 0, 1, 2, 3 or 4 from the list box. “0” means the respondent is unfamiliar with the service in question. “1”: Has heard about the service and its uses. “2”: Has close friends or family that use the service. “3”: Has first-hand experience using the service. “4”: Uses the service regularly and/or is convinced of its benefits. The site summary statistic for this question, an average generated for the *current service* report, will indicate the potential impact of marketing efforts on service demand.
- **mo. cos:** The estimated monthly expenditure on the service, if used. If not, leave the default “0”.
- **mo. con:** The estimated monthly consumption of the service in units as defined in the *servdist* form. The default is “0”.
- **source:** If respondent uses the service, who provides it? Keep these responses consistent, as all *current service* summary statistics will be sorted according to this field.
- **satisfaction:** If respondent uses the service, is he (1) satisfied, (0) neither hot nor cold, or (-1) dissatisfied with the current situation? Select 1, 0 or -1 from the list box.
- **expensive; insufficient; unreliable;** If respondent uses the service and is not satisfied, or, if the service is available but not used, ask “Why not?” Check the boxes of the reasons the currently available service is unsatisfactory or not used. The summary report counts the checks by each reason in order to rank the potential market’s priorities.

The bidding game

This is the most important part of the survey, and must be handled delicately. First, ask whether the service proposed would improve the respondent’s quality of life (for hh and mots) or business (for enterprises) (1)little, (2)some, (3)very much, or (0)none at all. Select 0, 1, 2, or 3 from the **improve** list box. In order to answer this question, the respondent must visualize some vague “default” usage level. The next question, then, will ask what level of usage, in roughly estimated units per month, would bring about the improvement referred to above. This response will be entered into the field labeled **d1** (for “quantity demanded₁”). While the vision is still fresh, ask how much money the respondent guesses he would have to spend per month on the service to enjoy said usage level and record this amount in the field labeled **wouldpay**. The interviewer should then quickly divide the **wouldpay** response by the **d1** response, record this as **p1** (for “price₁”) and say something to the tune of, “The actual price of the service, if it is offered, will be determined by the cost of production. The potential owner/operator, however, wants to know if the service can be provided at a reasonable price, and how much would be purchased at that price. You have said that you would expect to pay [**wouldpay**] for approximately [**d1**] units, so a reasonable price would be [**p1**] per unit. Is that correct?”

If so, interviewer should proceed with the bidding game. Otherwise, adjust **p1** until respondent is satisfied with this reasonable price. For **p2**, propose a unit price above **p1** and record the usage level, in units per month, that respondent would demand at this high price as **d2**. **p3** should be a unit price below **p1**, and the units per month respondent would purchase if the service was offered for **p3** is recorded as **d3**.

A least-squares linear regression equation will be calculated for each work type group, for households, key players, and men-on-the-street by service/distribution option, using “p” as the independent variable and “d” as the dependent variable. From this equation, the average quantity demanded will be predicted for every value of “p” that appeared in the bidding game for the particular service. $p \times \text{predicted average demand} = \text{predicted average revenue at price } p$. The number of enterprises or households to which the equation applies will be recalled from the listing exercise, and this number multiplied by the average quantity demanded will yield total quantity demanded by the sector at the given prices, and multiplied by the average revenue will yield a predicted total revenue. In addition to the sectoral breakdown, a community demand equation will also be available, but not as accurate as the sum of isolated sectoral results.

It is possible that responses to these “bidding game” questions will be too high in some instances. However, the responses should reflect the interviewee’s understanding of his needs and potential. Again, in the informal economy, this may be the most useful data. If a participant observation study were carried out, one could assess the individual’s actual budget constraint and utility curves, then pinpoint the benefit-maximizing reactions to infrastructure service offers at various prices. But since this method assumes optimization guided decisions, it sounds somewhat silly in the context of isolated, rural communities in the developing world. Besides, if the bidding game goes heavier on the optimistic willingness to buy and skimps on the ability considerations, this can be evaluated by comparing average flexible income with average revenue for a given work type.

More likely, the respondents will not be fully aware of the contribution reliable infrastructure services can make to their business and quality of life, and thus likely to underestimate their demand at the proposed prices. This downward bias is tolerable because the resulting demand schedules will represent the “rock bottom,” with plenty of room to grow as the services are actually introduced to the community and residents become more familiar with possible applications.

From the *demand* form, macro buttons allow the database user to open a new *demand* form for the next service/distribution option on the list, to open new *hh*, *ent*, *mots* or *players* forms, or to return to the main switchboard. [see *hh*, *ent*, *mots*, *players*, and *demand* forms]

3. Meeting the O/O and city officials

Upon arrival at the site, the potential investor should be greeted, introduced to the study team and informed what will take place over the next couple of days. Review the services and distribution options under consideration, and enter these into the *servdist* form. Interviewees will respond to a separate demand questionnaire for each service/distribution option. For example, at a particular site, the O/O may be considering (1) electricity distributed in the form of rechargeable batteries, (2) electricity distributed through several centrally located outlets, (3) electricity wired directly to households and enterprises, (4) water distributed in bottles, (5) water piped to centrally located faucets, (6) water piped directly to households and enterprises, (7) cellular phone service, (8) telephone booths, (9) telephone lines to

households and enterprises, etc. Review what unit terms the previously conducted cost study used to describe output ranges. Each service/distribution option is given a code by which it will be identified in database queries. Possible codes for the options above are (1) electbat, (2) electoutlet (3) electwire (4) waterbottle, (5) waterpipe, etc. Ask the O/O who they consider to be key players, and specifically what they would like to know about them. This will guide the discussions with key players.

In a meeting with municipal government representatives, describe the survey process and get the city's blessing. Then ask for help on the following issues: Who are "key players" leaders and how might they be contacted to arrange meetings (get names and addresses). Ask how the city is naturally divided into neighborhoods; what are their distinguishing characteristics, what are their limits? If there is no logical or natural division, propose divisions corresponding to directions on a compass from a central point. This information will be entered into the database through the neighborhood form (*nh*). Ask city officials to estimate the site's population and population growth rate (entered into the *city* form in the database). Finally, ask about the availability and history of the services to be offered. This is a powerful way to conclude the meeting because it brings the topic back around to the services themselves: The goal of the study. The directors may wish to schedule a closing meeting with city leaders to share the findings of the study.

During the meetings with the O/O and the city representatives, information should be entered into the *contacts* form of the database, and if the O/O and/or the city will themselves be potential clients, apply the *players* questionnaire and *demand* questionnaires (a *demand* questionnaire for each service to be offered). Notes should be kept directly in MSWord documents in the course of the conversations to refer to later and to help guide the study.

[*servdist* form, *contacts* form]

[*city* form] *notes field can be any object: a map, a picture, a word or notepad document generated directly

[*nh* form]

4. The listing exercise and strategic deployment of forces

The entire team then walks the dividing lines of the neighborhoods together, preferably with a local guide. Or, if there is a high vantage point nearby, climb it and look down at the site together, making sure that everyone recognizes the limits of each neighborhood (probably principal streets) and that keeping these straight is crucial.

Assign one person to each neighborhood (two would yield redundant lists), and instruct them to cover every inch of it, listing every potential interview. If there is an observable characteristic by which enterprise types and/or households can be subdivided, and that characteristic would logically account for significant variations in demand survey responses, instruct the listers to indicate whether the household or enterprise meets the criteria. The most obvious observable, important subdivision for households is "comfortable" vs. "uncomfortable." A study director could decide, for example, that houses with solid floors be considered "comfortable" and houses with dirt floors be considered "uncomfortable." For

enterprises, the obvious characteristic is workforce size. Enterprises that appear to have more than one worker will be deemed “large” and those with only one worker, “small.” This characteristic will be used to coordinate a more representative selective sample.

A list should look like this:

Neighborhood: Northwest Data-taker: Rachel Rodriguez Date: 3/15

grocery store – large
hardware store – small
dentist – small
restaurant – large
house – comfortable
house – comfortable
house – uncomfortable
mechanic – large
grocery store -- small
etc...

Data-takers not involved in the listing exercise should do a practice interview; or, if none are disposable, have the listers do practice interviews after the exercise. The household and enterprise versions should both be tested in the field. During this time, the directors begin tracking down key players and scheduling conferences. When the team reunites, each list is read aloud while a director enters the data into the database form entitled *list*. Households are listed simply as households, but each enterprise is assigned to a “work type” group according to its primary activity. Forces will be deployed and demand responses aggregated by work type group (horizontal aggregation) rather than output type (vertical aggregation). Why? In infrastructure service preferences and priorities, as well as ability to pay, a cloth retailer and a food retailer will have more in common with one another than with a weaver and a farmer respectively. Work type groups should be kept to a manageable number, and with future inter-site comparisons in mind. The list below is recommended, with preference for the left column; if necessary, one or more work types may be disaggregated to its sub-groups in the right column.

Hospitality	Restaurants, Hotels, Bars
Agriculture	Basic Agriculture (staple crops), Non-Basic Ag (spices, coffee, etc.)
Industry	Light Industry (simple tools), Heavy Industry (complex tools/machines)
Commerce	Retail and Distribution of Essential v. Non-Essential (or Durable v. Non-Durable) goods
Professional	High Skill (finance, education, health services), Low Skill (painters, cleaners, etc.)

The list of work types must accommodate all the enterprises in the market. Remember to enter *key player* enterprises into the *list* form as distinct work types such as “communication,” “fuel,” “government,” etc. so that their demand regression equations can be produced separately.

[*list* form] *the criteria check box is labeled “size,” but could refer to any characteristic, including “comfort” or “has front porch.”

Generate the *wtpportions* report to see what percentage of total potential interviews each work type group, broken down by “size” and “neighborhood,” constitutes, and distribute the number of interviews to be conducted during the course of the study proportionately. To do this, multiply $n=n*$ from the *design* spreadsheet (produced during the initial contact with the O/O; see step 1. above: “Budgeting the study”), by the percentage of total for each sub-divided work type group in each neighborhood.

[*wtpportions* report]

Assign interview targets to each data-taker according to this strategic sampling plan. For example, one data-taker might be instructed to interview “5 small commerce enterprises in neighborhood Northwest,” “2 large commerce enterprises in neighborhood Northwest,” “3 small industry enterprises in neighborhood Northwest,” “1 large industry enterprise in neighborhood Northwest,” “5 comfortable households in neighborhood Northwest,” and “10 uncomfortable households in neighborhood Northwest.” Preferably, data-takers will be assigned to neighborhoods with which they are already familiar from the listing exercise, making the target interviews easier to locate.

Before sending the interviewers into the field, discuss the practice interviews and make adjustments to the questionnaires as needed. Likely there will have been some misunderstanding about the unit terms, data types or number formats that will be cleared up at this point. As the datatakers are dispatched, schedule an appointment for each to individually return and report their findings during the day.

The man-on-the-street surveys exist to quickly and easily flush out a demand study. Whenever a data taker has a free moment, she should engage a passerby or barfly in a discussion and spring a *mots* questionnaire on him. People on the street are not strategically targeted, but they could represent a segment of the population somewhat hidden from the listing exercise; so they should be interrogated as often as possible.

5. Data entry

In Honduras, data takers turned in filled-out questionnaire forms at or close to the end of the study, at which point an assistant (the author) would enter the data into a spreadsheet. This process proved extremely frustrating due to illegibility and data-type inconsistencies (For more detailed comments on specific data entry problems, please see attached document entitled, “The Experience In Honduras.”) In order to avoid such strife, the data should not be extracted from written forms but rather from the data-takers themselves. Individual data takers report to headquarters at staggered, previously scheduled times.

As they transmit orally their questionnaire responses (reading their handwritten forms aloud), the assistant enters data directly into the appropriate database form on a laptop. These private sessions make immediate clarification possible, and facilitate mid-course correction in the event that particular questions are problematic in the field. Also, individualized sessions give each data-taker the opportunity to relate anecdotes, which should be recorded as footnotes in a Word document. At the end of a reporting session, the entered data and footnotes should be read back to the data-taker, and having approved the accurate transmission of information from the respondent to the database, the data taker returns to the field to conduct more interviews as the next researcher arrives at headquarters to disclose her findings.

6. Meeting “key players”

Meetings with “key players” (identified earlier by the O/O as critical to the success of the project, then contacted with help from the municipal government), should begin with a presentation of the researching organization, the nature of the infrastructure project and the objectives of the demand study. Then, the attending leaders should appoint a representative, whose contact information will then be entered into the *contacts* form. Together -- or if time allows, individually following the group meeting, the invitees respond to a *players* questionnaire and *demand* questionnaires for each service/distribution under consideration. The most important part of the meeting will be a free-form discussion of the key players’ concerns and expectations, and whatever topics the O/O regards as important to his investment decision (see step 3: “Meeting the O/O...”). One study director or assistant should concentrate on guiding the discussion while another keeps detailed notes in a Word document. Some key players may be interested in part-ownership of the project or special price or distribution arrangements with the O/O. If so, the study directors should take steps to advance these collaborative initiatives, as a broader stake-holder base will make project success more likely.

7. Using the Demand Schedule reports

To generate demand schedules, select “Demand Schedules” from the “View Reports” switchboard or open the *wform* form directly. Select the desired **work type** (includes households, mots, and “All”) and the desired **servicdistcode**, then click the report button. The form itself must remain open for the report and the queries on which it is built to run. The work type and service/distribution code appear at the top of the report, along with the average flexible income for the work type and the linear equation for predicting sector average quantity demanded. The prices are those proposed in all *demand* bidding games for the service/distribution option to every sector. The average quantity demanded is predicted by the equation, and the unit term is that entered into the *servdist* form earlier. Average revenue for each pricing choice is price * average quantity, and by multiplying these predicted average figures by the number of group members, we have total quantity demanded and total revenue expected according to each price at which the service could be offered. For any price, the expected quantity demanded and total revenue can be easily computed using the equation.

The sector breakdowns will be useful in isolation, especially the “key player” sectors. Still, the ultimately desired revenue and quantity numbers are for the site in its entirety. For a quick and easy idea of total site numbers, select the “All” option in the *wform* form. However, this lumps all surveys into the same pot and produces a single linear equation for the entire community, which is not the best we can do. For the most accurate community-wide numbers for a given service, generate isolated reports for each work type (including households and mots) and aggregate them in Excel. Here’s how:

(1) Generate a report by selecting a work type and the desired service in the *wform* form. (2) With the report activated, go to the “Tools” menu, down to “Office Links” and select “Analyze it with MS Excel.” The data table will appear as a spreadsheet. Name the worksheet after the sector, then return to Access. (3) Close the report, and select the next work type option in the *wform* form. DO NOT SELECT “ALL.” Remember to keep the *servicedistcode* the same. (4) Generate the report and select “Analyze it with MS Excel.” A message will appear that says, “The file ‘revenue.xls’ already exists.” Do not replace the file; click No. Save as ‘revenue2.xls’.

(5) In Excel, open the newly created ‘revenue2.xls’ workbook. Change the name of the worksheet to match the work type. (6) From the “Edit” menu, select “Move or Copy Sheet.” Move the selected sheet to ‘revenue.xls.’ (7) Now in ‘revenue.xls,’ go to the “File” menu, “Open.” Find the empty ‘revenue2.xls’ file, right-click on it and delete it. (8) Return to Access and repeat steps 3 through 8 until all work types are represented in ‘revenue.xls.’ (All work types except “All!”).

(9) When all work type worksheets are present in ‘revenue.xls’ insert a new worksheet and drag it to the very end of the workbook. (10) Activate all worksheets by clicking on the first tab, holding down the Shift key, and clicking on the last worksheet tab. On whichever sheet is open, except if it is the newly created blank sheet, select the range of cells in column A beginning with A4 and ending with the last price in the column. In the Edit menu, select Fill Across Worksheets. The column containing the bid prices should have appeared in the blank worksheet at the end, likely named Sheet2. (11) In cell B4 of Sheet2, type the unit term of the service. In cell B5, type “=SUM(*firstsheetname*:*lastsheetname*!F5)” where *firstsheetname* is the name of the first work type sheet in the book and *lastsheetname* is the name of the worksheet just to the left of Sheet2 in which you are working. The number produced is the sum of all total quantity demanded values in the workbook corresponding to the price in A5. Fill down such that B6 is the sum of F6 cells, B7 is the sum of F7 cells, etc. (12) In cell C4 of Sheet2, type “total revenue.” In C5, type “=SUM(*firstsheetname*:*lastsheetname*!H5)” and fill down. Or, if preferred, simply type in C5, “=A5*B5” and fill down. Either way, the result will be the total community revenue expected for each offer price.

Another important use of the demand schedules will be to evaluate the reliability of the bidding game responses over a mix of infrastructure service offerings in light of a sector’s average flexible income. For example, the hospitality work type group has an average flexible income of \$1000. At a price of \$5/gallon, a member of this group would demand on average 120 gallons of water per month, for an average expenditure of \$600. Alone, this is acceptable, since it is below the \$1000 ceiling. Consider, however, that electricity will also be offered at a price of \$10/kWh, and the average hospitality enterprise

would demand 90 kWh per month at that price. If this service mix were to be offered, the total predicted monthly expenditure would be $\$600 + 900 = \1500 , exceeding the amount of flexible income. In this case, reduce the quantities proportionately until all flexible income is exhausted: $600/1500 = 2/5$; $2/5 * 1000 = \$400$; $\$400/5 = 80$ gallons. $900/1500 = 3/5$; $3/5 * 1000 = \$600$; $\$600/10 = 60$ kWh. The adjusted predicted quantities of water and electricity at the given prices offered simultaneously are 80 gallons and 60 kWh, provided the enterprise will not spend more than its flexible income in the short term.

The optimum price is not necessarily the one that promises the greatest total revenue. Rather, the engineers' cost study must be revisited to determine the service price that promises the greatest profit. For each service's aggregate total quantity demanded (produced by the Excel exercise), figure out how much it would cost to produce that quantity of output in a month and compare it to the total revenue figure. Total revenue – total cost is total profit, which is what will interest the prospective investor.

As for demand growth over time, once an optimum price-quantity mix of services has been identified, simply grow the total quantity demanded figure by the population growth rate estimated by city officials in the *city* form: $\text{Total}Q_d * e^{rt}$ where "r" is the annual population growth rate and "t" is the time in years. Multiply this future Q_d by the price to get total revenue. Until several studies have been completed, both before and after installation of projects, it will be impossible to determine the demand growth rate with any confidence, so the population growth rate will serve as a proxy. It should be considered a "worst case scenario" growth rate. Later, we will be able to "doctor" the base-line population growth rate with responses to *city stat* fields, such as confidence, education, age, etc. but several studies must be done in order to estimate the effects of these statistics on the demand growth rate.

Appendix 1:
Database Forms & Reports

example

Enter Data

View Reports

example

- Setup
- Surveys
- Back to Main Switchboard

example

- New Data Taker
- New Service
- New Site
- New Contact
- Neighborhoods
- List
- Back to Enter Data Switchboard
- Back to Main Switchboard

example

- Households
- Enterprises
- Man-on-the-street
- Players
- Back to Enter Data Switchboard
- Back to Main Switchboard

example

- work type proportions
- Demand Schedules
- Data Takers
- City Statistics
- Calendar Trend
- Back to Main Switchboard
- Service Market

hospitality

water1

Avg. flexible income: 228.125

equation subreport

$$\text{Avg } Qd = -8.81 * p + 38.60$$

price	avg. quant. dem	avrev	#	total q. demanded	total rev
0.25	36.40 gallon	9.10	8	291.22 gallon	72.81
0.4	35.08 gallon	14.03	8	280.66 gallon	112.26
0.5	34.20 gallon	17.10	8	273.61 gallon	136.81
0.75	32.00 gallon	24.00	8	256.00 gallon	192.00
1	29.80 gallon	29.80	8	238.39 gallon	238.39
2	20.99 gallon	41.99	8	167.95 gallon	335.90
3	12.19 gallon	36.56	8	97.51 gallon	292.52
4	3.38 gallon	13.53	8	27.06 gallon	108.25
10	-49.45 gallon	-494.49	8	-395.60 gallon	-3955.96
30	-225.56 gallon	-6766.71	8	-1804.46 gallon	-54133.66

current services

electr

source

familiarity	<input type="text" value="1.44"/>	0 to 4	
total amount spent	<input type="text" value="0.00"/>	monthly by interviewees	avg price/unit
total consumed	<input type="text" value="0.00"/>	monthly by interviewees	#Num!
satisfaction	<input type="text" value="0.00"/>	-1 to 1	
expect. improvmt	<input type="text" value="1.50"/>	0 to 3	

source

city

familiarity	<input type="text" value="1.00"/>	0 to 4	
total amount spent	<input type="text" value="168.00"/>	monthly by interviewees	avg price/unit
total consumed	<input type="text" value="150.00"/>	monthly by interviewees	1.12
satisfaction	<input type="text" value="0.67"/>	-1 to 1	
expect. improvmt	<input type="text" value="2.67"/>	0 to 3	

water

source

familiarity	<input type="text" value="2.33"/>	0 to 4	
total amount spent	<input type="text" value="0.00"/>	monthly by interviewees	avg price/unit
total consumed	<input type="text" value="0.00"/>	monthly by interviewees	#Num!
satisfaction	<input type="text" value="0.00"/>	-1 to 1	
expect. improvmt	<input type="text" value="2.33"/>	0 to 3	

source

city

familiarity	<input type="text" value="1.70"/>	0 to 4	
total amount spent	<input type="text" value="114.00"/>	monthly by interviewees	avg price/unit
total consumed	<input type="text" value="119.00"/>	monthly by interviewees	0.96
satisfaction	<input type="text" value="-0.90"/>	-1 to 1	
expect. improvmt	<input type="text" value="1.70"/>	0 to 3	

Qexpensive subreport

serv	source	CountOfexpensive1
elect1		5
elect1	city	2
water1		3

Qinsufficient subreport

serv	source	CountOfinsufficient
elect1		4
elect1	city	2
water1		1
water1	city	4

Qunreliable subreport

serv	source	CountOfunreliable
elect1		2
elect1	city	2
water1		1
water1	city	7

city stats

Avg. age	37.35	at nearest birthday
Avg. education	4.88	yrs formal school; (-1:illiterate)
Purch's mostly local	69.2%	% making most purch's locally
Income mostly local	76.9%	% earning most income locally
Travel	1.77	0(none) to 4(often and widely)
Save for purch's	1.85	4:>3y; 3:>1yr; 2:<=1yr; 1:<=3mo; 0:none
Written Records	15.4%	% keeping written accounts
Confidence	0.23	1: high 0: ---- -1: low
Integration	0.75	1: tight 0: ---- -1: divided

calendar trend

Jan	-0.1	Jul	0.4
Feb	0	Aug	-0.1
Mar	0.3	Sep	-0.1
Apr	0.3	Oct	0.2
May	0.1	Nov	0.1
Jun	0.1	Dec	0.3

-1: worse than normal cash flow
0: normal cash flow
1: better than normal cash flow

		c-eff	n/n*-eff	description
<i>site</i>	exampleville			
<i>pop</i>	10000	pos	pos	
<i>perhh</i>	5	neg	neg	est. residents per household
<i>perent</i>	1	neg	neg	est. workers per enterprise
<i>N</i>	6000			100% sample coverage
<i>Z-score</i>	2.578	pos	pos	80% confidence: 1.2816; 90%: 1.6449; 95%: 1.96; 98%: 2.3263; 99%: 2.5758
<i>error</i>	7	neg	neg	acceptable error +- from average
<i>stdev</i>	40.6	pos	pos	mean +- units within which 67% obs will fall; 90-95% w/in 2x stdev
<i>n</i>	216			sample size (number of surveys to conduct)
<i>dt/day</i>	\$ 20.00	pos		cost per day per data-taker (per diem and expense reimbursement)
<i>cost/surv</i>	\$ 1.00	pos		cost per survey (materials, respondent gift)
<i>fixed/day</i>	\$ 20.00	pos		fixed cost of study per day independent of number of data-takers and surveys
<i>flat</i>	\$ 1,000.00	pos		flat consulting fee for survey
<i>dt</i>	8	pos	pos	number of data-takers
<i>days</i>	1.5	pos	pos	number of days spent surveying
<i>cost</i>	\$1,486.00			cost of study
<i>h/day</i>	6	pos		number of hours surveying per data-taker per day
<i>surv/dt/h</i>	3	pos		number of surveys per data-taker per hour
<i>n*</i>	216			number of surveys for above cost (must =n for accurate design)

Design

Data taker form

name: first last	<input type="text" value="Lula Lopez"/>
phone	<input type="text" value="576-7657"/>
street address	<input type="text" value="14 Calle Verde"/>
city, state	<input type="text" value="Tegucigalpa, Honduras"/>
background notes	<input type="text" value="Lula is beautiful, has 4 years experience and is single."/>
per diem	<input type="text" value="20.00"/>
days worked	<input type="text" value="2"/>
	<input type="button" value="switchboard"/>

name: first last	<input type="text" value="Rachel Gonzalez"/>
phone	<input type="text" value="263-7096"/>
street address	<input type="text" value="1411 Forest Ave."/>
city, state	<input type="text" value="Tegucigalpa, Honduras"/>
background notes	<input type="text" value="Rachel is a nice lady, always smiling. Experience includes work for the Department of Health. She is in her mid 30s."/>
per diem	<input type="text" value="20.00"/>
days worked	<input type="text" value="2"/>
	<input type="button" value="switchboard"/>

name	<input type="text" value="Lula Lopez"/>
phone	<input type="text" value="576-7657"/>
street	<input type="text" value="14 Calle Verde"/>
city	<input type="text" value="Tegucigalpa, Honduras"/>

notes/picture

Lula is beautiful, has 4 years experience and is single.

perdiem	<input type="text" value="20.00"/>
days	<input type="text" value="2"/>
surveys completed	<input type="text" value="6"/>

name Rachel Gonzalez

phone 263-7096

street 1411 Forest Ave.

city Tegucigalpa, Honduras

notes/picture

Rachel is a nice lady, always smiling. Experience includes work for the Department of Health. She is in her mid 30s.

perdiem 20.00

days 2

surveys completed 4

Household version

hh	hh	age	40	edu	5	integ	1
ID	2	res2age	45	res2edu	3	purchloc	<input checked="" type="checkbox"/>
		res3age	80	res3edu	0	inclocal	<input checked="" type="checkbox"/>
date	4/23/00	res4age	14	res4edu	5	confid	1
df	Lula Lopez	res5age	10	res5edu	-1	trav	2
num	1	res6age		res6edu		wr	<input type="checkbox"/>
nh	North	res7age		res7edu		save	2
size	<input type="checkbox"/>	res8age		res8edu			
		res9age		res9edu			
		res10age		res10edu			

Jan	Feb	Mar	Apr	May	Jun	Jul
-1	-1	0	0	0	-1	1
	Dec	Nov	Oct	Sep	Aug	
	1	1	1	0	0	

nsource1	hospitality	
nsource1i	500	
nsource2	light industry	demand
nsource2i	600	
ntotalin	1100	
nnesc	0.75	

Enterprise Version

ent	ent	integration	1	Jan	Jul
ID	2	purch loca	<input checked="" type="checkbox"/>	-1	1
		inc local	<input checked="" type="checkbox"/>	Feb	Aug
date	4/23/00	confidenc	1	-1	1
dt	Lula Lopez	travel	2	Mar	Sep
num	1	savings	1	0	0
nh	North	written recor	<input type="checkbox"/>	Apr	Oct
size	<input checked="" type="checkbox"/>	nsource1	hospitality	0	1
		nsource1in	500	May	Nov
age	45	nsource2	hospitality	0	0
edu	3	nsource2in	300	Jun	Dec
		ntotalin	800	0	0
		nnesc	0.75	demand	
<hr/>					
ent	ent	integration	1	Jan	Jul
ID	3	purch loca	<input checked="" type="checkbox"/>	0	0
		inc local	<input checked="" type="checkbox"/>	Feb	Aug
date	4/28/00	confidenc	-1	0	0
dt	Lula Lopez	travel	1	Mar	Sep
num	2	savings	0	0	0
nh	North	written recor	<input type="checkbox"/>	Apr	Oct
size	<input type="checkbox"/>	nsource1	hospitality	0	0
		nsource1in	300	May	Nov
age	30	nsource2		0	0
edu	2	nsource2in		Jun	Dec
		ntotalin	300	0	0
		nnesc	0.50	demand	
<hr/>					
ent	ent	integration	1	Jan	Jul
ID	4	purch loca	<input checked="" type="checkbox"/>	0	0
		inc local	<input checked="" type="checkbox"/>	Feb	Aug
date	4/28/00	confidenc	0	0	0
dt	Rachel Gonza	travel	1	Mar	Sep
num	1	savings	0	0	0
nh	South	written recor	<input type="checkbox"/>	Apr	Oct
size	<input type="checkbox"/>	nsource1	hospitality	0	0
		nsource1in	400	May	Nov
age	30	nsource2		0	0
				Jun	Dec
				0	0

man-on-the-street version

mots	<input type="text" value="mots"/>	nsource1	<input type="text" value="light industry"/>								
ID	<input type="text" value="2"/>	nsource11	<input type="text" value="160"/>								
		ntotaln	<input type="text" value="185"/>								
date	<input type="text" value="4/23/00"/>	nnesc	<input type="text" value="1.00"/> <input type="text" value="0.75"/> <input type="text" value="0.50"/> <input type="text" value="0.25"/> <input type="text" value="0.00"/>	confid	<input type="text" value="1"/> <input type="text" value="0"/> <input type="text" value="-1"/>	wr	<input type="checkbox"/>	save	<input type="text" value="4"/> <input type="text" value="3"/> <input type="text" value="2"/> <input type="text" value="1"/> <input type="text" value="0"/>	trav	<input type="text" value="4"/> <input type="text" value="3"/> <input type="text" value="2"/> <input type="text" value="1"/> <input type="text" value="0"/>
dt	<input type="text" value="Lula Lopez"/>										
num	<input type="text" value="1"/>										
nh	<input type="text" value="North"/>										
age	<input type="text" value="22"/>										
edu	<input type="text" value="8"/>	integ	<input type="text"/>								
purchloc	<input checked="" type="checkbox"/>										
inlocal	<input checked="" type="checkbox"/>										
											<input type="button" value="demand"/>

Key players version

players	players	nh:	
ID	5	age	45
	Jan	edu:	5
	Feb		
date	4/23/00		
	Mar		
party	city		
	Apr		
integ	1		
	May		
<input type="checkbox"/> purchloc	Jun	nsource1	
<input checked="" type="checkbox"/> inclocal	Jul	nsource11	
confid	0	nsource2	
travel	3	nsource21	
written record	<input checked="" type="checkbox"/>	ntotalin	
savings	4	nnesc	1.00
	Aug		
	Sep		
	Oct		
	Nov		
	Dec		

Demand Form

ID	<input type="text" value="4"/>	improve	<input type="text" value="1"/>	<input type="button" value="househol"/>
from	<input type="text" value="ent"/>	d1	<input type="text" value="50"/>	<input type="button" value="enterpris"/>
fromID	<input type="text" value="2"/>	wouldpay	<input type="text" value="50"/>	<input type="button" value="mots"/>
serv/dist	<input type="text" value="water1"/>	p1	<input type="text" value="1.00"/>	<input type="button" value="players"/>
familiarity	<input type="text" value="3"/>	p2	<input type="text" value="2.00"/>	<input type="button" value="switchboard"/>
mo. cos	<input type="text" value="0"/>	d2	<input type="text" value="25"/>	
mo. con	<input type="text" value="0"/>	p3	<input type="text" value="0.50"/>	
source	<input type="text"/>	d3	<input type="text" value="60"/>	
	satisfactio			
	<input type="text" value="0"/>			
	expensiv	<input checked="" type="checkbox"/>		
	insufficie	<input checked="" type="checkbox"/>		
	unreliabl	<input type="checkbox"/>		
				<input type="button" value="Next Service"/>

Servdist form

servicedistcode	<input type="text" value="elect1"/>
service	<input type="text" value="electricity"/>
distribution	<input type="text" value="wired to house"/>
unit term	<input type="text" value="kWh"/>
site	<input type="text" value="exampleville"/>
sub currently avail	<input type="checkbox"/>
	<input type="button" value="▶"/>
	<input type="button" value="switchboard"/>

servicedistcode	<input type="text" value="water1"/>
service	<input type="text" value="purified water"/>
distribution	<input type="text" value="bottles"/>
unit term	<input type="text" value="gallon"/>
site	<input type="text" value="exampleville"/>
sub currently avail	<input type="checkbox"/>
	<input type="button" value="▶"/>
	<input type="button" value="switchboard"/>

Contacts form

name: first, las	<input type="text" value="Dr. Dollittle"/>	
part	<input type="text" value="city"/>	
pos	<input type="text" value="Mayor"/>	<input type="button" value="switchboar"/>
ph	<input type="text" value="657-9876"/>	
st	<input type="text" value="Truck Drive 45"/>	<input type="button" value="players"/>
city	<input type="text" value="Exampleville"/>	<input type="button" value="➔"/>
fax	<input type="text"/>	
emal	<input type="text"/>	
bkg	<input type="text"/>	

name: first, las	<input type="text" value="Willy Williams"/>	
part	<input type="text" value="O/O cooperative"/>	
pos	<input type="text" value="head man on totempole"/>	<input type="button" value="switchboar"/>
ph	<input type="text" value="546-4564"/>	
st	<input type="text" value="14 Dusty Road"/>	<input type="button" value="players"/>
city	<input type="text" value="Exampleville"/>	<input type="button" value="➔"/>
fax	<input type="text"/>	
emal	<input type="text"/>	
bkg	<input type="text" value="Willy is a wealthy land owner and also runs a brewery. He is very interested."/>	

City form


site	<input type="text" value="exampleville"/>	notes
date	<input type="text" value="4/23/00"/>	
contact	<input type="text" value="Dr. Dolittle"/>	
pop	<input type="text" value="10000"/>	
popgr	<input type="text" value="4.30%"/>	
<input type="button" value="switchboard"/>		


neighborhood form


nh	<input type="text" value="North"/>
site	<input type="text" value="exampleville"/>
characteristic	<input type="text" value="slums"/>
<input type="button" value="▶"/>	
<input type="button" value="switchboard"/>	

nh	<input type="text" value="South"/>
site	<input type="text" value="exampleville"/>
characteristic	<input type="text" value="Much nicer than the Northern part of town."/>
<input type="button" value="▶"/>	
<input type="button" value="switchboard"/>	

List form

nh	North
dt	Lula Lopez
description	pizzeria
size	<input type="checkbox"/>
wt	hospitality
listID	3
date	4/23/00
	
switchboar	

nh	North
dt	Lula Lopez
description	pizzeria
size	<input checked="" type="checkbox"/>
wt	hospitality
listID	4
date	4/23/00
	
switchboar	

nh	North
dt	Lula Lopez
description	brewery
size	<input checked="" type="checkbox"/>
wt	heavy industry
listID	5
date	4/23/00
	
switchboar	

neighbrhd: North

worktype: heavy industry

size
CountOfwt 2
percent 5.13%

worktype: hh

size
CountOfwt 2
percent 5.13%

size
CountOfwt 5
percent 12.82%

worktype: hospitality

size
CountOfwt 2
percent 5.13%

size
CountOfwt 3
percent 7.69%

worktype: light industry

size
CountOfwt 2
percent 5.13%

worktype: pro

size
CountOfwt 2
percent 5.13%

neighbrhd: South

worktype: chickens

size
CountOfwt 1
percent 2.56%

worktype: hh


size
CountOfwt 5
percent 12.82%



size	<input type="checkbox"/>	
CountOfwt		9
percent		23.08%
worktype:	hospitality	
size	<input checked="" type="checkbox"/>	
CountOfwt		2
percent		5.13%
size	<input type="checkbox"/>	
CountOfwt		1
percent		2.56%
worktype:	light industry	
size	<input type="checkbox"/>	
CountOfwt		2
percent		5.13%
worktype:	pro	
size	<input type="checkbox"/>	
CountOfwt		1
percent		2.56%



Demand schedule builder form (wtform)

work type: 

servicelstcode

Appendix 2:
The Experience in Honduras: Notes

The Experience in Honduras: Notes

I. Honduras is slightly larger than Tennessee in land area and has a population of about 6.2 million.

The most recent full-scale general equilibrium study for Honduras that is available was done in the period of 83-85 and is very much out-dated. There was another comprehensive study carried out in 95, but funding fell apart and the raw data split several ways and was never compiled or published. Would it be useful information even if it was available? According to the World Bank in 1995 (from website) "Despite several attempts, the [Honduran] government has failed to develop a good statistical monitoring system. Annual labor force surveys were carried out between 1989 and 1993, but these suffer of important flaws in the design and do not provide important information for the monitoring of poverty."

It was estimated in 1985 that employment in the informal sector in Honduras was 44.7% of total employment having grown from 32.7% in 1981. It is highly likely that the informal sector currently employs over 60% of Honduran labor. Maquila (migrant) labor accounts for 30% of the manufacturing workforce. Furthermore, the World Bank statistic that 50% of the population lives below the poverty line in Honduras leads one to suspect that much income is hidden from government data takers. Another reason to believe that the Honduran informal economy is higher now than ever is that in 98, sales tax increased from 7% to 12% and the personal income tax is at 40% (Honduras Central Bank). A large informal economy is not a bad thing; it allows a country needed flexibility to absorb economic shocks. However, it can make research very difficult and national economic indicators unreliable.

Has always been considered a poor country... some problems

II. In November 1998, Hurricane Mitch seriously crippled the country's agriculture sector, which accounted for 58% of the workforce in 1997. Bananas and coffee, the country's two major crops lost over half and 20% respectively of their harvests, and many people were laid-off as a result.

Still lots of road construction, and signs of the natural disaster are everywhere: landslides

Since, Honduras has become the recipient of much emergency aid – accompanied by many studies.

Scattered, uncoordinated data and projects.

III. Has given rise to a class of professional data-takers.

Our group was in this class. found through an aid contact in Tegucigalpa. 8 interviewer ladies and one driver. Paid the equivalent of \$22/day for 7 days of intense study. My understanding, this is twice the respectable wage. One was college educated; all had been formally trained (two week seminars on data-taking methods such as focus group facilitation).

Following our study, several were already contracted to participate in a year-long live-in study for the national department of the Family and Children.

IV. We met the data takers at our hotel in Tegucigalpa shortly after arrival.

The debriefing 4pm Sun, March 5, El Alameda:

1. The project and the purpose. An introduction to TVIG; the two sites
 2. Introductions: Everyone stood up and introduced themselves; particular competencies and contribution to the project.
 3. Presentation of the Economic Study:
 - What we hope to learn
 - The proposed plan:
 - Opening meeting with investors and officials
 - Mapping exercise; walking
 - Team feedback/planning session
 - Transport survey
- The following morning, teams were to focus on: (1)Water vendors and commercial users; (2)pricing and marketing; (3) other businesses; (4) sampled households
- Following a feedback session, more interviews and a focus group on household hygiene.
- On the third day, the illustrated report would be prepared, presented, and field questions would be clarified by city officials.

The Report to follow from the study was to focus on:

- The community's Economic Profile
 - economic geography, GDP, trends
 - an overview of the productive sectors
 - ...of the commercial establishments
 - ...of the services
 - ...of the population, their health and education
 - an outline of opportunities for economic growth
- The Market for Electricity
 - current status and problems
 - future potential
- Conclusions

economic growth outlook, w/ and w/out an IIP
who will operate IIP and how
list of what investors need to secure; a management plan
the benefits, costs and the return on investment

4. The questionnaire

With the data takers, anticipated obstacles were discussed, especially concerns about the time of day that people would be working, how the interviewees would respond to personal questions about hygiene, how it may be clarified in the introduction that the interviewers are not tax collectors.

Then, the girls divided into pairs and practiced interviewing each other.

5. During this time, it was debated whether or not to leave a member of the team behind in Tegucigalpa to track down documents that might be relevant to the study. It was decided that this would not be the best use of limited time and manpower.

V. Cantarranas

The first town visited lies about 30km Northeast of Tegucigalpa, has a population of about 9,000 – 3,000 households, about 1000 in the town proper. About a third of the inhabitants of the town and the surrounding area are connected to the national electrical system, but service is unreliable: fluctuations damage appliances and frequent, long outages make refrigeration and other uses unreliable. There is pretty good and cheap water distribution, but lots of bottled water is sold in the city.

The major economic activity is the growing of sugar cane (according to the municipal tax records, 1 farm produced 12,700 tons in the 1999 harvest, 20 produced between 500 and 7000 tons; 25 farms produced between 100 and 500 tons and 11 farms produced less than 100 tons) and the refinery of sugar (one very large plant just outside of town processes sugar cane from the local as well as more distant farms for export, employs some 1000 workers). A few coffee cultivators, largely for domestic consumption because they don't have the equipment necessary to grade their beans for cost-efficient export – bad experiences with electrical surges burning up expensive equipment. 2 haciendas produce vegetables for export to el salvador and there are many smaller family farms in the surrounding countryside.

Interestingly, there is no market in Cantarranas. The shop owners depend on vending trucks from Tegucigalpa or go stock up on their wares in Teguc themselves (sometimes on the bus).

Morning of Day 1 the team met with city officials to present the project and obtain the city's blessing.

VI. The mapping exercise

Split into groups and walked the town, marking on the maps where businesses were and what kind. A city representative went with some groups.

- Visibility: introduced ourselves to curious onlookers, establishing a presence
- Familiarity with the town layout
- General Idea of distribution and types of shops in each area
- some interesting discoveries (the cable TV company)

Not as effective as hoped because:

- Trouble reading maps (the ladies spent much time arguing about where they were on the map)
- Too focused on accuracy of location rather than general observations
- The "barrios" were not well defined, and the girls were very concerned about overlap
- The girls and the city officials didn't know what to expect from each other and did not communicate

The review session focused on listing the businesses observed by type and location. Following the review session, it was decided that the teams would stick to their areas, rather than focus on particular aspects of the economy.

VII. The interviews

For each business in their neighborhood, they were to fill in the following blanks:

1. Name (of the shop, not the person)
2. Description
3. Products
4. Clients (Number and type)
5. Maximum distance to client
6. Suppliers
7. Maximum distance to suppliers
8. Value of sales on typical day
9. " " " good day
10. " " " bad day
11. " " " in typical month
12. " " " good month
13. " " " bad month
14. What are the good months?
15. What are the bad months?
16. What are the typical months?
17. Net earnings in a typical day
18. " " " good day
19. " " " bad day
20. " " " in typical month
21. " " " in good month
22. " " " in bad month
- 23-29. Major Costs:
 23. Labor
 24. Purchases
 25. floor space
 26. electricity
 27. telephone
 28. purified water
 29. other
30. If reliable electricity was available, are there appliances that would improve the efficiency of your firm?
31. Could you improve your productivity with reliable electricity? How? Estimated percentage.
32. Do you have or would you like international clients or partners?
33. How do you communicate with them?
34. How much does a telephone call cost?

If the shop sells purified water...

35. How much water do you sell in a normal week?
36. In what form do you sell water?
37. Purchase price of each type (bags, bottles, jugs)
38. Sales price of each type sold
39. Do you think you could sell more? how much more?
40. Do you feel that the market is growing or shrinking?
41. In what part of the year do you experience the greatest demand for water?

In each barrio, the team was to interview every 10th household:

1. List electrical appliances
2. What type of sanitary service do they use? indoor toilet?
3. Type of house
4. How much do they pay for electricity per month.
5. How do they use water?
6. In what part of the year do they experience the most sickness?
7. How do they prefer to get water: purified or at the tap?
8. Where would they like to buy water? in the store or distributed to their house?
9. Do they get water from the river?
10. What is the profession of the head of the family?
11. Where do you buy necessities?

The household questionnaire was created on the fly.

Some comments on the questionnaires in Cantarranas

- Between 3:15 and 5:15, the average coverage for a team was 6 businesses and 5 households.
- Summaries were given by each team, written on flipchart, typed later.
- For feedback on the household and the supplementary water sales questions, we had to rely solely on oral reports from the interviewers, because they all did it differently, on their own paper, handwriting difficult to read. But the summaries were better than the data would have been, and we got some interesting and helpful anecdotes.
- It seems to me that questions with initially low response rates were effectively dropped from the questionnaire by the interviewers.
- Business questionnaire questions # 2 and 3 were often confused, often the data taker wrote down the exact same thing for description and products.
- B.Q. 4: high response rate on number, but no indication of type of client whatsoever.
- B.Q. 5: answers in Km, in hours or minutes, and in words (in the neighborhood, Tegucigalpa). Some interviewers listed several suppliers and their distances.
- BQ6: in terms of product type ("chips" "bread"), name of supplying company, person's name, a number (probably the number of suppliers) or very general answers such as "stores" "other stores in the village" "Personal" "trucks" or "Valle de Angeles"
- BQ7: in KM, hours, name of city
- BQ8,9,10: generally pretty good responses, though sometimes the typical day=good day or the bad day.
- BQ11,12,13: Considering the daily responses, these numbers seemed very low. Often, the monthly sales reported equaled the daily sales reported, or the former would be a few dollars higher than the daily sales – leading me to believe that this question must have been misunderstood. Hardly ever greater than 10x the daily sales figures, any way you look at it. Often, a good month's sales figure would be less than that of one week of bad days. Other times, they looked directly computed (30x daily sales of corresponding type : typical, good or bad).
- Very frustrating, sometimes the respondents listed sales data by supplier or type of good sold, but it wasn't all inclusive, (just pepsi sales in a typical day, by units or currency).
- Arbitrary decimal places. Sometimes decimal places, other times none – even by the same data taker.
- Unclear whether a dash ("—") means "zero" or "no response." One line had "0" for all three daily sales figures, then had positive monthly sales – that "0" must mean "no response," right?
- Very often, one or two of the three would be completed, good day/month, typical or bad, but not all three. For example, one tortilla vendor reports "don't know" for typical day, 20 for good day, 6 for bad day, 20 for typical month and "don't know" for good and bad month. this seems like very selective knowledge.
- BQ14,15,16: types of responses include: a listing of months by abbreviation, by number, "Sept (arrow) Nov." (does that mean through or to?); all, none, don't know, the number of months ("9 bad months"). Very low responses on "typical months" (I guess it was assumed that the not bad, not good months are typical, which seems reasonable to me) some times, a numerical response was the same in more than one column, which makes me wonder whether the number represents the month or the number of months, but sometimes they add up to more than twelve and sometimes less than twelve when they repeat (example: good months: 2; bad months: 10; typical months: 2 – does this mean that february is both good and typical and october is bad, or that there are 2 good months, 2 typical months and 10 bad months, or that Feb is good, October is bad and there are 2 typical months?)
- BQ17-22: Net earnings responses: Very inconsistent. For example: One shop having reported a good month's sales as 900, proceeded to claim 1500 in net earnings after costs in a good month. Sometimes, a days sales = days net earnings.
- Very low response rate on net earnings questions (35%), and the ridiculousness of most of the responses suggest that the businesses interviewed do not keep accounts, even mentally. Anecdotes of shop owners who manage their cash out of a box, if there is money in it when a truck pulls up, they can restock. If there is no money in the box, they don't. Also suggests that many of these shops are not earning a profit at all. A couple even reported "0" or "none" as their earnings figure.
- To be fair, several of the earnings data did make sense considering the sales data.
- BQ23-30: Costs in the same line in different terms, so not even additive.
- The labor question was a particularly tricky one: Most often "don't know," then some responses in terms of number of employees, some in currency, some in daily wage (but no number of employees) some general ("various."). Some "no employees" and some "no labor costs." (could these be the same?)
- Purchase data was pretty good, considering.
- Space: don't pay, don't have, use their own, currency terms, don't know
- Electricity: usually pretty good response on this one. one word response: "variable"
- Telephone: Tricky – could be in terms of minute rate, "don't have a phone," "don't know" a dash (which I interpret to mean "no phone")

- Water: yes/no, amount per week, per day, per month (the requested value), the brand of water (and nothing else!) the amount in liters or gallons per day, per week or per month. The amount in either currency or volume by brand by day, week or month. And sometimes in terms of “for resale/personal use” or just “sells/doesn’t sell”
- Other: yes/no, words (“taxes”), numbers. generally a “0”
- BQ31: yes/no, “don’t know,” list of appliances, functions (“selling chicken”)
- BQ32: yes/no, “don’t know,” a suspiciously frequent occurrence of “100%”
- BQ33-35: To the question, “would you like or do you have international clients or partners?” there was a frustratingly high occurrence of the response “international” which doesn’t mean anything. “Don’t know” was the dominant answer, followed by “No.” 34 understandably got almost no responses, and 35 was a consistent minute telephone rate (I think), but sometimes answered as “350” and sometimes as “3.50” and sometimes “3.50/minute.” and other times a wholly different number, probably the rate multiplied by some average amount of time spent for a call.
- Overall, I feel that the filled out questionnaire forms were largely disappointing. The useful material we was delivered orally.
- The rows didn’t match up on the sheets, making them very tedious to read. The only way to do it was to count down from the top, but some pages had more rows than others, so it was hard to tell what went with what, and which ones had skipped the page.
- After we took up the questionnaires, there was no way to go back and clear up questions and inconsistencies. No one or few ladies were at fault; simply, none of the questionnaires fit together, and often, the columns on one sheet didn’t fit together. It would have involved re-establishing what we wanted exactly, then sitting down with each data-taker and filling out new forms for each questionnaire. I think that much of the information wasn’t even there, if we had been able to decipher it. lesson learned: enter the data as they read it out loud so you can get clarification on the spot.
- One lady abandoned the sheet altogether and wrote her info out on her own paper, which I was then unable to read.

Meeting with the Mayor’s Secretary

While the data-takers were doing their first round on the afternoon of Day 1, we spoke with the mayor’s secretary, asking questions about agriculture, transportation etc. This proved to be very insightful.

We were allowed to look at some of the municipality’s records, namely the list of licensed businesses in town for 2000 and the income tax paid from sugarcane growers in 99. The city’s list of businesses that were licensed to operate numbered them at 52. In two days, we interviewed almost 100 businesses, there were many that we couldn’t get to, and several on the list that we hadn’t even seen. In other words, the city’s list is either too short or most businesses in town are operating without a license.

Day 2

More interviewing, some girls went to neighboring villages. Somehow, by that afternoon, the central business district had been overlooked. I found out because a shop owner asked me when the surveyors would be coming by, and it was 20 minutes before dinner time; the girls were already finished (or so they thought) and waiting at the city hall. I rushed over and all of them said that the central business street was not in their territory. They were all dispatched to go cover it quickly.

In the morning, I tried to gather information on transportation, especially how much bottled water comes in and out of the city. I talked to truck drivers, bus drivers, van drivers, locals on the street. Got some interesting anecdotal information, but nothing certain enough to consider it accurate quantitative data.

That evening we began the review session with a successful attempt to describe the ‘typical’ shop in downtown cantarranas. Then began listing water feed-back according to barrio, and relating outstanding stories. Also talked about general responses and attitudes of the interviewees and found out some fascinating information: The people would rather have a foreign company run the electricity and water, were appreciative that it was hondurans, not foreigners asking them the questions. They all wanted electrical appliances but were afraid that they would be destroyed by the unsteady electricity. Most people were content with their tap water. We also ranked the barrios from richest to poorest, and noted the principle occupation of people living in each barrio.

Day 3

One team of data-takers went out to interview haciendas, but didn’t get far, and didn’t get to the vegetable growers that we were most interested in.

Meanwhile, we entered data and analyzed our notes, preparing for the presentation to the city council that afternoon.

In the presentation, lots of our Transportation information was pointed out as being inaccurate, but the rest of the information, if cautiously vague, was supported with nods. the report was a rough draught of the proposed final report above – same structure.

On the drive to Trojes and at dinner once we got there, bonded well with the data takers. lots of good conversation and progress in spanish. I am convinced that personal friendships with the data-taking team is crucial to the success of the project.

Trojes

town of about 5000 on the Nicaraguan border 86km east of Danli. the road is dirt; very rough and winding, impassible when wet. Once a zone of intense conflict during the Contra wars, it is now a coffee and ranching area purchasing electrical energy at high rates from Nicaragua – a relationship it hopes to sever by investing in an IIP. The town is the pet project of Honduran government energy officials who back the TVIG efforts. because electricity is expensive, people use firewood to cook, coffee growers lose much profits hauling wet coffee out of town to get it dried. the water system and sewer system are pretty new, and already have fallen into disrepair. People claim that the tap water is poisonous, and the broken sewer system drains visibly into a field.

The town has been aptly dubbed “dodge city” by our team. Incredibly dusty and smoky (fires burning trash on the street in front of stores). transportation is horses and toyota pickups. Rough looking characters carrying firearms.

Day 4

Already I had entered enough of the Cantarranas data into the laptop – or tried to – to know that there would be problems putting it to good use. I felt that a new approach would be in order, but the girls surprised us by taking a lot of initiative the following morning.

A gentleman (Luis Adolfo San Tandel) from the Trojes city hall came in for a meeting and our ladies really dominated the interrogation – asking lots of good questions. The topics covered included:

- a brief history of the town and the municipal government
- a brief history and status of the town’s electrical and water services
- television and radio
- community health services status
- community financial services (bank closed because robbed too many times. no financial services within 3h drive – Danli 86km of rough road)
- major enterprises, including 2 hotels, gas station, bakeries
- tobacco dryers and rollers departed in 97
- Dairy and chicken farm owned by mayor’s father; a few vegetable growers
- overview of all the surrounding haciendas, their crops (corn beans rice coffee yucca ginger) for export or local consumption, where the owner resides.
- industrial and office supporting businesses (fotocopiers, hardware stores and mechanics)
- bus schedule and fares
- cost of telephone calls
- underground economy – especially illegal lumber cutting and smuggling accross nicaraguan border (both directions)
- division of the town into 6 distinct barrios
- estimate of the number of households in town and in the surrounding country-side

With the help of Luis Adolfo, two of our ladies went and invited the coffee growers to attend a meeting the the morning of day 6.

Mapping exercise – Trojes

Following the meeting with Luis Adolfo, Bob and Lucy gave a public presentation at the high school auditorium. Bob, while hesitant to get the locals too excited, permitted an interview by the local radio stations following the presentation. Many people seemed interested, one man – the owner of our hotel (moderno) spoke fiercely against the hybrid idea, saying that the city had already received a grant to build a strictly hydroelectric plant.

Then, from the highschool, the data-takers split up into groups of two and with a guide recruited on the fly from the presentation congregation, scoped out a different barrio each. I went with Iris and Maria Dolores, who wanted to start interviewing, but since this would waste our guide’s time, I told them to focus on taking inventory of what was in their barrio. The guides and the girls alike scoffed at our maps and called them useless, so we abandoned the maps. Later, however, I took a map and walked the town to check it for errors and found it to be quite accurate – again, I think the locals were simply frustrated with map reading; it is indeed a skill to be learned, even if it seems natural to those of us who learned at a young age.

the surveys – trojes

Since in Cantarranas we ended up with lots of surveyed little grocery stores and snack shops but missed many unique businesses (the one billiard room and a hotel for example), we instructed the girls to ignore the small grocery stores and snack shops on the first round, until the larger and more specialized businesses had been covered in their barrios. Further, it was left up to them how to choose the households; just that they try to get a representative sample of their barrio.

As far as I know, only 14 household surveys were handed in, but since the results of hh surveys were analyzed in oral discussion in anecdotal format, recorded on flip chart sheets to be later entered into the laptop – it is possible that several were

done that weren't turned in. It also appears that the teams divided themselves – one focusing on businesses uniquely and the other on households mainly and some businesses. 96 businesses were interviewed in Trojes, and the girls were much neater recording the responses – much easier to read than the cantarranas questionnaires. We took up the first days questionnaires after the first day and gave them new ones for the following days interviews – that seemed to get them more focused on taking legible notes: whereas in cantarranas, the questionnaires seem more like memory joggers for the ladies themselves, these were clearly written to be read by me (or whoever was to be reading them). The rows were more clearly numbered and there were brief explanations in the margins, including how calculations were made in some cases. They now knew the drill: The questionnaires would be turned in and the data entered into a computer. I don't think they knew that in Cantarranas.

The responses seemed to be more consistent, though several of the old problems persisted, whether it be due to the misunderstanding of the interviewers or the interviewees is uncertain. Meanwhile, I was perhaps getting better at understanding them.

One curveball that showed up in Trojes several times but not in Cantarranas was the response to “Number and Type of Clients: Various.”

If the questionnaires coming from different data takers weren't always compatible, the columns within each suveyor's questionnaires had become much more consistent. If the first response was in number of employees, then so would be the rest of the responses, for example. Also, the descriptions or type of business covered a much narrower range this time, distance to clients and suppliers given rather consistently in words (in the neighborhood; Danli; Tegucigalpa; the mountains; etc.)

Interestingly, due either to fatigue, increased efficiency or both, the questions that had proven difficult to get responses for in Cantarranas became easy in Trojes. Indeed, responses were so similar in some columns that I suspect that some data takers proposed the response of the previously interviewed business upon hesitation. This is especially true for the good and bad months, and the last page. Also, the girls were not pushy: while the info they got was more understandable and more useful, they were quick to put down “don't know” or “no response.”

It appears that in general, if there was a response to daily sales, there was none for monthly sales and vice versa. Perhaps the girls judged this repetitive (correctly?).

Day 5

Dedicated to data-taking by the ladies – some at the outlying haciendas. We worked on entering data and preparing a rough draught of the final presentation already. I hiked up to the top of a hill that was in the center of town and from there took panorama photographs and sketched a map of the city, indicating the aparent wealth of each visible section.

Day 6

In the morning following breakfast, everyone sat in the conference room and reviewed what we had learned in Trojes. Bob gave a dress rehearsal in front of the data-takers to give them an opportunity to ask questions and give feedback – to help shape the presentation.

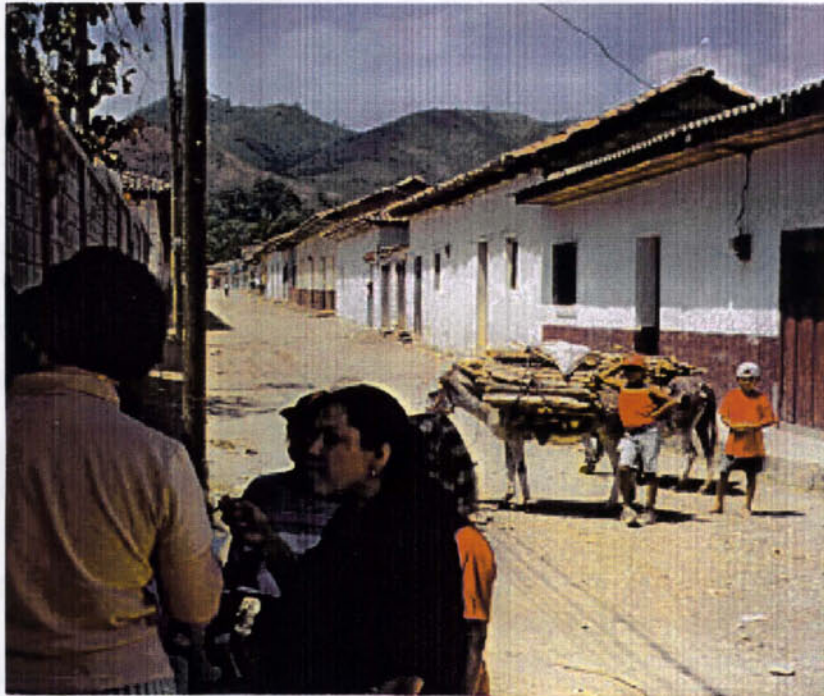
The coffee growers trickled in from 10am on, and Bob gave an excellent presentation. There were 12 of the most powerful coffee growers in attendance and this was perhaps the most important part of the trip.

Immediately thereafter, the final presentation was given in the school house. Attendance was low but supportive.

Appendix 3:
Picture Gallery



Meeting the data-takers Tegucigalpa



The mapping exercise in Cantarranas



Household surveys in Cantarranas



Reviewing questionnaire responses in Cantarranas



Mapping exercise in Trojes



Meeting “key players” in Trojes: The coffee-growers



Reviewing study results and preparing final presentation in Trojes

Appendix 4:
The Evolution of A Methodological Approach:
Early Pitfalls

The Evolution of a Methodological Approach: Early Pitfalls

A. A dynamic profit-maximization problem based on marginal productivities.

In the second week of January 2000, I went with the TVIG management to Morehouse University. Following a discussion with economist Dr. Handy, I started on a very mathematical track, involving much research of mathematical economics methods. X would be a complex system of equations, representing the various combinations of infrastructure elements available and their respective capital investment requirements and variable expenses. P_x would be the set of constraints that represents the various pricing combinations for each combination of services. D would be a system of equations with many variables and parameters, such as the number of households, the distribution of wealth, the total wealth of the community, the availability and cost of complementary appliances, estimated contribution to productivity in industrial or household work (reducing time spent on chores), wages, price of services to be offered, labor-leisure curve estimates, capital intensity estimates, etc. representing the various combinations of demand for the various services by industry and households. Then, there would be a dynamic growth component in this mix of equations, based on expected expansion of the production function and shifting of the wealth curve (somehow derived from a rate of increasing productivity and increasing production) and a coefficient linking demand growth to income growth.

Basically, variables extracted from an on-site survey and variables fed from a pre-established output-mix/total fixed cost table based on available equipment would be entered into a "black box." The black box would optimize output mix and price mix that would maximize the growth of total productivity subject to constraints of the demand equations and constrained within a reasonable and arbitrary (7-year or so) horizon to recoup investment costs. From the maximum potential production/income growth rate would be projected a revenue stream for the investor, which would in turn lead to long term profitability figures for the investor.

The more I worked on the black box, the more frustrating it became. I checked out numerous math and economics texts from the library. I struggled with production function models mostly, and productivity growth over time considering continuous adjustments of factor intensity. I tried to apply the Domar growth model to this problem, tried to find, then (when I couldn't find one) design a hybrid profit-maximization/investment theory models (complete with risk considerations and alternative uses of funds represented by the interest rate) – just for the time component. Another brick wall was the output mix/total fixed cost table. The mix seemed to present a near infinite number of options, so the full table couldn't be possible. Further, it couldn't be an equation system because total fixed cost of the equipment package would not be equal to the sum of its parts; there are relationships between the productivities of different components. For example, the amount of water produced and the equipment needed to do it is subject to the amount of waste heat produced by the electricity generation equipment. Or, irrigation and potable water services share some of the same equipment (pumps, for example), so the cost of adding irrigation to a system with potable water services (or vice versa) is less than the irrigation system alone, but it reduces the amount of potable water that will be available. These kinds of considerations caused me much grief in the early days of the project. I decided that the supply side variables could not be pre-set. They would have to be entered in as What-if scenarios against given site-specific data. Then, should I consider that the owner investor makes optimizing decisions about the service and price mix continuously, every set number of years, or just once – on the day he signs the contract – and lives with it until a certain point when it becomes wiser to either sell the equipment or expand the plant (also to be determined by the model, right?)

Because of all the feedback, I decided to review simultaneous equations and matrix algebra. This brought me back in touch with the Leontieff Input-Output model, and I began to reflect on how it might be of use in this situation.

B. Incorporation of the Input-Output Matrix

For several weeks, I played with input-output matrices, and fooling around with microsoft Excel. The underlying assumptions were that we should assume that every firm (household) in the local area is distributing his income among factors (goods) in such a way that its total benefits less costs are maximized, prior to the arrival of infrastructure services. This could be justified by the idea that the locals take into account many things, like traditions, for example, with an appropriate weight, that we had better not try to estimate ourselves. Financial profit might not be maximized, but the person's total utility, of which money is only a part was maximized. If we could establish the marginal benefit of each sector's goods to each of the sectors, we could perhaps estimate how these relationships would be altered upon the introduction of

infrastructure services as a possible good to consume. How would the person redistribute his income in the following period, taking into consideration that the purchase of infrastructure services would alter the marginal benefits of the other goods? At first, infrastructure services would be substituted for other goods, because of the budget constraint. Then, since that consumption of infrastructure would boost the marginal productivities of other goods, a scale effect would kick in and that would motor the economy (I was still thinking mainly in dynamics). After much meditation on the subject, I decided it had to do with the natural limits of each of the inputs.

Roughly, at the point when my confidence in this approach peaked, the methodology was roughly as follows:

1. Divide the site into homogeneous sectors based on similarity of productive activity (income generating). Find out an average wholesale price for each sector's output.

2. Construct the I-O table in units: a_{AB} = units supplied by A to B, or, units of A used by B in the period. a_{EX} = units (likely in currency units) from external economy (E) supplied to / demanded by sector X.

3. Compute (automatically) the several "mirror matrices":

- $p_i a_{ij}$: Puts everything in currency terms. This table might prove to be easier to construct first, depending on how much accounting the locals do. This could be compiled from checkbooks and balance sheets, if available (Ha!). From this table may be derived:
 - (a) local GDP = net sales to the external economy + combined income of the primary sectors (labor and owners) + change in inventories (considered as investment).
 - (b) check the relationship between market financial equilibrium and general philosophical equilibrium. Remember, we are assuming that the economy is at philosophical equilibrium, because there is no motivation for anyone to alter their behavior, unless a new opportunity comes into play. Tradition would be considered a theoretical good and deprivation a theoretical cost, or something like that. On the table, though, total community income should equal total production less change in inventories (the external sector as a row and column make the system closed). Some adjustments would surely have to be made in order to make this come out right, but that would be justified to some extent, because any inconsistency must be due to errors in extrapolating surveyed entities to describe entire sectors.
- $p_i a_{ij} / p_j T_j$: Represents each factor's expense as a share of total revenue.
- a_{ij} / T_j : Factor efficiency coefficient
- T_j / a_{ij} : Marginal benefit of factor (equal to average benefit because entity enjoys philosophical equilibrium).
- p_j / p_i : Marginal Revenue / Marginal Cost of i to j .
- $(T_j / a_{ij}) * (p_j / p_i) = p_j T_j / p_i a_{ij}$: This being entity j 's ratio of Marginal Revenue Product of input i to the Marginal Cost of input i , it should be equal for all inputs i . That is the rule of profit maximization with one product and several inputs, and we are assuming philosophical profit maximization by all entities. So, since every entry in a column should be equal in this table, a "philosophical coefficient" is derived for each one that would bring it to par with the average. This is a kind of multiplicative weight, the fraction by which it must be bumped up or down, illustrating the presence of non-financial "phantom factors" that consistently alter the marginal benefits and costs of real factors from those that would be derived from a rational expectations model.

4. Build a table of estimates, for every a_{ij} , of its upper limits as an input. Another matrix of estimated lower limits. Also, estimated limits of a sectors total output would be useful, since these would constitute the limits of summed upper and lower input rows. How could these estimates be made? Simply, how much of factor i could j possibly buy and still be reasonable, with given space and seasonal variations. How little could j spend on i and still be considered reasonable? How much could j possibly produce if everything was in his favor. How little could he produce if everything was going badly, before shutting down completely?

5. Now find out where actual usage and supply falls between the limits. This could be done perhaps by $(\text{upper limit}_{ij} - a_{ij}) / (a_{ij} - \text{lower limit}_{ij})$, or its inverse. Obviously, a value of 1 would represent mid range. From this, I was certain, could be quickly derived the elasticity of the input's marginal productivity or a good proxy for it at any rate. That is, %change in MP_{ij} / %change in a_{ij} , or, how fast does an input's marginal productivity change as its usage varies. We would assume that the relationship is negative; that

the MP of an input declines as its usage rises; and further, that near the upper limit its demand becomes highly elastic, and towards the lower limit, highly inelastic.

6. Now then, I thought, the potential MRP of the first infrastructure services consumed by an entity, divided by its Marginal Cost (unit price), would be greater than the average ratio for the other factors, so it would be purchased by an entity to the point where the ratios of all factor inputs (adjusted by their “philosophical coefficients”) now *including* the infrastructure services would all be equal. The period’s income would be the budget constraint (the money that the entity has to divide among the input choices), which is the sum of all the money that other sectors choose to spend on its output. Ofcourse, what the other’s wish to spend on the entity’s output is related to their income, which is a function of how much the entity wishes to consume of the other’s output. Pretty complex, but I believed that a solver in a database could be made to work it out. How would that shake up the mix of inputs and outputs in the economy? A second set of tables would be computed, now incorporating the infrastructure services, and showing clearly the owner’s revenues, costs and profit.

7. There was another problem, though. For there to be growth, the overall marginal productivity would have to vary directly with consumption of infrastructure services. More goods could be produced with the same inputs, or the same output could be made with fewer inputs from traditional sectors, and the value of extra production sold in the external economy or the value of the resources saved would represent the increase in community GDP, right? And the Marginal Productivity of inputs is not only a function of its own usage, but the usage of substitutes and complements in production. If, for example, the productivity of labor would be increased by the consumption of electricity or purified water, then that would be an increase independent of the number employed and the upper limit would be extended, right?

8. Right. And this interrelationship would surely cause a scale effect to dominate, leading to increased consumption of most inputs, and increased output, most of which could be exported.

This was the road I was heading down with general optimism but some uncertainty. I managed to push it a little farther before switching gears, trying out various approaches to the Marginal Productivity effects on growth and the infrastructure’s effects on Marginal Productivity, but the fuzziness was persistent. It was fun. It was philosophy, but would it ever produce something useful? This is where I was, facing some theoretical challenges, in mid February, when I was informed that the methodology would be employed at whatever stage it was in, in the second week of March by a feasibility study team in Honduras. The second week of March! I was only moderately confident that I could get the system ready by mid May, and was certain that no solid ground-work would be ready in the couple of weeks I had at my disposal. No more fooling around – I would have to shake some of the complexities out of the model-under-construction.

C. The K.L.S.S. (Keep It Simple, Stupid) approach: Keep the Matrix for consistency checks and drop the Marginal Productivity nonsense.

Following a meeting with Dr. Henry Herzog, one of my favorite economics professors at UT, in the course of which he woke me to the fact that my thoughts were too lofty, abstract, and struggling to connect, I sat down and rewrote the proposed approach in a letter to my boss, now focusing on the benefits of using the I-O matrix to check for accounting consistency (what the guy sells to the girl must equal what the girl buys from the guy). This drew my attention closer to the actual survey itself, and the importance of assigning “confidence scores” to each numerical response. The first table would be inconsistent at the intersections of rows and columns, sales info not matching corresponding purchase info, due to problems in the aggregation of sampled entities into entire sectors. Shaking the table out, using the confidence scores, the true values could be found: Somewhere in between the reported numbers.

Another major adjustment was the complete disappearance of Marginal Productivity and “philosophical equilibrium” from the mix. If we want to know how the entity would redistribute its income among the factors once infrastructure becomes an option, we simply ask! “Now, then, imagine that electricity was available at \$X/kwh, how would your responses change to incorporate this new option?”

So, we would have the table reflecting the relationships and flows in the “actual” economy, and tables reflecting “hypothetical” economies with infrastructure services. The hypothetical tables would be “shaken out” just like the original, to acknowledge the fact that an entity’s speculation is limited in reality by the speculation of its customers and suppliers. Then, it would be a matter of comparative statics. What has changed in the economy with the hypothetical introduction of infrastructure services? This change would be the basis of growth rates for all parts of the economy. (See attachments)

One fear was overriding: What if we got down there and couldn't get the needed information? What if no one was willing to cooperate and share with us their sales and purchase accounts? What then?

D. The rise and fall of secondary data.

Ideally, we would have something to show at the end of a few days, even if everything went wrong. All available secondary data, presumably at the national level, should be found and artificially reduced to describe the site in question. Then, on arrival, all we would have to do would be to verify and adjust the secondary data based on our survey findings. If there were no survey findings, we would at least have the pre-supposed results.

On this line of thought, I dove into literature about statistical techniques in practice for applying existing national I-O tables to a smaller geographic area – region or even a city. The more I read, however, the more skeptical I became. Furthermore, tracking down existing and relevant I-O data for Honduras proved frustrating: Too many leads, one to the next, and the documents I did get ahold of were on average 10 years old, I couldn't understand the methods by which they were compiled, and their "sectors" didn't correspond to what I had envisioned for our own work.

E. Utter rejection of the proposal and default to Rapid Rural Appraisal.

I presented the I-O based model the weekend before departure to Honduras, and it was not well received. It was maintained by the project coordinators that such complete income and expenditure data would be practically impossible to obtain, and even harder to believe. Besides, the model was too fuzzy for even the project directors to follow, much less the prospective investors on site. It was suggested that I suspend my efforts until after the trip to Honduras. In the absence of a viable quantitative methodology, the study team was to employ modified tools of Rapid Rural Appraisal, the Catholic Relief Service's qualitative method that stresses local involvement.

F. Following the Honduras experience

The experience in Honduras made me realize that indeed, my expectations of available information on the site had been too high. As an assistant to experienced development economist Dr. Lucy Philips, I was able to observe first hand the constraints on infrastructure development research in rural Honduras, and acquired a real foundation on which to build my own methodology. This database program and accompanying users' manual are the result of much reflection on the Honduras experience.

I would like to thank Dr. Huy Chang and Dr. Henry Herzog of the University of Tennessee Economics Department for their guidance; Mr. Richard Ector and Mr. Robert Blenker of the Tennessee Valley Infrastructure Group for their vision and the opportunity to contribute to a meaningful enterprise – these two men have freely shared their with me their experience, insights, concerns and dreams; and working with them has been one of the most important educational experiences of my life.

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Bohm, Robert A., Timothy J. Essenburg and William F. Fox. "Sustainability of Potable Water Services in the Philippines." *Water Resources Research*, Vol. 29, No. 7, Pages 1955-1963. July 1993.

Chickering, A. Lawrence and Mohamed Salahdine. The Silent Revolution: The Informal Sector In Five Asian And Near Eastern Countries. San Francisco: ICS Press. 1991.

Chickering is an associate director and founder of the International Center for Economic Growth, and executive director of the Institute for Contemporary Studies' Project on Economic Growth in the Soviet Union; has written critiques of centralized economic planning. Salahdine is a professor of socioeconomy at the University of Fes in Morocco, educated in Paris; has been a consultant to the World Bank and USAID on the informal sector. The International Center for Economic Growth is a nonprofit institute sponsoring research, publications and conferences around the world. Its board of overseers includes representatives from OPEC, the Arab fund for Economic and Social Development, BankAmerica Corp., Daewoo Corp., and the Development Bank of the Dominican Republic. Its academic advisory board features representatives from the Asian Development Bank, MIT, Stanford, the Kiel Institute of World Economics, Duke University, UCLA, the Harvard Institute for International Development, the University of Chicago, Yale, and Vanderbilt. I speculate that ICS is a moderately conservative institution.

The book provides descriptions and analysis of informal sectors through case studies and anecdotes and concludes that governments, "which often view the informal sector as a problem to be solved by law enforcement and regulation, actually ensure its continuation through misguided policies." Furthermore, the authors propose that informal sector participants must be brought into the legal economy, in order to share in the benefits and the costs of formal economic activity. The book criticizes the "bureaucratic" model of development currently in place as being highly Western, rationalistic, organizational and top-down with little attention to individuals or firms. The authors, believing that this model has failed, must be replaced with an environment "conducive to entrepreneurship." The specific issues addressed in the book are: How important is the informal sector? Who is in it? Why are they in it? Which model fits better, the bureaucratic or the entrepreneurial one?

Cole, Richard L. Introduction to Political Science and Policy Research. New York: St. Martin's Press, 1996.

Danesh, Abol Hassan. The Informal Economy: A Research Guide. New York: Garland Publishing, Inc., 1991. Danesh was associated with the Department of Sociology and Anthropology at the University of Rhode Island. This research guide "provides an exhaustive annotated bibliography on diverse aspects of the informal economy." Basically, this is a summary of the body of literature on the subject up to 1991.

Freudenberger, Karen Schoonmaker. Rapid Rural Appraisal and Participatory Rural Appraisal: A Manual for CRS Field Workers and Partners. Baltimore: Catholic Relief Services. 1999.

The publication was funded by a grant from the office of Food for Peace, Bureau for Humanitarian Response, United States Agency for International Development (USAID). The manual is not intended for general readership, but for Catholic Relief Services field workers, to familiarize them with a flexible methodology for obtaining qualitative information relevant to development projects. The manual addresses the need for information in development projects and offers a discussion of information gathering methodologies, characterized along two dimensions: qualitative/quantitative and participatory/top down. Quantitative seeks to describe "what" and qualitative, "why," and the manual stresses that both kinds are important. Top-down methods are those in which essential decisions are made by specialists, whereas in participatory methods, local people play a greater role in the information gathering process and in the use of the information. This publication strongly prefers participatory methods (which show respect for human dignity and subsidiarity), and points out a logical compatibility between qualitative and participatory research, which describe both RRA and PRA.

RRA is a study in one or more communities lasting from 4 to 8 days, have specific objectives and involving community members. PRA is more extended, its emphasis is on seeking ways to involve the community in planning and decision making rather than simply gathering information, and can last for months or years. The tools of both, featuring interviews (avoid yes/no questions), mapping exercises, venn diagrams, calendars, and problem ranking exercises, are guided by the principle of "triangulation" which seeks to

identify and reduce bias, especially gender and wealth bias, but also researcher bias. The manual also discusses how to organize a research team, schedule events on site and facilitate community involvement.

Frey, Bruno. (1989). "How Large (or Small) Should the Underground Economy Be?" The Underground Economies: Tax Evasion and Information Distortion, Edgar L. Feige, ed. Cambridge University Press, pp. 111-126.

Richardson, Harry W. Input-Output and Regional Economics. New York: Halsted Press, 1972.

While writing the book, Richardson was working for the Social Science Research Council. The book examines the theory underlying input-output techniques as applied to regional economics. Generally, limitations include reliance on linear relationships. Some advantages are that such approaches are based on the general equilibrium theory (a virtue or vice depending on what economist you talk to), neutral from a policy perspective, and contain inherent consistency checks that improve the reliability of the information. Survey-based models are preferable, but use of secondary data is becoming more reliable. Input-output methods are specifically valuable for forecasting economic impacts of new technology and changes in factor supply.

Herman, Bohuslav and Wim Stoffers. Unveiling the Informal Sector. Brookfield, VT: Avebury, Ashgate Publishing Company, 1996.

Herman is Project Coordinator of the Pakistan/Netherlands Project on Human Resource Development and Associate Professor affiliated with the Foundation for Economic Research, Erasmus University Rotterdam, The Netherlands. Stoffers is Senior Research Fellow of the Growth Dynamics University Institute, also at Erasmus University, and is currently the Chief Technical Advisor of the aforementioned Pakistan/Netherlands Project. Contributors to the book include experts from the US Bureau of Labor Statistics, the Bureau of Statistics of the International Labor Organization, and similar institutions in India, Tanzania, and Brazil.

The book emerged from an International Seminar on Informal Sector Employment Statistics, and presents varying viewpoints on the methodology of informal sector data collection in the developed and the developing world. Most important are the case papers from developing countries which describe in detail the needs and problems of data collection, focusing on the "statistical pitfalls."

Jagannathan, N. Vijay. Informal Markets in Developing Countries. New York: Oxford University Press, Inc., 1987.

Apparently, Jagannathan, following years as an official in the Indian Administrative Service, wrote this book while a doctoral student in Economics at Boston University. The book explores the "logic" of unorganized economic activities – how participants in village/rural economies operate -- and proceeds to apply his analysis to the problems of rural-urban migration and corruption systems in developing countries.

Portes, Alejandro. (1996). "The Informal Economy: Perspectives from Latin America."

In *Exploring the Underground Economy*. Kalamazoo, MI: Upjohn Institute of Employment Research.

Portes, Alejandro, and Lauren Benton. (1984). "Industrial Development and Labor

Absorption: A Reinterpretation." *Population and Development Review* 10 (December): 589-611.

Renzetti, Claire M. and Raymond M. Lee. Researching Sensitive Topics. London: Sage Publications, 1993.

Chapter 3, "Measuring the Underground Economy: A Suitable Case for Interdisciplinary Treatment?" by J. J. Thomas, originally published in the *American Behavioral Scientist*, 33, 621-637. Thomas discusses competing definitions of the "underground economy." Indirect macroeconomic approaches include the Cash-Deposit Ratio approach, and the Monetary Transactions approach. Microeconomic data has been obtained from income tax audits, labor market surveys and household surveys. The drawbacks of each of these approaches are considered, and Thomas proposes unconventional techniques such as the "randomized response technique."

Thomas, J. J. Informal Economic Activity. London: Harvester Wheatsheaf, 1992.

Thomas is a senior lecturer in Economics at the London School of Economics and Political Science. The book is a response to economists who consider that quantitative models have no place in the study of informal economies. Chapters particularly relevant to my own research are (4) "The Informal Sector: Aid to Development or Barrier to Modernization"; (7) "Macroeconomic Analysis of the Irregular Sector"; and (8) "Microeconomic Analysis of the Irregular Sector: Who is Involved, How and Where?" This is an expansion of Thomas's earlier cited article in Renzetti.