COLLECTING BASIC AGRICULTURAL DATA IN SAHELIAN WEST AFRICA: AN EXAMPLE FROM BURKINA FASO

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When I arrived as a young upstart in Burkina Faso I informed my project director that it might be interesting to collect data on agricultural production, marketed surplus and prices.

"Why?" he asked me.

"Well, then we could compute the price elasticity of supply,....."

"The what!!??"

"The price elasticity of supply." He frowned and looked at me as if he were thinking: "This guy might become a lot of trouble...".

"Listen, he said, why don't you check out a motorbike tomorrow morning and see what our enumerators are doing. Now that you're here, get them off my back."

Driving a motorbike for the first time through the countryside of Burkina Faso during the rainy season is an educational experience, to say the least. It is like being pushed off a black slope on your first day of skiing - only more dangerous. At least on the snowy slopes of your ski resort you will probably not find too many chickens, goats, sheep, cows, dogs and little children throwing themselves out of nowhere in front of your skis. Did I forget to mention the three-foot deep potholes filled with water?

I still don't know how I survived my first trip. Anyway, one month later, I returned to my director's office. He looked at me with an annoyed frown and said:

"Why are you here? You're supposed to be out there measuring plots. Of the 400 plots you and those enumerators were supposed to measure, you've only done a lousy 120!"
"You can't measure fields in August, Sir, the crops are so high you cannot see the guy at the other end of the measuring tape, let alone measure any angles. Maybe we can retrace the fields after the harvest."

Later on I overheard him talking to an Embassy employee at a cocktail party:

"You can't believe how idiotic these people are on arrival. Take this Van den Brink fellow. Can you imagine what he told me when he got here? Said he wanted to measure the 'price elasticity of demand'."

The two had a long laugh.

"Anyway, I kicked him into the field right away, and guess what? A month later he came back and told me the corn was too high to measure in August. Now that is useful information."
1. INTRODUCTION

In writing this short essay on collecting agricultural statistics I drew from my experiences as an FAO associate expert working for a regional department of the Ministry of Agriculture in Kaya, Burkina Faso over the period August 1983-June 1986. One of my assignments was to assist the Bureau of Economic Analysis and Planning in its efforts to set up a viable agricultural statistics program. I was lucky to have been part of an enthusiastic team of Burkinabe officers that managed to successfully fund and execute the first large-scale agricultural survey in the country. The methodology developed is now used throughout the entire country and within several other countries in the CILSS¹ region.

Although some of my observations may apply to a number of other African countries with comparable agro-climatic conditions, I will not make this generalization. Anyone who wants to work in Africa and with Africans must show proper respect for the continent and its people. Making sweeping generalizations from shallow observations is not the best way to approach your work and your colleagues.

Finally, this essay is not a manual. It is a collection of my experiences, observations, and thoughts gathered "from the field." These views reflect a specific context and are subjective in nature. This essay, then, simply aspires to give you some of the flavor of fieldwork. As they say in Burkina Faso:

"c'est en forgeant qu'on devient forgeron!"

(lit. it is by welding that you become a blacksmith).

¹ Comité Inter-États pour la Lutte contre la Sécheresse au Sahel. This regional organization of Sahelian states is comprised of Sénégal, Mauretania, Mali, Burkina Faso, Niger, Chad, The Gambia and Cabo Verde. It was created after the 1973 drought.
To attract funding for a large-scale agricultural survey (called "census" or "sample census", which usually means "a large sample") one must first justify the need for the survey. My Burkinabe colleagues and I lobbied hard for the necessary funding of our survey (approximately $300,000). In so doing we probably won the debate not on merit, but on stamina and on a favorable political climate.

A number of organizations had to be convinced of the need for the survey. Fortunately, the marxist government very much favored "planning" and recognized the need for "scientific" data as the basis for planning. Thus, we had some powerful support from above and we could make several government institutions an offer they couldn't refuse. The Ministry of Agriculture had come under increasing attack for its yearly ritual of invented agricultural statistics and was in need of a legitimate effort. The "raison d'être" of the Ministry of Planning is "data" and it was thus also easily convinced. The National Institute of Statistics and Demography was equally a natural ally.

The more of such alliances one makes, the better. They look quite impressive to the various potential donors. Furthermore, even if all these different organizations do not actually participate in any of the fieldwork, they provide important backing that comes in handy at all stages of the survey. More important perhaps, if large projects are set up without the consent and at least token participation of all potentially involved government institutions, the project might later be ignored or even boycotted in various formal and informal ways.

The donor community was convinced with more difficulty. Luckily, one of the buzz-words at the time was "early warning systems" for emerging famines and it was possible to ride on that, since an agricultural survey has obvious
ties to any early warning system. In the least, we argued, the survey could provide essential benchmark data for use in such a system.

In spite of the support, it was not easy to justify our need for the $300,000 required to carry out the survey. The drawers of some desks in the Ministry of Agriculture were already full of never-analyzed surveys that had cost a lot of money.

Moreover, many seasoned development practitioners had no trouble in discrediting numerous arguments. Below are some of these debates. I have caricaturized them a bit for purposes of presentation:

"Planned Development"

We: The objectives of collecting statistics in general are justified under any system of planned development. If we want to plan anything, we need data. For instance, if we need to provide a province with wells we must know how many are needed, where they must be dug, how deep they need to be, how many people need to use them, how much water is needed per day, and so on. It looks like we need a lot of data, in fact.

They: But do we need a large-scale "scientific" survey? For even if we had the data, would we be able to dig all these wells? How many drills do we presently have? Two, and one is not working? How many wells does the ministry of public works dig in an average season? Four, if they're lucky? And these wells aren't even
working two years later? The pumps keep breaking down?
And there is no budget for maintenance? The villages themselves were supposed to have saved money for that?
But they didn't because the chief had the well dug on
his land and so the village felt that he should pay
for it himself?

Thus, we do not even want a survey. There is already too much to be done
without the added trouble of an army of enumerators raising false expectations
in every village of the province.

The same problems of cost-effectiveness, relevance and lack of ex-post
project capacity arise with agricultural statistics. Would a large scale
production survey provide us with new insights in the agricultural problems of
the region? We already know that harvests are poor: one field trip will firmly
establish that point. A quick-and-dirty survey might establish that they are
somewhere between 300 and 500 kg per hectare. Do we now need to spend $300,000
to know exactly how poor they are, i.e. 407.67 kg per ha at a 1% significance
level? What would we do with that knowledge?

"Early Warning Systems"
We: We need exact figures on yields so that we can react
quickly and efficiently to emerging famines.

They: In this case, there is an obvious need for the data.
But again, would an agricultural survey be the most
efficient way of reaching our objective? One talk with
local transporters will already tell us a lot: where food prices are rapidly rising, which villages are being abandoned, where village stocks are depleted, where children and elderly people are showing signs of malnutrition. And by the way, if we do not have any grain "pre-positioned" in the country the moment the famine hits, we will be too late anyway. It will take at least 6 months to get grain through the international bureaucratic pipeline. And once it is delivered to the capital, there is no guarantee that the logistics are there to transport it into the villages.

There is also a minor but interesting sociological constraint on early warning systems. Bad rainfall is looked upon by many Burkinabé farmers as a sign that somebody is screwing up and that the ancestors are not pleased. This might make rainfall data rather politically sensitive, especially to somewhat nervous leaders.

Again, an agricultural survey will not be very cost-effective, the time it takes to process the information will make it irrelevant for all practical purposes and, again, there are plenty of other problems to be dealt with first.
"Structural Food Aid"

We: Obtaining and dispensing of structural or non-emergency food aid is on the hidden agenda of donors and national governments alike. This type of aid is given regardless of emergencies and is unfortunately diverted from its intended recipients on a large scale, usually towards government employees in the urban areas. What's left over is sold on the market. It is a powerful political instrument for the government. For donors it is an elegant way of dumping their grain surpluses. The effects on producer prices are of course very depressing indeed. Sound agricultural statistics could yield better estimates of structural food aid needed and prevent unnecessary downward price movements.

They: Unfortunately, farmers do not overthrow governments, instead salaried urban workers, civil servants, and disgruntled military do this. And high food prices are certainly a good way of upsetting urban people.

At present, the FAO assesses the amount of emergency food aid on a yearly basis. In Burkina Faso, it relies on its own "fact-finding missions" (a one or two week trip of a team of experts) complemented by national agricultural statistics -- if available. The latter usually are not based on any objective methodology at all and are therefore easily subject to
bureaucratic routine ("let's not change last year's report too much") and certain political pressures.

A serious effort at collecting sound agricultural statistics could perhaps break the vicious circle of estimated estimations and unnecessary food aid, especially if all parties involved participate in the design of the methodology. One argument effectively used to convince farmers to participate in our survey was that the data would enable the government to more effectively target the food aid. Once everybody -- donors, governments and farmers -- subscribe to the method, they cannot ignore the results, even if they imply a reduction of structural food aid.

"Data for Data's Sake"

We: How come you say you don't need these data but every time you come to our office you request them?

They: Touché...

No matter how convincing an argument can be made that all these statistics are not necessary, one must still face the demands of the bureaucracies and the institution of development aid. Governmental reports thrive on data. People on missions from all over the globe will harass one continually in their quest for data, because for many of them the bottom line is that they need numbers and they have one week to obtain them. A good story simply won't do.
2. GENERAL SURVEY DESIGN

In spite of all the valid counter-arguments made, we were able to convince the donors, and the project was given the green light. This, of course, forced us to rapidly tone down the rhetoric of our proposal so that it matched what we could actually achieve.

Everybody could think of hosts of variables which were all very important and interesting for one issue or another, but if we wanted sound data, we had to limit ourselves severely. The bottom line was thus: we had to be able to guarantee reliable results.

As a first option, we wanted very basic agricultural statistics, such as yield per hectare of principle crops and basic demographics, such as average family size and composition. Also under consideration were inputs like labor, fertilizer use, equipment, soil types and livestock data.

2.1 Data Excluded

For various reasons we excluded the following data. It should be mentioned at this point that we were planning a large scale survey including hundreds of villages, not a micro study for research purposes. Thus, many of the data which we excluded would be absolutely necessary for small-scale, in-depth surveys.

Other data or a particular method of collection were excluded because of the particularities of the farming system in the region. Such exclusions can therefore not be generalized to other farming systems.
2.1.1 Labor data

In most parts of Burkina Faso, plot-level labor data are extremely difficult to collect. Moreover, once you have them they might not explain very much about per hectare yield differences between plots.

First, you obviously cannot have enumerators with stopwatches timing labor inputs on every plot in your sample. Even if you were to make a sub-sample, the enumerator would be watching a very heterogeneous group of people with a changing composition during the day of adult men and women and boys and girls. These people might in turn perform a variety of tasks during a single day. You would need all sorts of weights to aggregate these differential labor inputs. It is unlikely that the average enumerator would be able to keep up with all of this, even on a limited sample of plots. Moreover, the agent would also need to sleep near the farmer’s compound, since work starts very early. This is probably too much to ask of an enumerator, who is after all a government employee with certain concepts of what is "reasonable".

An obvious solution is to have enumerators make weekly or bi-weekly visits and ask farmers to recall who worked when, doing what and for how long. If you want to create response fatigue with your farmers and perhaps "question fatigue" with the enumerators, this is the way to do it.

But let us assume that you successfully obtain detailed labor data. Would it explain much variation in production? In a relatively land-abundant and extensive agricultural system as you will find in much of the Savannah in West Africa, labor force is probably not constrained by land area. Thus, given a certain family size and demographic composition, there might be a strong correlation of labor force with operated area and not much variation in labor-intensity on a per hectare basis. Much more important, then, than observing
differences in labor inputs at the plot level, may be observing changes in the work force at the household level. For instance, a young adult suddenly departing or falling ill in the middle of the season, will have a major effect on area harvested and thus on household production.

We decided to abandon the idea of gathering plot-level labor data altogether, but if you are really in need of labor data for production (for instance because you are studying the adoption of technology), you will have to collect such data. I wish you good luck. You will need it.

2.1.2 Modern Inputs

The use of inputs such as fertilizer and those needed for animal traction (plow, weeder, draft animal) will depend very much on the region. In our region fertilizer application was minimal, and if it was done at all, the farmer knew exactly where, when and how many kilograms he had applied, since he had paid dearly for it. Whether the fertilizer was correctly applied was another issue. In nearly all cases, the dose was far below the optimal dose and thus its effects on yields minimal. Farmers sometimes applied fertilizer only on their best fields, so that you would actually be measuring the dummy effect of "good soils" and not the effect of fertilizer.

Animal traction is another issue. In our region plow ownership did not imply that the farmer was actually using the device. In a previous survey, we had tried to measure "actual use". After having surveyed 150 farmers who owned a plow, we had measured only 1000 m² actually plowed (this is about 1/5 of a football field) out of a potential 6,000,000 m². All the plows and weeders were obtained on credit from various development projects. It turned out that the majority of farmers in the region had been more interested in the monetary
part of the credit package than in the plow: they received $100 or $250 cash to buy the oxen or the donkey needed to pull the equipment. Many of them never even bought the animal, and even if they did it was for fattening and not for pulling a plow. Some of the plows were used as decoration in the living room.

We skipped collecting detailed data on these "modern" inputs. It was felt that the objective of our survey should be less ambitious. We should provide reliable benchmark data. More detailed studies, conducted on a smaller scale, could provide essential follow-up.

2.2 Data Included

Many debates later, we reached agreement on the inclusion of the following variables.

2.2.1. Demographic Variables

Ideally, one hopes to unambiguously define the basic production and consumption unit. In our case, we were faced with an extended family system which seemed to be evolving to a more individualized system. This created many ambiguities and a wide variety of different production and consumption patterns. No definition could capture its complexities.

Thus, it seemed appropriate to start with local concepts which had meaning for the farmers themselves, instead of immediately trying to operationalize Western concepts and definitions. After some kicking around, one might find an acceptable definition, which will ideally have roots in local culture and valid economic meaning.
We decided we wanted quantitative information on the work force engaged in agriculture. Thus, we needed:

- the number of compounds. A village is made up of compounds, the basic residential unit. A compound consists of several houses or huts surrounded by a wall.
- the number of households. Each compound can consist of several households. We defined the household as a group of persons usually related by kinship or marriage, who resided habitually in the same compound along with other households. The members of a household produce collectively and have rights to meals from a shared kitchen. Theoretically, only one person has budgetary authority, the "household head."
- number of individuals in each household.
- number of people actively involved in agriculture.

This is best left to the subjective evaluation of the interviewees complemented by direct observation in the field. At what age does a boy or a girl become active?

- the primary economic activities of the head of the household
- the secondary economic activities of the head of the household

2.2.2 Agricultural Variables

- Crops

We were not able to cover all crops, nor all crop mixes. Thus, we selected the major crops in the area: white sorghum, red sorghum, millet, corn, peanuts, rice and niébé. We did cover all possible crop mixes between these. We were careful to include crops that are mainly produced by women as
well as those which are considered the domain of men. Although we knew that the female-controlled peanut plots would add tremendously to the workload (they are usually many, small and far away), we felt that this female cash crop was too important to be omitted.

We did only focus on rainfed agriculture, not on irrigated agriculture undertaken in the dry season or on special perimeters.

- Area planted to each crop

In our region there was no quantifiable concept of area. Whether or not local culture has such notions crucially depends on the farming system. My guess is that land-constrained farming systems usually will have quantified area concepts, whereas many land-abundant systems do not.

Although the method used for measuring area is relatively simple in principle, the logistics of the operation can become gigantic due to the phenomenon of "plot scattering" in the semi-arid tropics. Farmers use this system in an attempt to hedge against the variation in rainfall and its differing impact on various soil types. Moreover, the plots are not rectangular: they take on bizarre shapes, with plots sometimes having up to 50 corners. A given household may have anywhere from 10 to 30 scattered plots (some may be 10-15 miles away).
Crop mixes or intercropping pose another special problem with respect to area. How do you accurately attribute the area to each crop? We adopted the following solution:

\[ A_b = A \times \frac{r_b}{\Sigma r_b/R_b} \]

\[ \Sigma A_b = A \]

- \( A \) = area of the plot
- \( b \) = crop index
- \( r_b \) = yield per ha of crop \( b \) on the plot
- \( R_b \) = average yield of crop \( b \) as a single crop
- \( A_b \) = area devoted to crop \( b \) on the plot

Thus, the areas attributed to the crops which make up the crop mix are the result of weighing by their respective yields. This index is obviously a crude compromise.

- Yields

There are basically two opposing methodological schools when it comes to estimating harvests. One school swears by the method which measures "carrés de rendements." In the United States, this method is known as "crop-cutting". "Carrés de rendements" are rectangles randomly chosen within a given plot. Preferably, one should use a deterministic and reproducible method for choosing the rectangles, e.g. using random number tables. The throwing of stones or hoops to do so usually results in upward biases of yield estimates: many enumerators tend to rule out throws which land on empty or near-empty spots.
The plants within the "carres" should be harvested separately and set aside by the farmer or the enumerator. Even though the "carres" are relatively small (e.g. 10x10 meters), farmers might object to this extra work.

The method should work relatively well for crop systems in which there is little variation in yield within a given plot. I have been told that the method originated from work on irrigated rice paddies, which would explain its popularity. However, Sahelian plots are a far cry from the uniformity of paddy fields and can show extreme variation in yield within the same plot. Sampling within such plots might produce a large error.

The opposing school propagates farmers' subjective evaluation of harvest size. This means that the farmer tells you the number of bags he or she has harvested from within a given plot. Farmers are very sure of these amounts and retain sometimes perfect recall over 10 years of farming. This recall is not surprising. After all, the amount they produce is the single most important economic indicator of their livelihood. However, even in the United States farmer recall is still verified by crop-cutting or other methods. In developed countries, then, there are many more possibilities for checks on consistency of the data than exist in developing countries.

In addition to the limited scope for verification and consistency checks within the Burkinabé setting, some other problems remain.

For instance, the farmers might each use different types of bags and baskets and/or filled these differently. Moreover, even supposedly standard measures like the "tine" (a tin can used as a standard volume measure on the local markets) varied from region to region. Thus, the enumerator must exactly calibrate all pertinent local measures, at least on a village by village basis.
Irrespective of what method you use for yields, you need to establish a conversion factor for gross into net weight. Gross weight is the weight of the produce as it comes directly off of the field in the form of freshly harvested pods. In the case of corn this would be the cobs. Net weight is the weight of the produce after it has been dried and separated from the pod, i.e. the grain. In the case of corn you would measure the kernels that have been removed from the cob. Since the ratio of gross and net weight may vary from locality to locality and from year to year, we estimated this ratio on a per plot basis, rather than for the whole village or region.

- Soil Types

The type of soil on which a crop is produced obviously has an important effect on crop systems and their yields. Valley-bottom lands differ from sandy slopes. Permanently cultivated and manured compound plots differ from bush plots under a fallow system. There is a wealth of information to be obtained from farmers on soil types and their role within the farming system. Unfortunately, researchers have not yet in any systematic way tapped into this knowledge.

- Control

Without going into the details of the tenure system, it is important to know whether the plots are under the control of men or women.

- Plant Density

This is the number of heads per stand.
2.3 Free Riders

If you have done your public relations groundwork well enough, there is a chance that other institutions will by now have heard of your plans to conduct a large-scale survey. Some may therefore choose the same region in order to use your data as a benchmark. In our case, CILSS tested a version of an Early Warning System in the same region in which we collected our data. In fact, we participated in the planning and execution of this test. At the time, the University of Leuven (Belgium) was doing some remote sensing, using the new EEC satellite (SPOT). Since they needed some "grounding" for the interpretation of the infra-red pictures, they also focussed on our region.

As long as such projects are undertaken in a way which does not interfere with the logistics of your survey, there is of course no objection to them. However, some projects might try to "lean on you", for instance by quickly creating a questionnaire and then asking you to execute it for them. "Just a few questions, I mean, as long as your agent is there anyway ...." If you have planned efficiently, there will be no extra enumerator time available for these "few" questions. Moreover, if the farmers have not been notified of and consented to these extra questions from the beginning, they might rebel, and suspicious feelings might be created.

This scenario actually took place in our case. Specifically, the last-minute addition of a questionnaire on livestock data was not well received by certain farmers. It also created the suspicion that we were somehow linked to...
taxation activities of the government. Questions were asked about the number of cattle, goats, sheep, pigs, donkeys and horses kept on the farm.

2.4. **Target Population**

Our target population consisted of settled farmers, whether in villages or rural towns. We first needed to determine what geographical units above the household level we would be focussing on. These primary geographical units are usually determined by the administrative division of the country or the Ministry. Burkina Faso is divided into Provinces which are again divided into Sectors, which are again divided into Sub-sectors made up of villages. Given the Ministry of Agriculture’s intervention structure, we chose the Sub-sector as our first aggregation level. Thus, our target population consisted of all farm households in a given Sub-sector.

2.5 **Sampling Frame**

If you define your target population as all farm households in your region (in our case: each sub-sector of the region), you might ideally want to choose your sample from a list of all households. Such lists do not exist in Burkina Faso. Furthermore, even if such a list were available and you took a random sample from such a list, the selected households would likely be so dispersed over the area that your enumerators would spend most of their time travelling. This would greatly reduce your sample size or increase the cost of the survey.

In light of the above, you might want to draw your sample in two steps. First, you define your sample frame as being a list of all villages in the primary geographical units. You draw a sample of villages. Secondly, you
establish a list of all households within the villages sampled and from that
list you draw the final sample of households.

Our sampling was done in two steps. We had no comprehensive list of all
farm households in our region, but we did have a list of villages. Thus, the
first step was to draw a sample of villages. This step may seem obvious, but
there are other possible ways to start. For instance, you could use grid
sampling with the help of an aerial survey.

The second step included sampling a number of households within each
selected village. We knew of much variance in village size, i.e. number of
households per village, but did not know the effect of size on yields. Thus,
we tried to give every household an equal chance of being chosen -- whether
the household was in a large or small village. Note, if you treated every
village as uniform and drew a fixed number of households from every village,
the households in smaller villages would have a greater chance of being drawn
than those in large villages. Whether this is of importance is another matter:
indeed farmers in small villages may farm in a manner identical to their
colleagues in big villages. However, when villages are larger because of
better soil conditions, village size might matter.

You can make this sampling framework much more complicated than this,
depending on data sought. However, simplicity should probably overrule most
arguments that favor more complex sample frames. In particular, methods which
increase the number of times samples are drawn in a sequential manner over the
growing season can be a planner's nightmare. If every phase in the survey
needs a different sample drawing, and if one phase provides the framework for
the next, realize that you will need to have all the necessary data collected,
checked, sent to the central level, processed, sampled and sent back again
down the hierarchy, before your enumerators can start with the next phase. Trivial logistical problems are not the only possible problems. You might run into unavoidable delays because of an uneven rainfall pattern over time and over the region which will affect farmers' activities. While one village has already started weeding, another village might still be planting or replanting. Thus, sample methods which reduce your flexibility over time may carry very high costs. You will have to decide whether you want to run that risk.

Ultimately, the sample frame you choose will depend on the particular field conditions you face. For instance, a pastoral production system will need a totally different approach than an agricultural system. Pastoralists wander around a lot so it is difficult to target them in a static village framework. Also, the number of animals a pastoralist owns might be one of the best kept secrets of his life. (My project director told me he had tremendous success in terms of coverage by tying his survey of pastoralists to a vaccination program. The animals and the owners suddenly poured in from everywhere!)

2.6 Stratification

Another issue involves stratification, which permits reducing the variance of your estimator by using prior information about other variables which are in some way related to your dependent variable. Assume for instance you want to know the number of radios per individual. You know that your population always consists of 50% males and 50% females and that males own systematically more radios than do females. If you now stratify, i.e. draw two samples instead of one (one among males and one among females), you will have
effectively reduced the variance of your estimator relative to an estimator
generated from an unstratified method.

Even though you may have no clue as to which variable affects what and
whether significant differences exist between strata, stratification -- in
theory -- never increases the variance of your estimator, so it doesn't hurt
to make some reasonable guesses. However, in practice an unnecessary
complicated stratification procedure may introduce all sorts of logistical
problems and will increase the variance of your estimator.

For our survey we stratified between rural farm households and urban
farm households, and on household size.
3. FIELD OPERATIONS

The implementation of a survey involves not only statistical problems. Many non-statistical problems will also need to be addressed. Below is first -- an assortment of institutional problems likely to surface within a development project setting in general, and within the context of a large-scale survey in particular. Second, some highlights of the actual field operations are given.

3.1 On Nationals and Expatriates

In many projects, there is often a strained relation between nationals and expatriates, somewhat euphemistically known as "management problems". However, it is necessary to spend a few words on this relationship, especially since the excellent relations maintained within our survey project were obviously the main reason for its funding and successful completion.

Many problems can start right from day one. Imagine you are a government employee in Madison, Wisconsin. You have a graduate degree in your field and ten years of experience. One morning a young African walks into your office. You do not know him and he is difficult to understand, since he hardly speaks English. He has never been to the United States. Nonetheless, he informs you that he will be "advising" you since his employers in Dakar told him that your office has serious problems. "But don't worry," he says. "You and I are going to work things out."

He has the same diploma you have, is ten years younger, and earns about ten times what you make. Whereas he is officially your
"technical advisor," he has his own private car with chauffeur, a huge villa, a cook and a night watchman, all paid for by the project. You and your colleagues do not even have a motor-bike for your work, and the only car of your department is always out of fuel.

It takes you a few days to get over the humiliation. You try to be professional about the whole situation. Okay, your office has problems, which you know very well, but you have thought a lot about this and if you get the necessary resources you are sure they can be solved. Your new "advisor" tells you he "really appreciates your input," but that the project design and budget was agreed upon in Nairobi last year. In fact your own minister signed the document, a very detailed document written by a consultant from Ghana who had worked in California for a couple of years.

You protest: "But California farming is quite different from Wisconsin farming!"

"Well, that may be," he replies "but the document even contains the questionnaires you are supposed to use. Did you never read it?" You are too embarrassed to tell him that this is the first time you have ever heard of its existence.

"Of course" says your "advisor" magnanimously, "we can make a few adjustments, but the main course is set. The things you are proposing are nowhere in the budget, so I can't take responsibility for them." You thought the project was officially
your department's project, but now it turns out that your
"advisor" is also the one who decides on every dollar to be spent.

The above story is not exaggerated. In fact, it is fairly routine. Many
frustrations and misunderstandings arise from this clash between cultures and
the way in which the "development aid" business is being run. Many projects
fail because of these simple human relations problems and the institutional
context of development aid, not because of lack of management capacity,
qualified personnel and/or adequate training.

3.2 Organizational Chart

Most of the time of the executive committee will be spent managing
personnel. It would seem to be imperative to set up a detailed organizational
chart and to formalize each professional's duties and responsibilities. On the
other hand, too much detail can be stifling, and it is obvious that
flexibility is worth a lot. Do NOT attempt a daily planning: it will be of
absolutely no use. Be ready to improvise at every step, but never fail to
identify the crucial factors without which the whole undertaking stalls.

If the survey is being undertaken by a Ministry of Agriculture, there
might be a choice between using the already established network of extension
agents or recruiting special enumerators for the duration of the project.

In general, extension agents are on the receiving end of every project
in the Ministry. These agents must actually execute all of these wonderful
projects and programs which are supposedly so wonderfully "integrated" and
"coordinated" (there is a direct negative correlation between the quality of a
project and the number of times the words "integration" and "coordination" appear in its basic documents.) In reality, extension agents are completely swamped with uncoordinated projects and unintegrated ministerial decrees, while they are underpaid, do not have access to adequate transportation, and are hopelessly frustrated because of the absence of any relation between their performance and advancement in their career. Many times, they must implement projects which they know are based on false premises and out of touch with the reality of the field. Their involvement with such projects usually has undermined their prestige in the villages because they promised the villagers a lot, but never delivered on their promises.

More often than not, extension agents have hardly any relevant contacts with their alleged supervisors and receive absolutely no support from the central level. The failure of many higher level civil servants to visit their agents in the rural areas is not only simply poor management. It also has a disastrous effect on the morale of the agents in the field. Not surprisingly then, some turn cynical, some turn to drinking, some become apathetic and some become angry. Some might have regretfully developed very strained relations with the farmers of villages they are working in.

If such is the situation, it might be unwise to rely on the participation of extension agents. Even if the situation is not so bad, an extension agent may simply not have time to devote to the survey. Even a relatively simple survey is usually in practice a full time job. Thus, if possible, hire specialized agents to enumerate your survey.
The organization of the personnel involved in our survey was as follows:

1. Technical Committee

To design and plan the operation we invoked the aid of a Technical Committee comprised of various representatives from different government departments involved in the project. ("Technical" is the correct term, since it does not imply any bureaucratic hierarchy.)

2. Central Executing Team

This team's job was to manage the project in all its details on a daily basis. The team was located in the regional capital. NEVER let your project be managed from somewhere outside the region in which you are doing your survey. Apart from having vital expertise on technical issues, the team must have full budgetary authority within the limits of the adopted budget. Nothing is more frustrating than having to justify every dollar to a person at the Embassy who hasn't the faintest idea what he is talking about, but who is nevertheless determined to be "coordinating" everything.

3. Sub-Regional Supervisors

Because of the logistical problems during the rainy season, we divided the survey region into three zones, each of which had a supervisor. Agents could easily reach these supervisors in half a day even during the rainy season. In addition to managing part of the budget, these supervisors double-checked the work of the controllers and the enumerators.
4. Field Supervisors

We assigned field supervisors to each of the 14 sub-sectors. Field supervisors perform many checks on all the filled out questionnaires. They are crucial to the entire operation and make the difference between "reliable" and "questionable" data. They operated the programmable calculators which could detect area measurement errors. They should be hired on the basis of competence, enthusiasm and willingness to travel on a motor-bike.

5. Enumerators

The enumerators go to each of the two assigned villages at the appropriate intervals and fill out the survey questionnaire. They are stationed either in one of the villages or as close to the villages as possible.

We recruited 75 enumerators who were hired on the basis of performance on a test which was announced nation wide. Two or more enumerators should be kept on reserve constantly, i.e. paid but with no responsibility for a specific village, while a few more enumerators should be kept "on call."

Due to the chronic unemployment of young, well-educated people in Burkina Faso, many enumerators proved to be of outstanding quality and motivation. Some of them were later rehired for other surveys.

3.3 Recruitment and Training

The process of recruiting enumerators can be a lengthy one especially for a survey as large as ours. You will likely be unable to find as many as 100 agents locally, so to avoid any suspicion of favoritism, you will have to
recruit through a national open exam. Leave this to experienced people, since
the formalities of the test must be handled with the utmost discretion.
Remember: your project is offering a year of employment in an area
experiencing a very high unemployment rate.

After the recruiting of our enumerators, we held a week long training
session for them which covered the entire survey operation. We stressed the
questionnaires used in the first and second rounds. Finally, we organized a
refresher session directly before the last round, i.e. the harvest.

The golden rule of our survey methodology must have been "if you cannot
explain the logic of your sampling to a high school student, forget it." Many
enumerators will probably have only two years of high school education and if
they do not understand why they are doing what they are doing, you're in
trouble.

3.4 Public Relations

Everybody involved must be "formally informed" and kept informed of the
survey activities, including people within the Administrative hierarchy and
political bodies, all the relevant technical ministries, and so on. Burkinabé
culture attaches extreme importance to formally correct and respectful
behavior. This is often at odds with the Western "bottom line" and result-
orientation behavior. If you are an expatriate and you do not understand the
hierarchy and the formalities involved in dealing with government bodies and
you have a "let's-get-down-to-business," "cut-the-baloney" and "I-don't-care-
who-does-it-as-long-as-it-gets-done" attitude, you might want an experienced
colleague to take care of your PR. In addition, you should probably seriously
consider whether you should stay in this line of work at all! A mechanical
approach in this setting means you have an attitude problem which will likely lead to failure and frustration for you and your colleagues.

3.5 Implementation of the Sample Frame

There were two lists of villages available for our region. One was a list from the Ministry of Agriculture, the other was the list which the Administration used. They were different and it took about a month and several field trips to get a consistent list. This time lag reflected numerous problems, including: some villages were so small that the sample number exceeded their size, so they needed to be regrouped with other villages; some villages had disappeared through migration; some villages were new; some "quarters" had been defined as a village or vice versa. Such issues can be politically explosive, so watch out.

The entire region was comprised of 14 sous-secteurs. Our target population lived in 624 villages, of which we sampled 20%, i.e. 124 villages and 6 towns.

Given the average enumerator’s capacity for work, we estimated that each enumerator could cover two villages each comprising 8 households. For the towns, we chose 16 households per enumerator, except for the region's capital, where we chose 48 households for two enumerators.

For a sample technique we used systematic sampling with probability proportional to population size of the village such that the bigger the village, the higher the probability for the village to be included in the sample. First, we ranked all villages in a given sub-sector according to their population size.
We wanted to cover 20% of all villages in each sub-sector. Since there were 23 villages in the particular sub-sector of Table 1, this resulted in a sample size of 5 villages. The systematic approach we used to choose the villages to survey was as follows. First we divided the total sample population by our sample size. In this case: 36,660/5 = 7,332. This ratio is called "sampling interval". Second, using a table of random numbers, we drew a number less than or equal to 7,332, which was 5,186. Looking at the cumulative total column, the corresponding first village selected was Dakoré. We then added 7,332 to 5,186 to obtain 12,518. The second village was Ipala Silmimossé. This process was repeated until we had selected 5 villages.
We wanted each enumerator to cover two villages. To match the enumerators with villages, we grouped the villages in pairs, the choice of the pairs being based on their proximity to each other on maps of the region. We should not have done this. Not only were the maps faulty, but a distance measured "as the crow flies" is not always a very relevant measure. During the rainy season, two neighboring villages can be completely cut off from one another. Lengthy detours will be required to travel from one to the other.

Once you have selected the villages and assigned each enumerator to his or her villages, you will have to inform the villages about the survey and politely ask their participation. The first fear you probably must neutralize is the fear of taxation. Other fears are related to the fashionable and usually ill-advised "agrarian reforms." Even towards the end of our survey, hostility related to these issues kept resurfacing. Thus, take your time in explaining exactly why you want the cooperation of the village. Assure everybody that the sources of the data will remain strictly anonymous.

The village chief and village elders can supply you with a list of compounds. However, certain compounds might be "marginal" to the village, e.g. settlements of pastoralists or dwelt in by "strangers." Make sure that these are not overlooked. It is useful to make a map and to number every compound.

Now the enumerator should start visiting all compounds in order to obtain general data for every household. To facilitate the work of the controllers place a sign with its number on it in every compound or paint the number on the wall.

For each compound, establish the number of households and the number of people in each household. Again, this might look simple at first glance but there may be a category of individuals who live and work in the household, but
are not considered "family." You should make it clear that you do want these non-family members included. Also, some households may be one-person households (e.g. headed by widows or divorced women), and there is a real danger that these might be "forgotten." Thus, if you talk to compound heads only, you will most certainly have a low estimate of the average number of households in a compound, a low estimate of compound population, a high estimate of household size, and an equally faulty estimate of the total number of plots.

3.6 Sampling the Households

Now that you know the number of households in a village, you can choose which ones you will actually survey. We decided to choose 8 households from each village. All households in a sample village were put on a list which specified their size (number of persons resident.) Each household was assigned a unique identification number.

We stratified the households on size. The three strata we chose were: 1-5 persons, 6-10 persons and 11 over. For logistical reasons we set the number of households to be surveyed in each village at 8. The number of households to be drawn in each stratum thus equalled:

\[
\text{#households in specific stratum} / \text{#all households} \times 8
\]

A random number table was then used to select households in each stratum.
3.7 Plot Inventory

The next step is to make an inventory of information on all plots of the selected households: the crops grown on them, the basic soil type, and who is in charge. Be careful with the local concept of a geographic area. A "field" might in fact consist of several plots, each planted with a different crop.

The inventory of plots never stops. Even after harvest time the enumerator may have to add new, forgotten, plots to it. Furthermore, farmers react in a flexible way to the rainfall pattern as it unfolds over the season: be aware of farm plan changes at all times.

3.8 Measuring Plot Area

The enumerator should erect a sign on each plot and on it list the village name, the household identification number, the number of the plot and the particular crop or crop mix grown on it.

Since the plots are polygonal in size, the enumerator has to measure the length and angle of each side. A programmable calculator can be used by the direct supervisor with which to calculate the area and the error of closure, if any. If the error exceeds, say, 5%, the plot has to be measured again.

With each subsequent plot visit, the enumerator and the supervisor should check all plot information. Moreover, since "rapport" builds up over time, the enumerator should recheck all data whenever possible.

3.9 Positioning of Harvest Squares

Since we choose not to weigh the total harvest of each plot, we selected two sample squares (10x10 meters for cereals, 5x5 for the others) within each
plot. Additionally, 10% of the plots were selected to record data on plant density (number of plants per square meter).

The details of selecting the squares can be found in the standard FAO manuals and in the report of the survey on which this paper is based (see References).

3.10 Weighing the Harvested Produce

To establish a ratio between gross and net weight of the produce we tried the following method. After the harvesting of a square, the enumerator took an armful of fresh cobs and weighed it. He asked the farmer to set it aside for drying. Anywhere from 10 to 20 days later, the farmer threshed the sample, and the enumerator weighed it again. The ratio of fresh cob to dried grains then provided our gross to net ratio of the weight of the entire harvest of the square in question.

This method proved to be especially problematic in the case of corn. Corn is a crop which matures earlier (one to two months) than the other cereals. As such it fulfills an important dietary function. Children, hungry for a snack, might go into a square and harvest a bit themselves, covering up by pulling out the whole plant.

In retrospect, the harvest weighing phase proved to be the most difficult phase of the fieldwork. We recorded missing 9% of the data. It seems obvious the method needs improvement.
3.11 Processing the Data

To process all the data and to write up a simple summary with only the most basic descriptive statistics may still take a long time. Do not underestimate this. Many surveys do not make it through this phase and it took our project two years to finish the initial report. If we add the total fieldwork time to the first test year of the methodology it seems that time doing fieldwork and time analyzing data are about equal.
4. BUDGET

4.1 Incentives and Indemnities

Work incentives are one of the most crucial elements in the success of a project like ours. Many of the bureaucracies within Burkina Faso are completely stifled by the absence of a good system of performance incentives. At times the prevailing system is so inefficient that it even punishes the individual who tries to make a legitimate effort.

Let me first explain your situation if you are an average Burkinabe government field agent, whether an extension agent or an enumerator:

The promotion system -- inherited from the French -- is such that your career in the organization is completely determined by your entrance credentials. Only by obtaining more diplomas and degrees can you better your position, and you are not likely to meet with such possibilities (i.e. scholarships, or internships) once you are in a remote village far away from the capital. Whether you work or not, your career is already determined, and the only way to increase your salary is by staying out of trouble and growing old. Much of the inertia within the bureaucracy is directly related to this phenomenon, which at the same time pushes people to look for "other ways" to advance their position, i.e. by some form of influence peddling.

On the other side, your employer (i.e. the government) is virtually bound by the labor laws brought about by the lobbying of the influential unions. These laws have been copied from French labor laws and with some amendments have made it completely impossible to fire anyone for anything less than repeated criminal
behavior. The post-independence governments were so afraid to be identified with the old authoritarian colonial system that they abandoned -- de jure or de facto -- many of the disciplinary mechanisms of the colonial system. Since your direct supervisor is also a government employee working within the same system, he will likely think twice before taking any disciplinary measures.

There is not much that can be done about this. It is a problem bigger than your project. But many projects have found loopholes. Since nearly all development projects are operated using "outside funding," they devise incentive schemes which operate parallel to the official bureaucracy through which the projects are supposed to operate. Financial rewards are usually called "indemnities" and are not considered part of the agent's official salary. Instead, they are compensations for "actual" costs incurred by the agent during his work. Thus, you have "housing indemnities," "gas indemnities," "travel indemnities," "food and lodging indemnities," "responsibility indemnities," "indemnities for handling money," "training indemnities" (wear-and-tear of one's brains), "hardship indemnities," "encouragement indemnities," etc., etc.

The fact that different projects offer widely varying indemnities, has usually created tremendous differences in take-home salary between agents. Some will have doubled their base salary simply because they had the luck of being stationed in the concentration area of a certain project or projects. This situation creates a lot of jealousy and can foster general feelings of injustice within the organization, especially since most agents do nearly the
same work anyway, whether or not they are funded by a Dutch, Danish, American, UNICEF, ILO or non-government project.

An added complexity is that many of these projects have bookkeeping which may be managed by officers independently of the regular financial structure of the ministry in question "so as to avoid all the red tape". Expenses may then not be centrally cleared. You might thus be unable to find out who receives what within your organization. You will have to talk to those involved with the projects in question to find how their system works -- and if it works.

Indemnities can provide powerful incentives if they are indeed directly contingent on actual work performance. Unfortunately, most have no direct relation with performance and in practice agents collect them whether or not they have done the job. Thus, they become "sursalaires" and are stripped of their purpose.

It is not difficult to design indemnities which are directly related to performance. In the case of enumerators, you will want to establish a positive relationship between the collection of reliable data and monetary reward. Thus, you can give "encouragement premiums" for every plot correctly measured by the enumerators. You can apply this system at every phase of the survey. Note that you do not want to remunerate any activity, but an activity correctly carried out. By also remunerating the field supervisors on a piece rate, you can create a lot of feedback in the system. Of course, if non-compliance exists at the top of the system (who monitors the monitor?), it will break down, but let's assume that you and your colleagues who are running the show are motivated by "a job well done" and need no evaluation.
I will not describe the myriad of possibilities for linkage of work and pay within an indemnity system. If the basic principle is adopted, the next steps will usually be obvious. The following is an example with respect to travel allowances.

4.2 Transportation

The budget's largest item will probably fall under the "transportation" category. As such it deserves special attention.

The enumerators especially need reliable motorbikes to be able to perform their duties under adverse road conditions that may be common during the rainy season. Such machines cost a lot of money.

The following options exist with respect to matching agents with motorbikes:

1. The project buys all the motorbikes and lends them to the agents. They remain project property and are serviced by the project.

2. The agent buys the motor. To do so, he obtains a credit from the project with the motorbike as collateral.

The first option is advantageous because you can buy a quality product. But if agents are based in the village, proper maintenance is bound to suffer. The agent will have to pay repairs and maintenance out of his travel allowance. However, since the motor will never become his or her property, there is little incentive for him or her to spend this money on repairs, especially if travel allowances are fixed. If a motorbike breaks down, management might accuse the agent of not having properly maintained the motor, but this will be difficult to prove. Moreover, the agent can easily claim that the travel
allowance was insufficient for the necessary repairs or that the type of motor was not right for the job. I think I spent almost half of my first year at work bickering over such problems.

The second option makes the agent the prospective owner and solves the problem of proper maintenance. However, if travel allowances and other work incentives are not directly related to actual travel, there is a risk that the agent might try to "spare" his motor. (Another reason to create performance related indemnities.) Finally, the amount of credit a temporary agent can absorb might be limited, and the preferred motorbike might be more costly than the agent can afford. In that case, the project might want to subsidize part of the purchase price.

We obtained very good results with the second option coupled with an indemnity system based on actual mileage. For every mile travelled the enumerator could claim:

1. gas;
2. repairs (50% of purchase price of motorbike over economic life expressed in kilometers);
3. depreciation (also calculated per kilometer);

An example might clarify the system. Imagine the agent wants to buy an $800 motor-bike. A good estimation of its economic life might be 40,000 kilometers. Gas costs $1.20 a liter, while the bike uses 1 liter for 30 km travelled; amounting to a per kilometer gas cost of 4 cents. Repairs will cost an average $400/40,000 km- 1 cent/km. Depreciation will amount to 2 cents. With every kilometer travelled, the agent can claim 7 cents. In our case, an average workload per month might be 500 km, amounting to an average of $35. Of course, everything depends on the actual distances the agent had to travel.
The agents themselves participated in the design of this system and the estimation of its parameters. It had been used in the region by a non-government organization which was satisfied with its performance. The final proposal was voted on by the agents themselves. They felt it was an equitable and fair system. Since that historic day I never again received a single complaint about travel allowances and the project saved a significant amount of money while work performance increased dramatically.
5. CONCLUSIONS

We have described how the particular methodology of a large scale survey was established and how its execution was organized. Many of the issues in this paper are "non-statistical" and therefore escape treatment in statistical textbooks. The purpose of this paper was to fill this void and to give students a first-hand account of an actual survey project.

A recurring theme in this essay involves the continuous feedback regarding what you want to measure (i.e. objectives), what you operationalize as the thing to measure, and what your enumerator returns with, i.e. what you actually measured. To keep these variables as close together as possible there is no substitute to leaving your office and finding out for yourself what’s going on. No amount of theory or experience from other surveys can make up for ignorance about the exact situation your enumerator is facing. This is why you can never do without a thorough test of your methodology before you implement the full sample.

The budget is probably one of the project’s most important documents, yet it is often presented as a mere annex to a report or a final and secondary point at a meeting. This "final point", however, may take excessive time to work out.

Related to budget issues are the project’s human factor such as the relation between nationals and expatriates and the problems of lower-echelon civil servants. The recurring principles in dealing with these problems are respect and understanding. Forget about "the bottom line," it will likely get you nowhere.

A most important management tool involves the structure of incentives with respect to the implementation of the project. Incentives should be as
closely linked to performance as possible. Establishing such a system may take some long discussions and might be a threat to certain vested interests in the bureaucracy, but your field staff will ultimately wholeheartedly support any measure which guarantees them fair and objective remuneration for hard work.
MAPS

1. Burkina Faso
2. Survey Region