Systems of Production and Production of Knowledge: Reflections on the Basis of Ivorian and Mexican Experiences

Jean-Philippe Colin

ABSTRACT
This paper discusses the links—so important in farming systems analysis—between the type of data collection techniques used and the type of knowledge produced, in terms of causal explanation. The major point argued in the paper is that if one aims to understand and explain farmers' socioeconomic and technical practices, rapid information collection with low personal involvement of the researcher may not be the best suited methodology. This point is illustrated through two research experiences: an in-depth study of a village economy in Lower Ivory Coast, and a study based on a classic questionnaire survey in various Mexican villages.

INTRODUCTION

The concept of production system, whatever its meaning, is an intellectual construction intended to facilitate the perception and the interpretation of the real world. This perception and interpretation requires the “operationalization” of the concept, the implementation of a whole set of information collection techniques, to provide an empirical content. A fundamental point, then, is to recognize that strong bonds link the type of data collection technique used and the kind of knowledge produced.

This article provides an illustration of this point through considering the methodology of two research experiences: the first in the Ivory Coast between 1983 and 1985 (Colin, 1990), the second in Mexico in 1990-91 (Colin, 1992). These research programs were both based on the economic analysis of agricultural production system (APS); however, they used very different data collection techniques. The first was an in-depth study of a village economy in Lower Ivory Coast; the second was a study based on a classic questionnaire survey in various Mexican villages.

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1. Research on "farming systems" or "production systems" (in a generic sense) is usually likened to "Farming Systems Research" (FSR); however, it is important not to confuse them (Crawford, 1981). The main differences between FSR and Agricultural Production Systems Research (APSR) are the following:

- FSR involves an interdisciplinary approach, whereas APSR is explicitly an economic research program.
- FSR is explicitly problem-solving research; its objective is the generation and dissemination of relevant technologies through on-farm research (even if, according to Tripp et al. (1990), the principal contribution of FSR has more to do with methodological improvement than technology development. APSR does not have this aim. I would have called it subject matter research (SMR), but according to Johnson's definition (1986), SMR must be multidisciplinary, and this is not the case. We sometimes make the distinction, in France, between cognitive research (recherche cognitive), aimed at understanding a given subject without any explicit orientation toward action to change the situation under study, and problem-solving research (recherche-action); APSR as presented here would be labeled as cognitive research.
- The scope of FSR is limited—in practice more than discourse, showing what Baker (1991) describes, from an economic viewpoint, as an over-investment in technology production, with little interest in improved institutional performance, or in feedback relating to the effects of policies and development programs on producers. As defined, the scope of APSR is broader as far as socioeconomic issues, and much more limited regarding technological issues.
- FSR stresses quick data collection, such as rapid rural appraisal, whereas APSR, even if better implemented with more data collection, does not set up any prescription regarding fieldwork techniques.

These differences do not preclude similarities such as a same-system orientation (which does not mean a real "system science" perspective), on-farm research, the recognition of farmers' goals and the relationships between human and technical factors, and the recognition of local specificity and heterogeneity.

2. The APS includes explicitly, as a principle point of analysis, the social organization of production—i.e., the way in which production units function: internal decision structure (who decides what?), conditions of access to productive resources (land tenure system, labor relationships, etc.), and relationships between the farm and its economic environment (parastatals, cooperatives, markets, etc.).

- The economic approach followed here is close to the American "Old Institutionalist" stream (Colin and Losch, 1992). Research is not restricted to the analysis of resource allocation but rather considers the social conditions of access to resources. The economic calculation in terms of production costs and factor productivity is set within the institutional context that gives it its meaning. The economic calculation is not in itself the purpose of the research but serves as an explanatory element of peasant practices and economic dynamics, in addition to other factors. The analysis must include a diachronic and spatial dimension, necessary for shedding light on the present conditions of access to resources and, more generally, the ambient economic system. The processes of economic differentiation are stressed; rural society is considered neither stable nor homogeneous. This heterogeneity proves to be a determining factor for the understanding of the diversity of peasant practices, even at local or regional levels. Starting with empirical questions, the research has to provide a framework for the understanding of a specific, localized reality. This viewpoint tends to extend the connection with established theoretical bodies and with a "hard" disciplinary approach.

In the first part of the paper, I sketch a link between fieldwork and explanations. In the second part, I illustrate this point through the presentation of two research experiences. In the Ivory Coast, it was possible to give causal explanations of the dynamics of the agricultural production systems. In Mexico, the APS were roughly described and some typologies and correlations produced, but what I would consider satisfactory explanatory models were not reached. The focus is on the objective of each program and the fieldwork techniques used. For further information regarding the differences in the types of knowledge produced, see Colin, 1992.

**PRODUCTION OF KNOWLEDGE AND DATA COLLECTION SYSTEM**

**Regarding Explanation**

The deductive-nomological model of explanation proposed by Hempel and Oppenheim (1948) is generally considered as the model of scientific explanation. It defines a valid explanation as composed of two parts, an explanandum (description of the event to be explained) and an explanans (including a list of antecedent conditions and general laws), the former being a logical conse-
Fieldwork and Explanation

It is my view that the main aim of APSR is not to put forward a general theory or to embellish an existing theoretical edifice, but rather to provide explicative models that are valid locally—that is, partial (as opposed to general) theories.

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rural appraisal? Defining the purpose of information collection is essential to answering this question. I feel strongly that if one aims to understand and explain farmers' socioeconomic and technical practices, rapid information collection with a low researcher involvement may not be the best methodology.

An implicit assumption of FSR methodology is that it is possible to define the problems and discover their causes through rapid data collection. This may sometimes be the case, but is surely not always true—especially regarding socioeconomic issues. In FSR, as Baker remarked (1991:46), data quality is often pragmatically sacrificed in favour of quickly obtaining results. Unfortunately, in many cases, “time- and cost-efficient” methods were not actually so efficient since inadequate understanding was generated on the important factors influencing farmer behaviour and farming systems performance.

The risks of misunderstanding farmers' socioeconomic and technical practices and environment are real. Let me give just four illustrations.

- Motivational explanation may encourage an easy construction of ex-post facto accounts. The lower the researcher's personal first-hand knowledge of the local society, the higher the risk.
- As emphasized by Malinovski in anthropology (quoted by Salamon, 1979), or more recently by Milleville (1987) in agronomy, what people say about what they do has to be distinguished from what they actually do. In order to distinguish between the norm and the practice, it is questionable whether rapid information collection is the most appropriate field technique.
- In some contexts, the definition of socioeconomic categories such as production, consumption, residence, and accumulation groups (Gastellu, 1980) may need some time.
- If the analysis is too superficial, the theoretical and practical risk of causal explanation is to over-reduce the conditions (causes) of what has to be explained. Using the deductive-nomological model form, “if L, L2, ..., Ln, and if C, C2, ..., Cm, then E”⁶ the risk is to put forward “if C, then E” where it would have been necessary to write “if C₁, C₂, ..., Cₘ, and especially C₁, then E” (Mingat et al., 1985). One way to limit this risk is to develop models of explanation that are as complete as possible—that is to say, to have the best possible understanding of the situation under study.

This brings up to the key question of how far one has to go in empirical observation to avoid these pitfalls. Or, to put it differently, how can we know that we have reached a satisfactory explanation? It is always possible to build a coherent explanatory model, whatever our knowledge of the situation—even if it remains very superficial. But it is also possible to progress toward more satisfactory (complete) explanations—under the stimulus of better empirical knowledge, and under the pressure of external criticism. Unfortunately, in our

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6 With L for law, C for conditions (explanans), and E for what has to be explained (explanandum).

FROM INTENSIVE TO EXTENSIVE INFORMATION COLLECTION METHODS

The Place of APS Analysis in the Research Programs

In the Ivory Coast, research was concerned with the dynamics of a smallholder plantation economy. This economy can be characterized by land abundance, labor scarcity, and extensive coffee and cocoa production. Two dominant factors of change act upon this model: an increasing land shortage and, mainly in the Lower Coast, diversification of farming systems led by agroindustrial parastatals that are developing smallholder contractual farming. Understanding the evolution of the peasant plantation economy in this new and relatively specific context was the purpose of the study. Two fundamentally related topics were addressed by the research: (1) the sources and features of technical and institutional changes, and their incidence on the plantation economy; and (2) the production strategies adopted by farmers, according to their different opportunities, resource availabilities, and objectives. The research required a holistic, empirical analysis encompassing cropping systems (food and cash crop relations, place of new crops), input combinations (toward intensification), and the social organization of production (evolution of the land tenure system, evolution of labor relationships, analysis of peasants-parastatals relations).

In Mexico, the analysis of the agricultural production systems was only the first stage of an economic program that was itself part of a multidisciplinary study of the production and commercialization of potatoes in the central area of the country. This diagnostic (not problem solving) study was initiated at the
request of the Veracruz State authorities, who were facing an agricultural crisis in the Sierra (Cofre de Perote region). The crisis was linked to agroecological and economic problems facing potato production—a near monoculture in this region. An agronomic program was concerned with the study of potato yield and producers' technical practices. The economic program, implemented by four researchers, had various components beyond the conception of the APS research: the study of sharecropping systems, the labor market, and the potato subsector. The author of this paper had responsibility for the APS analysis and for the study of sharecropping. The purpose of the APS study was to draw a general picture of the socioeconomics of potato production in the area delimited by the Pico de Orizaba (Puebla State) and the Cofre de Perote (Veracruz State). This was done to provide an overview for the other components of the research program, and to prepare the analysis of the sharecropping system.

The features of potato production (a cash crop with great price variations and high production costs), the economic context (breaking-down of the prices since 1989, bank credit rationing), and the socio-economic production (differentiated production structures) led to the following questions: Is there an economic efficiency difference between small- and large-scale farmers, and what are farmers' reactions?

The two APS studies differed in the following ways:

- In the Ivory Coast, the economic APS study was the objective of the research, conducted by only one economist. In Mexico, the purpose was to draw a panorama, a context in which to situate other economic or agronomic studies; in other words, the research served as a simple component of broader multidisciplinary research.

- In the Ivory Coast, the approach was open to all the diversity of agricultural production systems at a local level. In Mexico, it was restricted, focusing on a specific crop. Because potato production was almost the only enterprise on the farms, the “system” perspective came mainly from the analysis of farm and off-farm activities.

Thus the researcher's direct participation in data gathering, the length of the data collection stage, the complexity of the information collection system, and the quality of the data were intensive in Ivory Coast and extensive in Mexico.  

From the Researcher-Observator to the Researcher-Supervisor

In the three-year research project in the Ivory Coast, the researcher was a constant presence in the field and participated directly in the information collection, with the help of one permanent high-school level enumerator, and temporarily with a team of topographers. In Mexico, the information collection stage for the APS study was limited to five months, and largely delegated to enumerators (four agronomists and two graduates in history and geography). In the Ivory Coast, the researcher used data collection techniques close to the fieldwork tradition of anthropologists—but common in the practice of French Africanist rural economics (see Colin and Losch, 1992). In Mexico, he took care of research design, logistics, and data analysis, but had little direct involvement in data gathering.

From a Simple Village Study to a Multi-Localized Survey

An essential difference between the two programs came from the choice of a single-site study in the Ivory Coast (mainly a single village) and multilocalized sites in Mexico.

In the Ivory Coast, the research was an in-depth analysis of the economy of agricultural production at the level of a Lower Coast village (Djimini-Koffikro, in Adiéak sous-préfecture). Study of a simple village afforded various advantages. The village is often an optimal level at which to observe the relationships between production units, and the diversity of producers' constraints, strategies, and practices. Here it was considered a life-size laboratory in which to observe changes in the plantation economy. Another advantage was that the checks permitted by the researcher's immersion in everyday village life greatly improved the quality of data.

In Mexico, the APS analysis had to be carried out quickly and it had to ensure a regional perspective. For these reasons, the study was conceived as a classical questionnaire survey, with the collection of information on a sample of production units in various villages.

The Question of Representativeness

In neither case were sample sites chosen at random. This choice merits some discussion.

The major criticism of approach chosen in the Ivory Coast is the lack of representativeness of a village study, and consequently the impossibility of inferring rigorously from the conclusions. But first, let us recall that orthodox statistical approaches may and often do hide, by the “scientificity” of the figures, the fundamental problem of the quality of field data on which analysis is based. Furthermore, there is a significant risk of reductionism, as these
approaches presuppose the collection of information on the basis of a conceptual framework that may not reflect the complexity of the real world. However, the lack of representativeness criticism is well-founded if the study pretends to build a general model of refined applicability. Such was not the case in the Ivory Coast research experience. The village was conducted and was not intended to be representative of the villages in the area. Djimini-Koffikro was deliberately chosen for its specific characteristics of land shortage, and its wide range of cropping opportunities related to the simultaneous intervention of several parastatals. These features, especially the presence of cropping opportunities, were expected to give rise to a range of production strategies and behavioral patterns. Our objective was to build models of behavior of production units taken from a life-size laboratory, which under the same economic and institutional context faced different constraints in land, labor, etc.

Data was gathered for some variables in all the farms of the village, or in the farms for which the variable under study had meaning, and for other variables the information was collected through purposive sampling (informal quota method). Complementary surveys were carried out in four other villages, all farmers being interviewed, to test whether the behavioral models identified in Djimini-Koffikro could adequately explain the strategies adopted by farmers operating under different circumstances. These villages were chosen from the same region to be as different as possible from Djimini-Koffikro, on the basis of two variables, easily discernible in a pre-survey: the type of tree crops planted, and ethnic composition of the village.

In the Mexican case, the village was chosen as the first sampling unit, on the hypothesis of the existence of a village specificity regarding potato production and marketing conditions—the existence of this village-effect was, in fact, proven by the investigation. After a pre-survey (visit to all villages, and collection of data regarding the number of potato growers and potato cropping cycles), the villages were chosen on the basis of their location (distribution along the Sierra, and between Sierra and Altiplano) and the number of producers, in order to include systematically the most important centers of the potato production zone.

Contrary to the initial plan, the farms to be surveyed in each village were not chosen from probability sampling; first, because of the lack of sampling frame and the unfeasibility of constructing one for what was primarily an exploratory survey—some of the villages having around 500 production units; second, because of a serious reluctance of the producers to participate in surveys. This reluctance comes, on the one hand, from governmental taxation and mandates; to consious purposc. The informal quota method...
The basic DCS framework was provided by an initial agricultural and
demographic census, by the measurement and mapping of the plots of all the
village farms (as there was no previous cadastral survey), and a weekly 34-
farm sample survey over a one-year period. Furthermore, a set of specific topic
semistructured or structured surveys included a review of land transactions
since the end of the pioneer era for all land owned by farmers in the village, off-
farm activities, migration itineraries, labor requirements per hectare for each
crop, crop yield measurements, production strategies, labor availabilities,
aricultural product sales for all farms not sampled for the weekly survey,
technoeconomic analyses of local processing activities, etc. (see Colin, 1990).

Thus the information was collected at various levels, according to the
variables under study:

- **All 180 production units of the village.** Basic history of the farm; land
tenure; area of cultivated crops; agricultural product sales (excluding market
gardening); cash-crop yields (estimated on the basis of product sales, assuming
no or insignificant autoconsumption); quantitative analysis of permanent
labour force availabilities; qualitative analysis of temporary labor force
employed; and one year agricultural net income (excluding temporarily hired
labour cost and market gardening income).

- **34-farm sample** (weekly-visit survey). Quantitative analysis of labor use
and social division of labor; quantification of market gardening; off-farm
income; and budget data.

- **Ad hoc samples.** Food-crop yields; labor requirements per hectare,
processing activities, etc.

The frequency of information collection varied according to the variables:
single-visit surveys to grasp structural data; multiple-visit surveys to establish
flows of labor, products, and money. Multiple-visit surveys included the
weekly visit of the 34-farm sample, as ad hoc visit surveys; for example, the
collection of marketing information was organized for each of the 180 farms
on the basis of the anticipated harvesting time calendar, specific for each plot
for those crops (as cassava) that did not present a common cropping cycle
(planted and harvested all year long). Therefore, the combination of
methods used during the study of this village economy borrowed various types
of data collection techniques, from qualitative surveys to structured question-
naires, and from micro-approaches (in-depth study on a limited sample) to
macro-approaches (collection of rough quantitative or qualitative data on a
large number of production units).

In the four other villages to which the research was later extended, a single-
visit questionnaire—built on the basis of the knowledge produced by the former
baseline study—was administered to all farms in each village (128 production
units in total), without plot measurement or direct observations. Information
was collected on variables such as farm structure, historical processes (migra-
12To obtain reliable data on land availability and use, and to provide a solid baseline for future
studies of the evolution of this village economy.

13Because producers' estimates of acreage were not reliable, we planned
to measure the plots to improve the quality of the quantitative economic
analysis; however, it was possible to realize this time-consuming measurement
for all farms. A general questionnaire was also filled out for each village, during
interviews with key informants, to collect historical information regarding the
village, potato production and marketing, land access, etc.

A common weakness of both the Ivorian and Mexican programs has to be
stressed: over-investment during what was initially devised as only the first
stage of the research. In the Ivory Coast, extension of the research to other
villages was excessively subordinate, in comparison with the simple village
study, and should have received a more significant time investment. In Mexico,
what was planned initially as a rapid baseline survey turned into a rather heavy
study, requiring major fieldwork and data analysis that was probably not
justified by the quality of the data. Thus between these two remote poles of the
methodological continent, the equilibrium point is still to be found—assuming
it exists.

The Search for Data Quality: From Purism to Compromise

The differences in DCS led to differences in data quality between the two
research programs. In the Ivory Coast, the DCS monographic stage involved
a search for information as reliable and precise as possible. This search used a
set of measurements (acreage, yields), the duration and localized character of
the information collection (allowing acquaintance with farmers, progressive
rectification of errors in structural data, crosschecks of the information), the
multiple-visit system for flows-information collection, and the researcher’s
existing contextual knowledge.

In the Mexican experience, the objectives and conditions of the APS study
precluded such data quality. However, the intent of some elements of the DCS
was to limit the risk of collecting excessively questionable information: the
selection of highly qualified enumerators; the one-month stay of the enumer-
ators in each village, which offered the possibility of building up confidence
relationships with farmers and the progressive subjective evaluation of the
quality of data collected; and the fact that questionnaires were filled out only

18Using only 159 of the 245 questionnaires, after eliminating questionnaires of doubtful
reliability or, more frequently, presenting incomplete information.
with volunteers. The decision to measure one plot per farm to provide a sound basis for quantitative economic analysis is an example of excessive concern for data quality. Seen a posteriori, the decision was not justified for this study, the other data remaining of a relatively rough quality. However, even these attempts to reduce the risk of collecting low-quality information were not sufficient to overcome the limits on information collected through a single-visit questionnaire survey.

CONCLUSION

This account of the two research methodologies provides an opportunity to examine the kind of knowledge produced by each. Of course, the objective of the research can never be forgotten.

The method followed in the Mexican research program is probably well justified if the research aims at sketching the main structural characteristics of a given situation, or answering a few simple questions on the basis of an already available database. This kind of knowledge is no doubt useful, but will provide less an explanation of a situation than a set of correlations.14

If, however, the objective is to understand peasant decision-making and its institutional setting, to go beyond the what they are doing to reach the why they are doing it', to build explanatory models, then such a method is inadequate. It constitutes only a pre-survey—the first stage of research that has to be followed by a personal field-investment of the researcher (without spending necessarily three years). To take a concrete example, the first insights for the analysis of sharecropping systems in potato production, in the Mexican case, came from the APS analysis, but subsequently required specific fieldwork carried out directly by the researcher and a graduate student who lived for several months in two villages.

Ultimately, the problem does not lie in the choice of method, but in the purpose of its use, the bias—is it exceptional in the vast field of farming systems research—occurring when one pretends to complete the second type of objective using the first type of method.

REFERENCES


14 For example, it has been possible to answer the questions regarding economic efficiency differences between farmers, but the analysis could not offer a coherent and well documented explanation of these differences.

Evolving Crop-Livestock Farming Systems in the Humid Zone of West Africa: Potential and Research Needs

M.A. Jabbar

INTRODUCTION

Livestock is an integral part of the economies of most Sub-Saharan African countries. For the region as a whole, livestock constituted eight percent of total Gross Domestic Product (GDP) and 25 percent of agricultural GDP in 1988. If the values of intermediate products such as traction and manure were included, livestock’s share of agricultural GDP might be as high as 35 percent (ILCA, 1987; Winrock, 1992).

The incidence, functions, and relative importance of different types of livestock vary across countries and agroecological zones. The main focus of this paper is the humid zone consisting of rain forests and derived savannas located mainly in Central and West Africa. The purpose is to assess the status and potential of livestock development in the zone and determine research needs and priorities.

PREVALENCE OF LIVESTOCK IN THE HUMID ZONE

The incidence of tsetse flies and trypanosomiasis has been the single most important determinant of the distribution of livestock across ecological zones. The humid zone has generally been considered unsuitable for livestock production due to high tsetse-fly infestation (Stenning, 1959). However, transhumant pastoralists from the semi-arid and sub-humid zones visit the derived savannas during the dry season, when the tsetse challenge is reduced, in search of feed and water. In fact, transhumant pastoralism made cattle production viable in the given ecological stratification in West Africa.

Where the tsetse challenge allowed and/or where an acceptable degree of tolerance developed in the livestock, there has been a tendency among pastoralists to remain in the more humid areas. Over a long period, this process has led to a degree of adaptation, facilitating permanent exposure of livestock to light tsetse challenge (Ford, 1971; Fricke, 1979). There are also breeds of cattle, goats, and sheep that have developed trypanotolerance through long

2 International Livestock Centre for Africa, Humid Zone Programme, PMB 5320, Ibadan, Nigeria.
Erratum

Page 31, footnote 1, read "Colegio de Postgraduados en Ciencias Agrícolas (Texcoco, Mexico)."

Page 33, 3rd paragraph, last sentence, read "Because of space constraints, I will not present as such these differences in the type of knowledge produced (see Colin 1990 and 1992), but will concentrate rather on the objectives of each program and on the fieldwork techniques used" instead of "The focus here ... see Colin, 1992)."

Page 38, footnote 7, read "Ejidatarios hold a use right on land, in the framework of a land tenure system inherited from the Revolution; pequeños propietarios hold a private property right on land".

Page 44, at the end of the second paragraph of the introduction, add "To give an illustration, it has been possible to answer the questions regarding economic efficiency differences between farmers, but the analysis could not offer a coherent and well documented explanation of these differences".
1. Concept of the Average Farmer and Putting the Farmer First
   James Beebe

17. An Evaluation of Soybean Planting Methods for Small-Scale
    Farmers in Central Province, Zambia
    M. Beuwel, F.J. Olen, P.T. Gibson, and K.S. Chanda

31. Systems of Production and Production of Knowledge
    Jean-Philippe Celfin

47. Evolving Crop-Livestock Farming Systems in the Humid
    Zone of West Africa
    M.A. Jabbay

61. Growth, Forage Content, and Biomass Yield Response
    to On-Farm Fodder Tree Species Trials in Nepal
    Madhan B. Karki and Michael A. Gold

75. Survival and Sustainability in the Midwestern Hills of Nepal
    Ashok K. Vaidya and David Gibson

93. Circumstances of Rapid Spread of Improved Cassava
    Varieties in Nigeria
    Felix E. Nwoko, S.K. Hahn, and B.O. Ugwu

121. Gender Differences in Livestock Production Management
    in the Chitwan District of Nepal
    Pradeep Tulachand and Adin Basnet

137. Institutional Linkages and On-Farm Research in Zimbabwe
    Enay M. Shumba

147. Farm-Level Evaluation of Adoption and Retention
    of Maize Variety in Central Province, Cameroon
    Menwoyellet Maurice and Angustin Fougougue