THE ROLE OF THE TYPOLOGY OF AGRICULTURAL PRODUCTION SYSTEMS IN FARMING SYSTEMS RESEARCH AND EXTENSION

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ABSTRACT

Very often, farm diversity has been considered as an obstacle to the dissemination of technical innovations which were proposed, like recipes, to all farmers in the area at the same time in a non-discriminant way. It is still a common statement to hear that only a limited number of usually better-off producers follow the recommendations. More frequently, the proposed explanations are either the low level of farmers' technical knowledge or the inefficiency of the extension service. Meanwhile, more and more, the appropriateness of the proposed "technical packages" is questioned.

At the same time, the processes of regional specialization and socio-economic differentiation are making the farm diversity even more obvious every day. But it is now recognized that a single objective scientific classification cannot suit every purpose. In Farming Systems Research/Extension, we are most interested in the identification of the main limiting factors for each type of Agricultural Production System (APS)[3], in order to propose adapted research or extension activities to remove them and, later, to be able to evaluate the efficiency of such development programmes.

As the practical value of a technical diagnosis depends on the precise context of the whole APS, it is necessary to take into consideration its global internal coherence. This can be achieved by studying farmers'technical decisions and choices through the confrontation between his objectives and the set of bio-physical as well as socio-economic constraints that he is facing. In other words, we try to understand the functioning of the APS, i.e. the logical sequence of strategic and tactical decisions made by the farmer to realize one or several objectives (family food consumption, family income, living standard, farm continuity).

In a given area, APS having similar objectives, strategies and limiting factors are grouped into a single type. Key indicators for each type of APS are then selected in order to be able to assign rapidly any particular APS to one class of the typology with a good probability. The size of each group of farmers is assessed as well as the relative importance of their specific problems at the regional level.

In an another step, the study of the possible sequence of changes for each main type of APS is carried out. Sub-types are identified and distributed along a trajectory of evolution of a given type of APS. The usefulness of such typology of trajectories of evolution of the APS for monitoring the regional agricultural situation is demonstrated by an example from southern Thailand. The role of this classification of APS in the preparation and evaluation of adapted agricultural development programmes is shown. And the use of the functional typology of APS as a rational basis for the elaboration of appropriate agricultural technical references is underlined.

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3/ *APS = the whole structured set of plants, animals and other productions or activities selected by a farmer for his production unit to realize his objectives.*

INTRODUCTION

For many years, the diversity of Agricultural Production Systems (APS) has been considered as an obstacle to the dissemination of technical innovations which were proposed like recipes to all farmers in the area at the same time, in a non-discriminant way. It is still a common statement to hear that only a limited number of usually better-off producers are following the recommendations. More frequently, the proposed explanations are either the low level of farmers' technical knowledge or the inefficiency of the extension service. Meanwhile, more and more, the appropriateness of the proposed "technical packages" is questioned. Looking especially at the consequences of the so-called "greenrevolution" during the 70's, the failure to produce improved techniques that could be adopted by farmers on a significant scale is obvious in a great number of countries and regions. In these areas, the misappreciation of agrarian realities led to a very unequal distribution of the benefits from agricultural research and contributed to an increase in the geographical and socio-economic differentiation between farmers.

This is why APS diversity is more obvious every day as the process of "modernization" of agriculture is taking place in the context of relatively unified national and world markets. From very unequal situations, regions, differing by their bio-physical and socio-economic characteristics, are competing with each other according to their comparative advantages and... disadvantages. Differences in levels of productivity, income and capacity of investment among farmers are leading to cumulative increases of the initial disparities between regions as well as between APS in a given area (MAZOYER, 1981). Such a process results in an increasing regional specialization of agricultural production and a widening of the socio-economic differentiation among the farmers. As an example, Figure 1 shows the degree of inequality of the distribution of land, equipment and more generally productive capital in Sathing Phra area of Songkhla province.

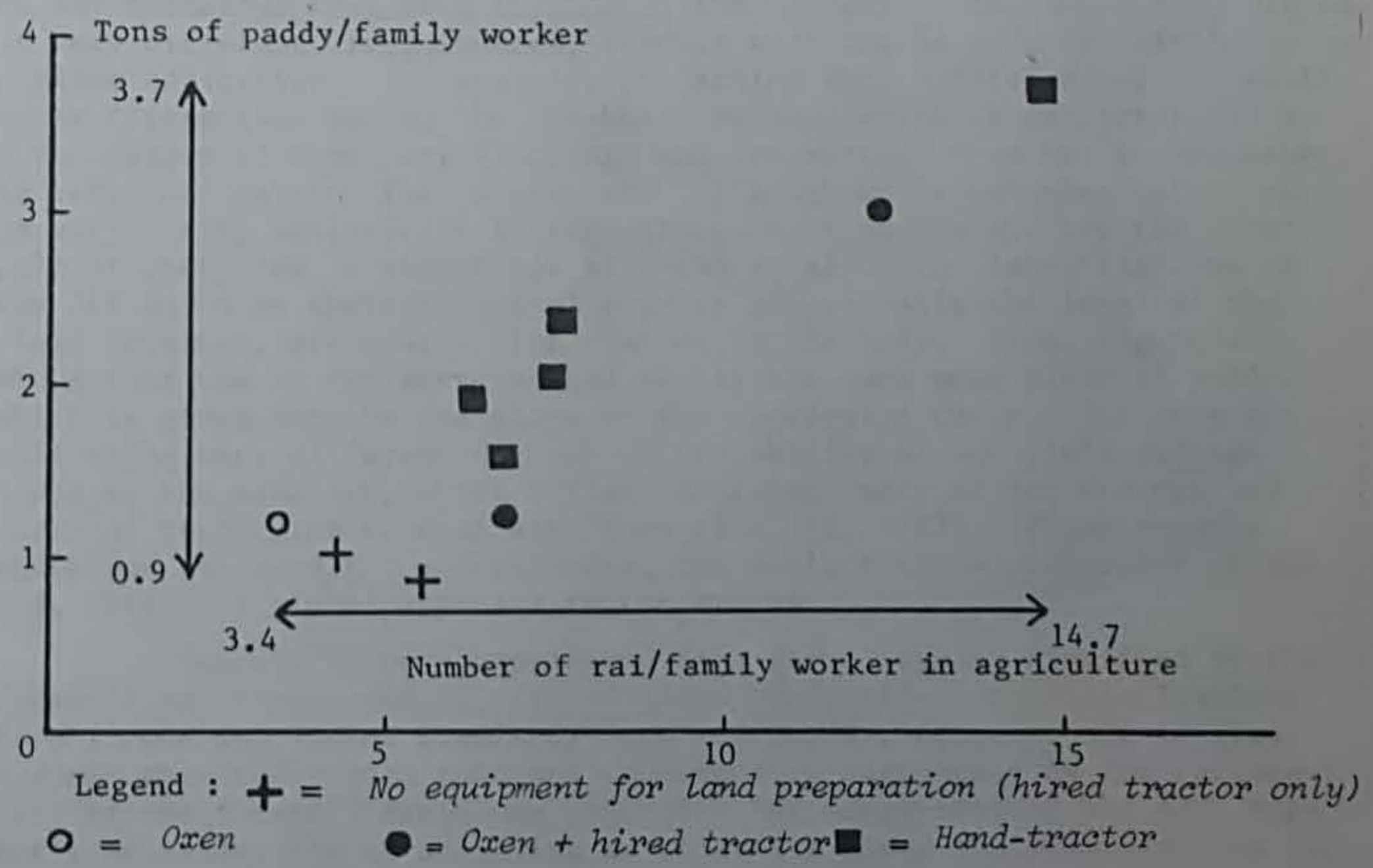


Figure 1 . Disparity for land/labor ratio and equipment among ten farmers in Sathing Phra area, Songkhla province. 1982-83 crop year.

Such a level of disparity has important consequences on the relations between farmers (as we shall see below for our example), on the local dynamic of agricultural development and so on the kind of research and extension activities which can be conceived and carried out. To propose the same extension topic to all these farmers is a nonsense because, having so different amount of productive resources, they cannot farm the same environment in the same way. It is necessary to consider the specificity of the various kinds of APS in one area. Limiting factors should be identified per type of APS in order to be able, later on, to propose adapted advice or solutions as well as to evaluate the efficiency and impact of the research and extension activities. This is the objective of the preliminary diagnosis, which is a pluridisciplinary exercice aiming at identifying and grading, at a given moment, farmers' problems in a small area per types of environment (agro-ecological units) and APS (TREBUIL, 1988). But what kind of classification of the APS is desirable in FSRE?

PERTINENCE OF A TYPOLOGY OF APS BASED ON THEIR FUNCTIONING AND HISTORY

Theoretical framework.

It is now well recognized that no objective classification of the APS can suit every purpose. In FSRE, a central question is : how to define farmers' problems, their importance and nature? Past experience proved that problem identification based on "expert" judgement, only referring to an ideal model of growth and development of the crop or domestic animal can be misleading, because only one part of the real conditions of production are considered by such "experts". Now, the practical value of any technical diagnosis depends on the context of the whole APS. Placed in very different circumstances, farmers will not be affected similarly by a given constraint. For example, in Sathing Phra rainfed area, the soil/water interaction during the pre-humid season, which is characterized by a succession of temporary floodings and dry periods from May to September, is very constraining for farmers growing mungbean or cucumber before rice on very clayey soil; while a large group of producers who tap the sugar palm at that time is almost not affected at all. So classifications of the APS based on their technical results only,usually the level of the yield obtained, are most of the time of little help. Thus, Figure 1 shows that the 10 APS surveyed had nearly the same mean yield of paddy, which is given here by the slope of the regression curve. But this result hides very different degrees of variability of the yield between plots of the same APS, which reflect different sets of constraints and farmers' strategies to deal with them (TREBUIL, 1983). These remarks underline the need for understanding the whole internal coherence of the APS, through a global approach to the system.

The APS is here considered as a global system finalised by the farmer's socio-economic objectives (food production, desirable level of farm income and living standard, farm continuity, etc...). It is also assumed that the system internal coherence is guaranteed by the rationality of the farmer's decisions regarding the management of his APS. Farmer's decisions aim at achieving an objective given the possibilities for action of his family group, at a given moment, which are delimited by the

APS situation. This situation is defined by the whole set of bio-physical and socio-economic constraints which are limiting the farmer's possible choices provided by the potentialities of his APS. Such a theoretical framework proved to be stimulating for the researcher because, when facing situations that he does not understand immediately, it forces him to look beyond simplistic explanations dealing with farmers' mentality or routinist behaviour (DEFFONTAINES, 1985).

What is the functioning of the APS?

Given the above-mentioned appoach of the APS, its functioning is defined by the logical sequence of strategical and tactical decisions made by the farmer to realize his objectives in a given situation (CAPILLON et al., 1980). Some of the important decisions to consider when analyzing the functioning of an APS deal with the choice of the current characteristics of the APS selected by the farmer, the labor management, the distribution of the crops among the various plots, the intensity of use of the available equipment, the decisions concerning relations with markets (purchases and sales)... A simple representation of the functioning of the APS and how to analyse it is given in Figure 2. The figure shows particularly that a good knowledge of the history of the APS is required in order to understand its present situation and farmers' current objectives.

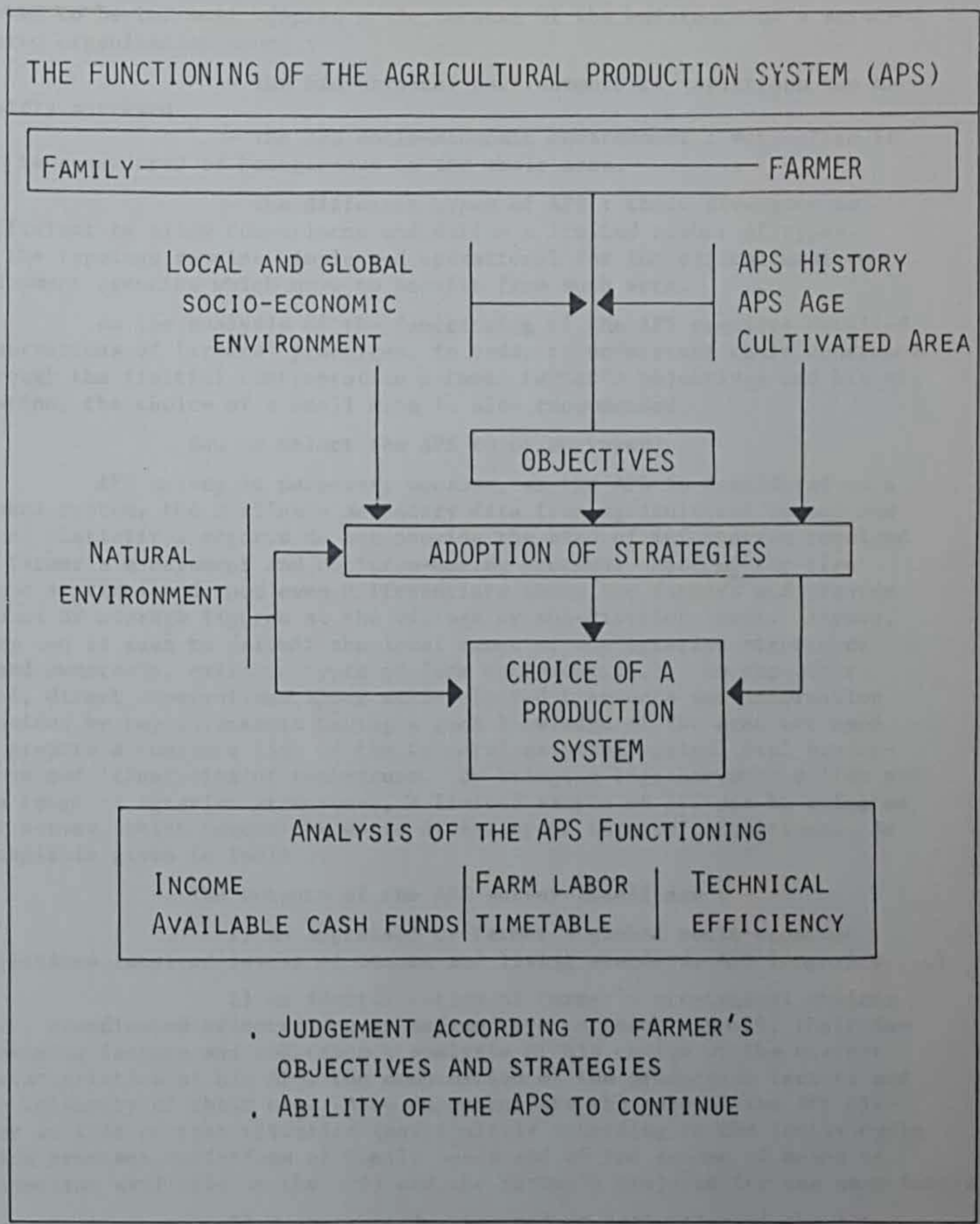
Why do we need to understand the functioning of the APS?

A modern conception of the extension work is to help farmers make adequate decisions according to their socio-economic objectives and management strategies of their APS,given their specific situations. In such a context, the farmer will consider a constraint anything which impedes a smooth, optimal functioning of his APS to reach his objectives. Solutions to these limiting factors will have to be compatible with the current state of the APS he has selected. That is why, if he wants to solve farmers' problems defined in this way, the on-farm researcher should first understand the varied functionings of the APS he has to deal with. We think that in FSRE, farm diversity should be evaluated through the elaboration of a typology of the local APS based on the different types of functionings observed, which correspond to as many kinds of farmers' socio-economic objectives and management strategies. As within each of such groups, producers are meeting the same kind of constraints,the classification of the APS on such a basis leads also to the delimitation of clienteles for following research and extension activities. At the same time, the danger of particularism, which otherwise could limit the impact of such work, raise its cost and make extrapolation of the results very unlikely, is avoided.

Method of study of the APS functioning.

The method presented here has been elaborated in France and tested in several tropical areas by Professor SEBILLOTTE's team. Since 1970, it has been refined after more than a dozen farm surveys carried out in small agricultural areas of the country (CAPILLON et al., 1980). Only the main characteristics of the method will be presented here, as a detailed case study has been published by our project previously (TREBUIL et al., 1983).

Figure 2



Source : adapted from SEBILLOTTE M., 1986.

. At what scale is it desirable to work?

The small regional area (from one tambon to one changwat) has proven to be the most adapted scale because of the existence of a struc--tured organization among :

- The bio-physical environment: its variations can be rapidly surveyed.
- The APS socio-economic environment : very often it can be considered as homogeneous in the whole area.
- The different types of APS : their diversity is sufficient to allow comparisons and define a limited number of types. So the typology remains simple and operational for the agricultural development agencies which have to benefit from such work.

As the analysis of the functioning of the APS requires detailed observations of farmers' practices, in order to understand their coherence through the fruitful confrontation between farmer's objectives and his situation, the choice of a small area is also recommended.

. How to select the APS to be surveyed?

APS survey is necessary because, as the APS is considered as a global system, the available secondary data from agricultural census and other statistical reports do not provide the kind of information required on farmer's management and decision-making process. Most of the time these statistics do not even differentiate among the farmers and provide global or average figures at the village or sub-district level. Anyway, they can be used to delimit the local range of the agrarian structures (land ownership, existing types of farm equipment,...). On the other hand, direct observations along well-selected transects and information provided by key informants having a good knowledge of the area are used to prepare a complete list of the farmers' existing agricultural productions and itineraries of techniques. By bringing together such a list and the range of agrarian structures, a limited sample of APS can be selected for survey, which covers the whole diversity of farmers' situations. An example is given in Table 1.

. The outputs of the APS survey itself are :

1) An appraisal of farmer's global socio-economic objectives (desired levels of income and living standard, APS longevity,...).

2) An identification of farmer's strategical choices (i.e. coordinated orientations at medium term to reach a goal), their determining factors and coherence : analysis of his choice of the current characteristics of his APS, the combination of the production factors and the intensity of their use. Also important are the role of the APS history in this current situation (particularly according to the family cycle which provokes variations of family needs and of the amount of means of production available on the APS) and the farmer's projects for the near future.

3) A characterization and an evaluation of the APS key sub-systems open to improvement such as staple food or cash crops sub-systems, labor or financial management, etc. The aim is to achieve an independent judgement of farmers' practices (of their "good reasons to do what they do") and tactical choices (i.e. the daily management of production factors put into action in order to achieve the strategical orientations). Usually this step involves a more quantitative approach (flows

Table 1 . Selected criteria used to build the sample of 10 APS studied in Sathing Phra district in 1982-83.

TYPE OF VILLAGE AND AGRO-ECOLOGICAL UNITS (AEU)	FARM STRUCTURES			CROPPING AND ANIMAL REARING SYSTEMS PRACTISED
	Age	Members	Surface (ha)	
Village type I :	30	3	0.9	RICE (broadcasted) - DUCKS
Higher, medium, lower paddies + gardens	58	5	1.4	RICE (broadcasted) - PALM SUGAR (all the year round) - DUCKS - OFF-FARM ACTIVITIES
Highway + sea : many off-farm opportunities.	61	7	4.8	RICE (broadcasted) - GARDENS - CATTLE - FISHING
	60	4	5.4	RICE (broadcasted, hand tractor) - GARDENS - CATTLE
Village type II :	46	8	1.8	RICE (broadcasted, hand tractor) - PALM SUGAR - CATTLE OFF-FARM ACTIVITIES
Higher, medium, lower paddies + small gardens	47	5	3.6	RICE (broadcasted + transplanted, hand tractor + pump, hybrid variety) - GARDENS - OFF-FARM SEASON CROP BETWEEN RICE - CATTLE
Secondary road, few off-farm opportunities.				
Village type III :	40	8	1.0	RICE (transplanted, hybrid var.) - PALM SUGAR - FISHING - OFF-FARM ACTIVITY
Medium, lower paddies + pastures along the lagoon.	46	4	2.5	RICE (broadcasted + transplanted) - CATTLE + SWINE + DOVES + FINISHING
Few off-farm opportunities apart from fishing on the lagoon.	45	8	4.4	RICE (broadcasted + transplanted, hand tractor, hybrid varieties) - MUNGBEAN - SWINE
	61	6	7.5	RICE (broadcasted + transplanted, hand tractor) - RICE MILL - SWINE - WAGE LABOR - OFF-FARM ACTIVITIES

and balances for cash, labor or fertility) in order to appraise the evolution of the APS potential of production (maintenance, accumulation or degradation).

4) By bringing together points 2) and 3), we are able to correct or refine the analysis of the strategical choices. They are used to grade the detected limiting factors in point 3) as well as to forecast the possible effects of a proposed solution on the other APS sub-systems. If no adapted advice can be provided, this situation underlines the need for the elaboration of the specific technical reference during the following phase of the FSRE process.

. Importance of APS monitoring.

The quality and the coherence of the set of recorded data is much improved when several visits are made to the APS at key stages of the management of the main sub-system subject to the in-depth analysis. This allows the researcher to adopt a back and forth process between data collection and analysis. At the same time, farm monitoring allows the direct observation of phenomena in farmers' fields. As many facts will not be raised by the farmer himself, because he considers them as not interesting for us or of no priority, or simply forgets to mention them, direct observation of farmer's practices feeds the interview with appropriate questions. More important is the fact that APS monitoring allows us to compare between farmer's declarations, which are based on his personal representation of his APS situation, and his real practice, the actually performed APS. This is a very valuable source of information on farmer's decision-making process as both successful and not successful choices are observed. To put it more simply, we can say that observing what the farmer is really doing is at least as interesting as what he is saying about his APS. Farmers' socio-economic objectives and management strategies can be more directly assessed through observation of their practices than during interviews only.

. Elaboration of the typology of APS.

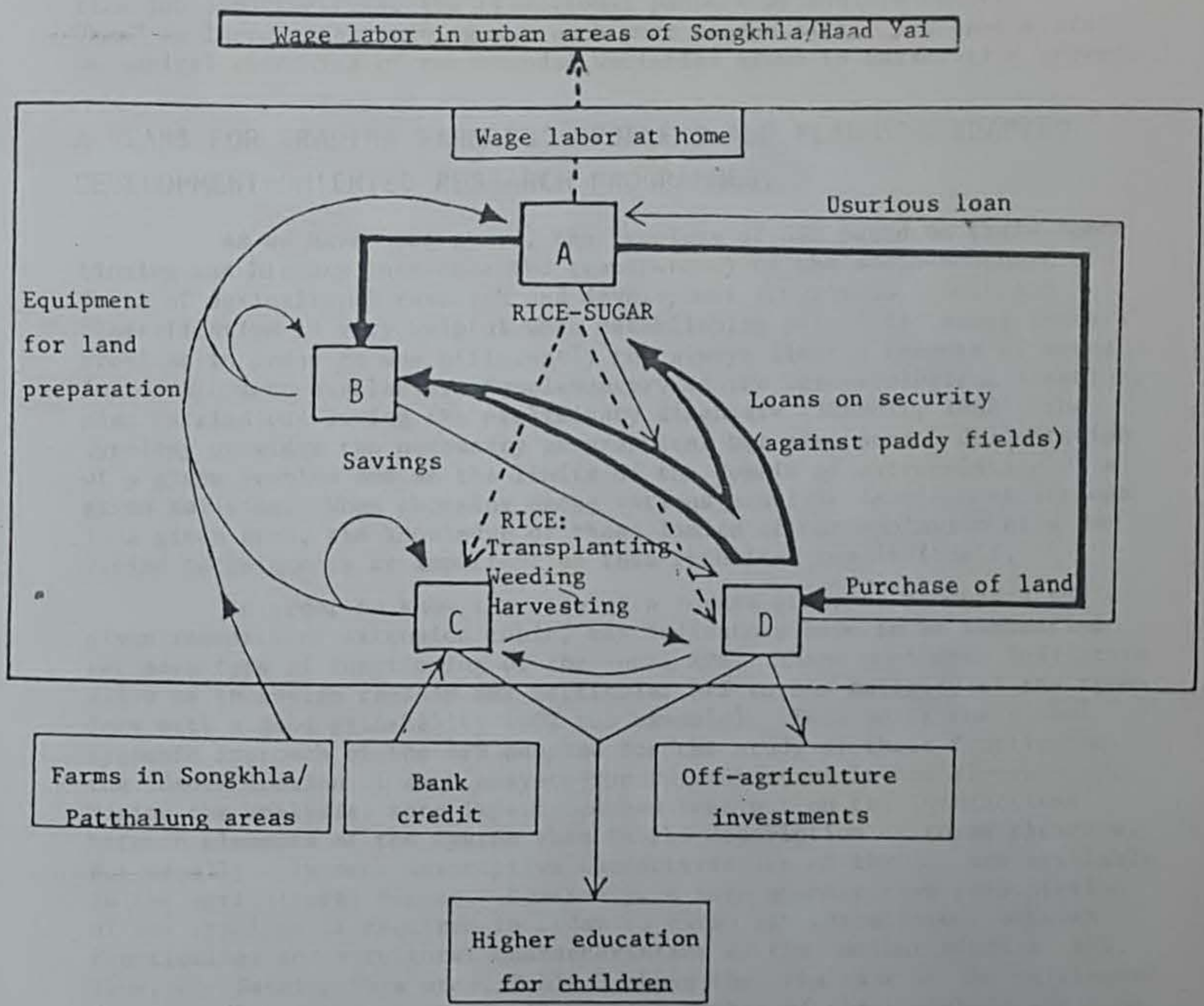
During the APS survey, these production units are grouped according to the similarities of their functionings, of the way (objectives and strategies) they produce, maintain or degrade their potential for production. APS belonging to the same type are concerned by the same kind of advice or other extension assistance. Thus, Table 2 shows that, if in Sathing Phra area, APS of the A and B categories need assistance to increase the efficiency and the economic results of their palm sugar sub-system (SINGRAT et al., 1988), rice-based types C and D require the elaboration of adapted technical references in order to improve rice implantation and weed control in dry-seeded broadcast paddies (MOREAU et al., 1988).

Such APS survey leads also to a good understanding of the interrelations between the various types of APS identified for the distribution and use of the available means of production, as well as with their socio-economic environment (markets, education,...). Eventual conflicting interests between types of APS have to be considered when grading farmers' problems at the small regional level. Such output of the APS survey underlines the fact that the research and extension activities which are to be chosen represent social stakes. For example, Figure 3 shows that in Sathing Phra area, the choice to improve and reinforce the palm sugar production with the A and B types of APS is running against the interests of the C and D categories of bigger rice producers who need hired labor

Table 2 . The main types of functioning of the APS in Sathing Phra area

TYPE OF A.P.S.:	PRINCIPAL ECONOMIC OBJECTIVES :	GLOBAL STRATEGY CHOSEN BY THE FARMER =	MAIN CONSTRAINTS FACED TO IMPLEMENT IT :
A	. Production of enough paddy for family needs. . To maximise the daily income of the family labor force.	. Non-rice economic activities are dominant. . They are selected, according to the local opportunities, in order to maximise daily income on a short term basis. These activities vary if a small initial capital is available (duck or chicken raising) or not (palm sugar making, fishing, shrimpdeshelling,wage-earner,...).	. Access to land (loans on security if savings) and capital (dependence on village money lenders). . No equipment for land preparation. . Family labor involved in other jobs at key phases of rice cycle (transplanting, weeding, harvesting) . Lack of local firewood for palm sugar making and low quality of the final product.
B	. To maximise family income through, full employment of the family labor in low risk activities . Relations with the market and productive investments (purchase of land) are still limited.	. Traditional rice production occupies all the family labor in the humid season. Important storage of paddy is common. . Cattle herd is a form of "live-savings" and is managed by the elder man. . In between rice other activities (palm sugar production, gardens) do not necessitate cash investments.	. Access to land (number of "rai" per active person is still limiting) : rent in more land or loans on security. . Low labor productivity in rice and cattle rearing. . Reduced mobility of the family labor force (often aged) limits access to certain job opportunities.
C	. To maximise the gross margin per hectare and the family labor productivity in rice	. New rice technologies are adopted on the well-located plots. . A large part of the rice harvest is sold every year. . Cash crop production (mungbean, cucumber,...), in paddy field between two rice crops or in gardens	. Labor is scarce at certain phases of the rice cycle = transplanting (without good water control), harvesting(sickle and threshing in the field of recommended varieties sensitive to shedding).
D	. To maximise the profitability of the investment capital. . Eventual cautious land accumulation	. "Extensive" rice production for the market with frequent recourse to hired labor. . Various investments in activities linked to agriculture (ricemill and associated swine production palm sugar marketing,...) or not (transportation, real estates,...). . Exchange of paddy fields against loans on security and purchases of vacant land.	. Hired labor availability because of new more profitable and less tedious job opportunities, and lack of water control which does not allow a staggering of cultural practices such as transplanting or weeding.

Source : Monitoring along a rice cultivation cycle of a selected, limited sample of farming systems in 1982-83.



Legend : - - - - - - > = Labor

——————> = Land

= Industrial means of production

——————> = Savings, capital

Source : Survey by the authors in Sathing Phra district, 1982-83 crop year.

Figure 3 . Relevant interactions between types of APS and relations with the other economic sectors in Sathing Phra area.

at harvest. As wage labor is scarcer, due to the availability of non-rice job opportunities, the traditional panicle by panicle harvest by "kae" is increasingly giving way each year to the sickle and on-the-plot mechanical threshing of recommended varieties grown by market rice growers.

A MEANS FOR GRADING FARMERS' PROBLEMS AND PLANNING ADAPTED DEVELOPMENT-ORIENTED RESEARCH PROGRAMMES.

As we have seen above, the typology of APS based on their functioning and history increases the transparency of the socio-economic effects of agricultural research and development programmes. Such APS classification is very helpful when establishing priorities among farmers' problems in order to use efficiently the always limited amounts of means for development available. Complementary to the agro-ecological zonation, also carried out during the preliminary diagnosis (TREBUIL, 1988), the typology provides the necessary geographical but also social delimitation of a given problem and so the limits of the domain of extrapolation of a given solution. When choosing among various possible development actions in a given area, the knowledge of these limits of extrapolation of a verified technique is as important as this technical result itself.

In order to know the size of a target group of producers for a given research or extension topic, key indicators have to be identified for each type of functioning of the local APS. These synthetic indicators allow us to assign rapidly any particular APS to one category of the typology with a good probability (80% for example). Because of the global systemic approach of the APS adopted for the study of their functioning, the identification of such easy-to-record indicators is not always easy. During the analysis, more importance has been put on the interactions between elements of the system than in the description of these elements. But usually only such descriptive characteristics of the APS are available in the agricultural census. Generally, a more quantitative presentation of the typology is required in order to establish correlations between functionings and structural characteristics of the various kinds of APS. Thus, for Sathing Phra area, Table 3 shows that the size of the cultivated (not owned) area per economically active member of the household could be used as the principal indicator. The table displays also other APS characteristics which can be used when doubts exist about the adherence of a specific APS to a given category of the typology. A test of these indicators on a larger second sample, when possible, can be used as a verification of the typology of APS.

By using the census data, the regional size of each type of farmers is assessed (Figure 4) and the prioritization of farmers' problems can be based on the knowledge of the number of types of APS and households affected by each of them.

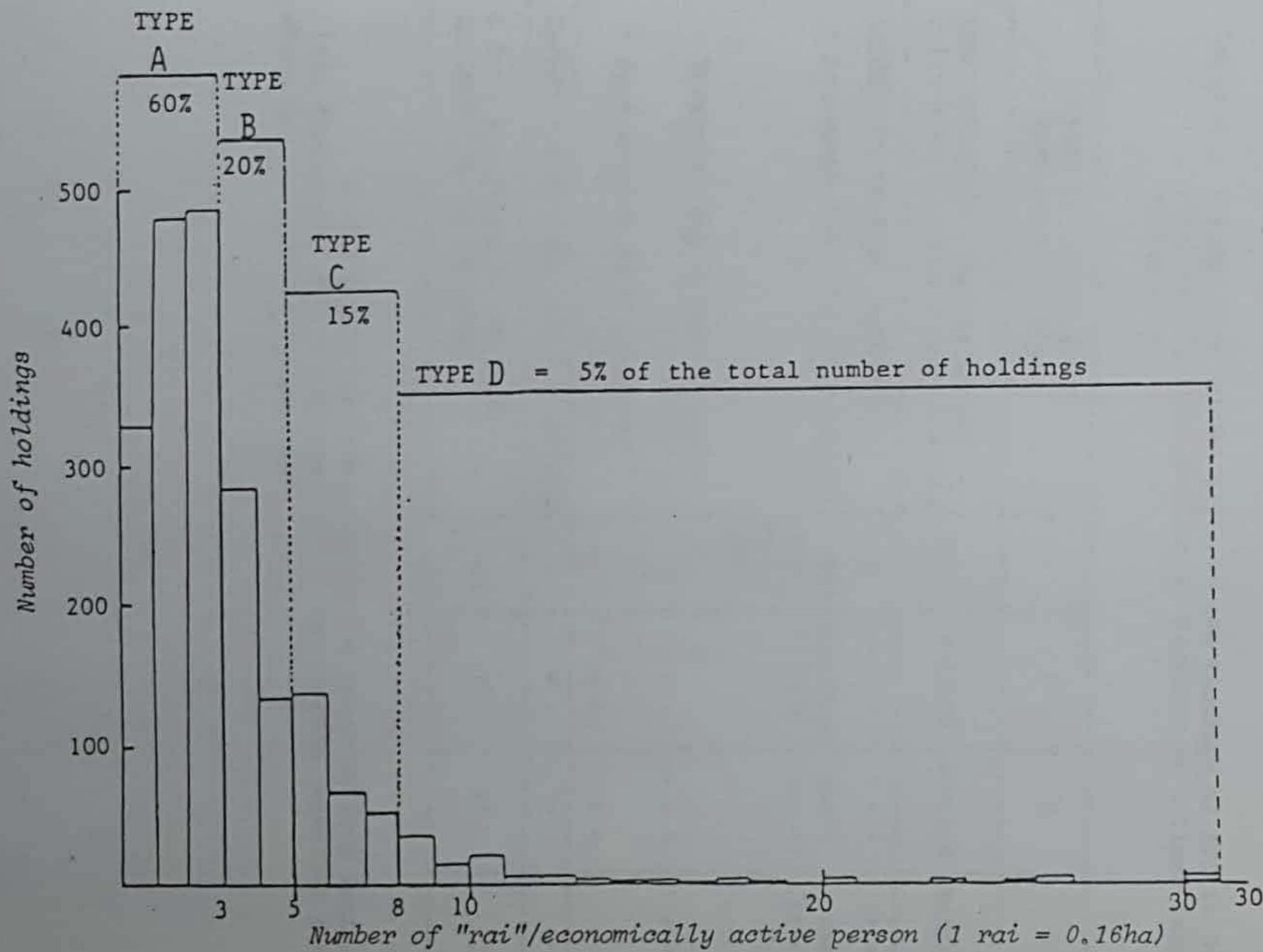
Table 3 . Differentiation among the APS in Sathing Phra area for several relevant characteristics

(Legend : - = none, + = not important, + + = important, + + + = very important)

TYPES OF AGRICULTURAL PRODUCTION SYSTEMS =	A	B	C	D
LABOR :				
1 - Number of hectares cultivated per economically active person in the household :	0 - 0.5	0.6 - 0.8	0.9 - 1.2	> 1.2
2 - % of hired labor in agricultural production :	3 - 15	0 - 1	1 - 5	16 - 34
3 - Global labor productivity in rice (kg paddy/day of work) :	19 - 24	13 - 15	22 - 30	20 - 26
LAND :				
4 - % of the cultivated area owned with formal land title (no so 3) :	0 - 65	80 - 100	100	100
CAPITAL :				
5 - Equipment for land preparation :	None (or oxen)	Oxen or hand-tractor	Hand-tractor	Hand-tractor, Oxen
6 - % investments + inputs in agriculture/family consumption + savings :	10 - 1000*	20 - 30	100 - 1000	40
RICE CROPPING SYSTEM :				
7 - % of the rice growing area planted with recommended varieties :	0	0 - 15	50 - 90	20 - 30
8 - Importance of hand weeding in broadcasted paddies :	+ +	+ + +	+	+
9 - % of the total rice harvest commercialized :	0	5 - (90)**	40 - 50	50
ANIMAL REARING SYSTEM :				
10 - Intensive chicken or duck raising :	-/ + + +	+	-	-
11 - Swine :	-	+	+ +	+ +
12 - Cattle :	-	+ +	+	+
PALM SUGAR PRODUCTION :	+ + +	+ +	+	+

* *If intensive chicken or duck raising.* ** *Massive sales of stored paddy to pay for the purchase of a piece of land.*

Source : Monitoring of a sample of 10 APS in Sathing Phra district in 1982-83 crop year.



Source : Adapted from the data recorded among 2029 households in 4 tambon of Sathing Phra district by the agricultural extension officers in 1982-83.

Figure 4 . Frequency of the types of Agricultural Production Systems according to the land/labour ratio.

At this stage, a simplified presentation of the typology can be proposed to the agricultural development agencies. Table 4 shows how, in Sathing Phra area, the target groups of producers concerned by the two selected topics for on-farm research and extension could be simply presented. Such presentation facilitates later the organization of the related research and extension activities.

Table 4 . A simplified presentation of the typology of APS in Sathing Phra area for the planning of development actions (same legend as Table 3).

TYPES OF AGRICULTURAL PRODUCTION SYSTEMS:	A	B	C	D
IDENTIFICATION : Number of rai cultivated per active person = R/A	R/A<3	3<R/A<5	5<R/A<8	8<R/A<50
IMPORTANCE OF RICE PRODUCTION :	+	+ + +	+ + +	+ +
- Equipment for land preparation:	none (Hired equipment)	Oxen/Hand tractor	Hand-tractor	Hand-tractor/ Oxen
- Transplanting of hybrid varieties:	-	+	+ + +	+ +
- Hand weeding in broadcasted paddies:	+ +	+ + +	+ +	+
IMPORTANCE OF PALM SUGAR PRODUCTION	+ + +	+ +	+	-
% OF A.P.S.BELONGING TO EACH CATEGORY IN THE DISTRICT :	60	20	15	5

At the same time, the contribution required from various scientific disciplines for the elaborations of the adapted technical references which are lacking can be assessed.

A RATIONAL BASIS FOR THE ELABORATION OF APPROPRIATE AGRICULTURAL REFERENCES.

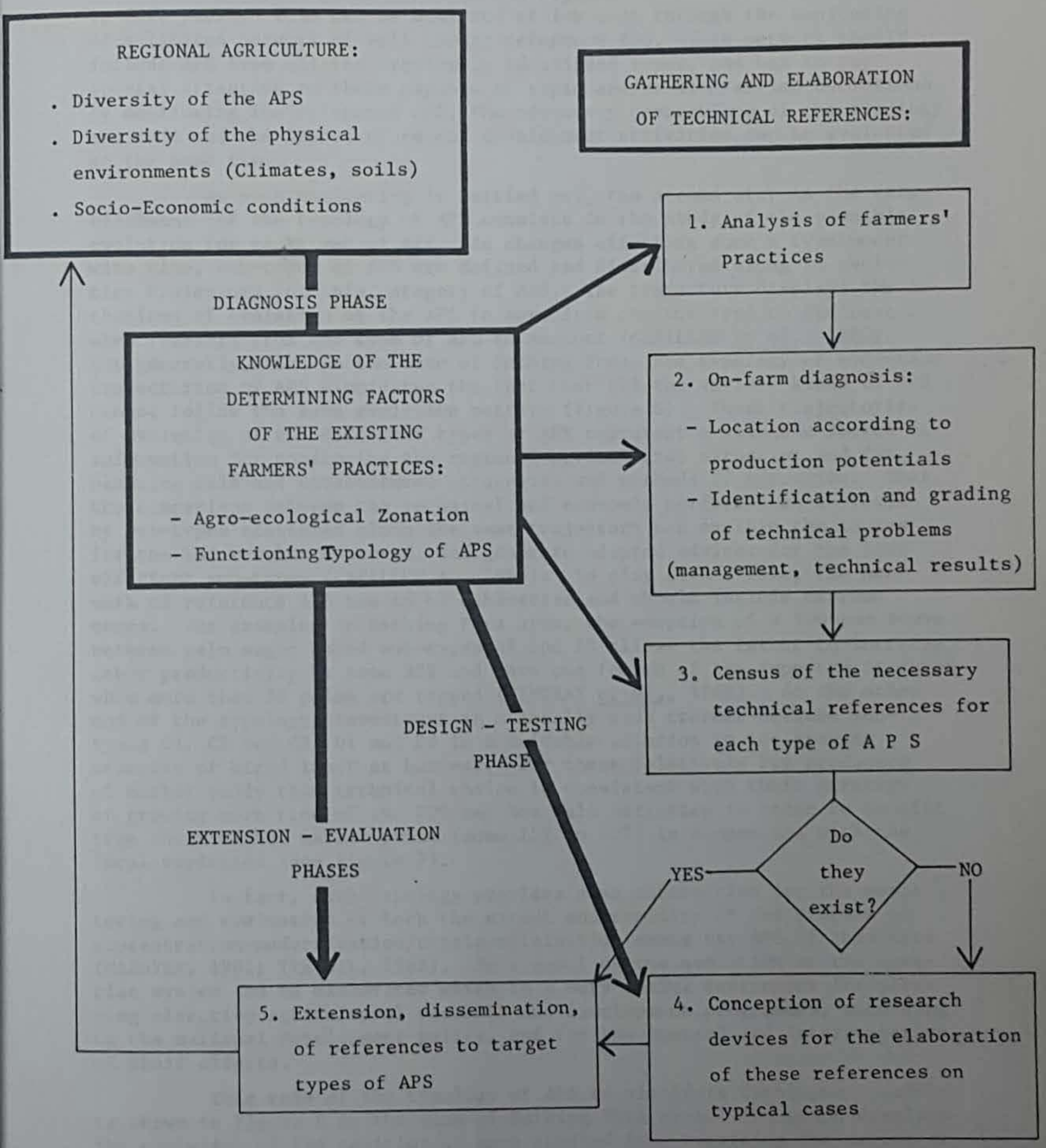
Because the typology of functionings leads to a good understanding of the relation between the farmer's objectives and his technical choices,given his situation, it is a valuable tool for planning (choice of topics) and implementing (where, with what type of APS) adapted experimental devices. They are able to fit with specific farming conditions and so guarantee the appropriateness of the regional experimental programme because the whole set of constraints to be faced by technical solutions has been identified. The required technical references to solve farmers' problems are classified per agro-ecological unit and type of APS. Figure 5 shows how the research and extension of such references can be organized along the various phases of the FSRE process.

The kind of new required references for crop production generally consist in new itineraries of techniques (i.e. logical and well-ordered successions of techniques applied by the farmer to achieve his objectives) which aim to optimize production according to farmers' objectives and situations. It is understood that such references will be more appropriate than those elaborated by the researcher in a very different set of objectives (maximisation behaviour) and constraints. The knowledge of the different types of functioning of the APS in the area allows the researcher to study the necessary compatibility of the new itinerary of techniques that he is designing and testing with the objectives and strategies of his target group of farmers. So the domain of extrapolation of the proposed technical solution or improvement can be well delimited. A good example of such approach is given in MOREAU et al., (1988).

During the elaboration of the new itinerary of techniques, on-station and on-farm research are considered as two complementary approaches to be put into action. Their relative importance varies with the topic and the amount of technical references already available on it. But, if generally on-station experiments are designed to study the effects of the factors and their interactions, they do not provide information on the extrapolation of their results, their generalization. On-farm agronomic surveys and trials are then necessary in order to analyse the pattern of variation of these effects and interactions when the studied systems are changing, by using the usually important variability existing between plots belonging to the target group of farmers defined by the typology of functionings of APS. This on-farm part of the research allows the researcher to grade the factors and interactions to be taken into consideration in a given situation, to build a model of the farmer's managed (SEBILLOTTE, 1987) system.

New itineraries of techniques and the typology of APS based on their functioning and history can be considered as two very inter-dependent levels of regional technical references which need to be elaborated and refined simultaneously. Their confrontation is particularly interesting when looking for the causes of non-adoption or rejection of a technical innovation.

Figure 5 . Analysis of the regional agriculture and research of adapted agronomic technical references: the role of the typology of Agricultural Production Systems (APS).



Source : adapted from CAPILLON, A. 1985b.

A TOOL FOR MONITORING THE EVOLUTION OF AGRICULTURE AND EVALUATING AGRICULTURAL DEVELOPMENT SCHEMES.

The typology of APS requires regular actualization, every four to five years. This can be achieved at low cost through the monitoring of a limited network of well chosen reference APS. This network should include APS from all the previously identified types, and has to pay special attention to those capable of rapid and/or diversified evolutions. By monitoring the reference APS, the necessary corrections of the typology are made and the impact of recent development activities can be evaluated at the same time.

As such monitoring is carried out, the second step in the establishment of the typology of APS consists in the study of the possible evolution for each type of APS. As changes affecting such a type occur with time, sub-types of APS are defined and distributed along an evolution trajectory for this category of APS. The trajectory displays the mechanisms of evolution of the APS to move from one sub-type to the next or when feasible from one type of APS to another (CAPILLON et al., 1980). But generally, like in the case of Sathing Phra, the typology of evolution trajectories of APS elucidates the fact that all the various kinds of APS cannot follow the same evolution pattern (Figure 6). These trajectories of evolution of the different types of APS represent a valuable source of information for monitoring the regional agricultural situation and for planning relevant agricultural strategies and methods of extension. Thus, the comparison between the technical and economic performances achieved by sub-types scattered along the same trajectory can explain the causes for the bad results observed, and generate adapted advice, for the less efficient sub-types (CAPILLON A., 1985). To play such a role, the network of reference APS has to be exhaustive and should include extreme cases. For example, in Sathing Phra area, the adoption of a two-pan stove between palm sugar based sub-types A1 and A3 allows the latter to increase labor productivity by some 35% and save one fourth of the imported firewood when more than 30 palms are tapped (SINGRAT et al., 1988). At the other end of the typology, investment in a locally made tresher between sub-types C1, C2 and C3, D1 and D2 is a suitable solution to the growing scarcity of hired labor at harvest. For these relatively big producers of market paddy this technical choice is consistent with their strategy of growing more rice of the RD9 and Hom Mali varieties in order to benefit from their higher market price (some 25% to 30%) in comparison with the local varieties (See Figure 7).

In fact, such typology provides also information for the monitoring and evaluation of both the extent and rapidity of the process of concentration-modernization/crisis-elimination among the APS of this area (MAZOYER, 1981; TREBUIL, 1988). So a model of the evolution of the agrarian system can be elaborated which is a very useful instrument for planning effective agricultural research and development programmes, according to the national development policy, and for the control and interpretation of their effects.

This role of the typology of APS to elucidate development models is shown in Figure 8 in the case of Sathing Phra area. The graph displays the evolution of the position of each studied APS, regarding the amount of productive resources available (summarized here by the number of rai/family

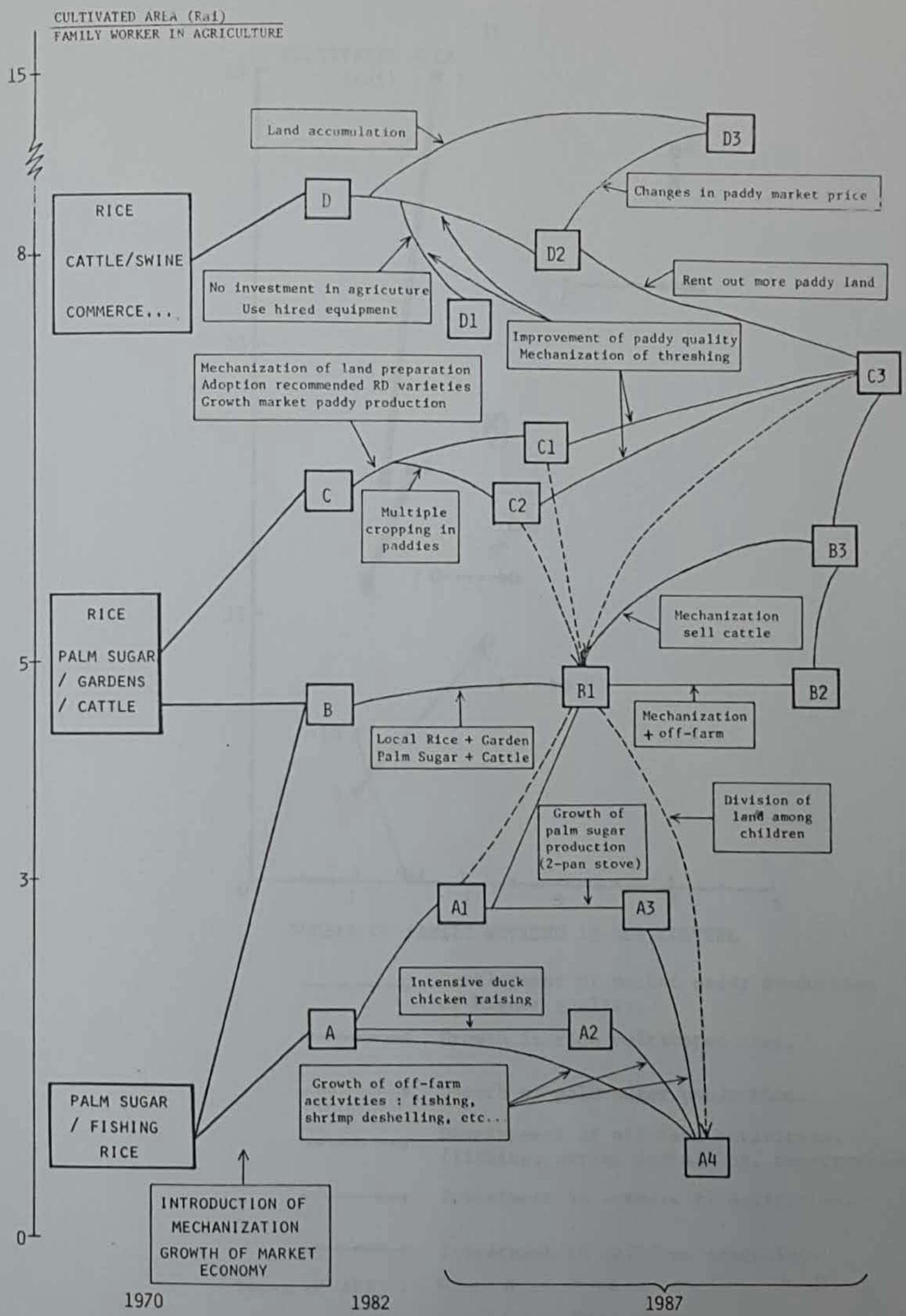
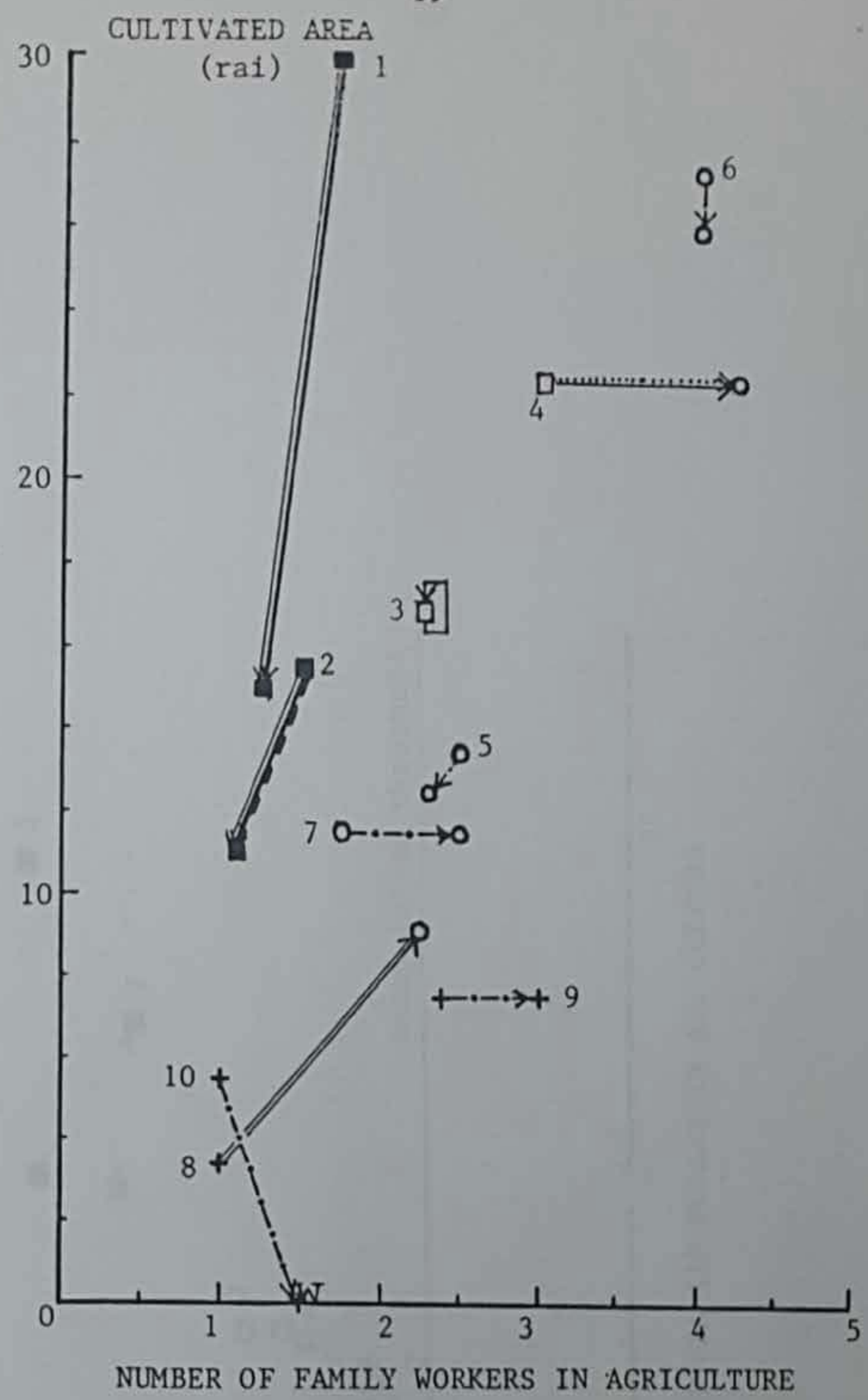


Figure 6 . Evolution of the different types of APS in Sathing Phra area according to the monitoring of a limited sample of reference farms.



Development of market paddy production of higher quality.

Growth in rice cultivated area.

Growth of palm sugar production.

Development of off-farm activities. (fishing, shrimp deshelling, construction worker,...)

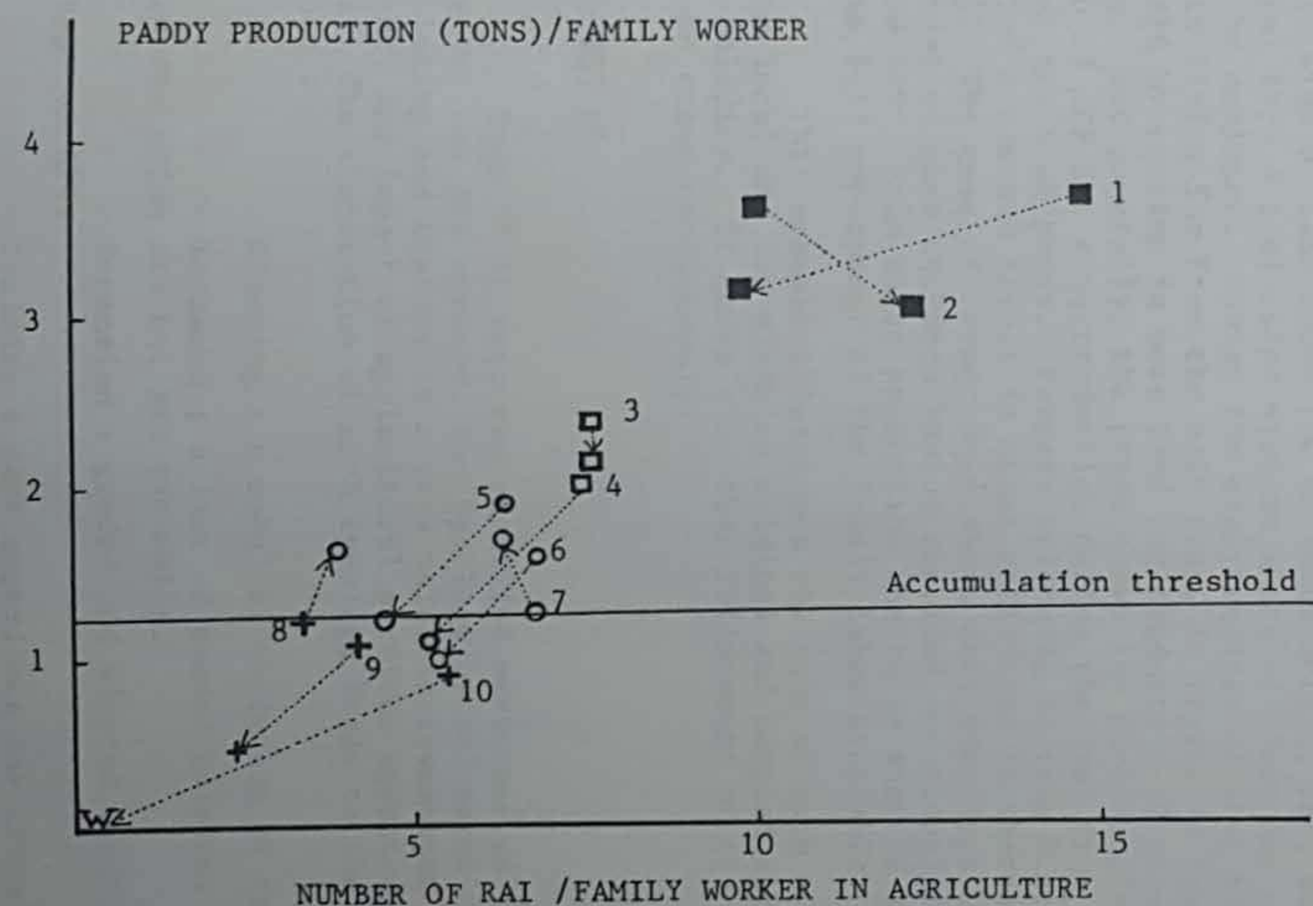
Investment in commercial activities.

Investment in children education.

Types of APS : + = A = B = C = D

W = Wage earner

Figure 7 . Changes in the land/labor situations of 10 APS in Sathing Phra area between 1982 and 1987 and related strategies adopted by the farmers.



Legend : Types of APS : + = A o = B □ = C ■ = D

W = wage earner

Figure 8 . Evolution of labor productivity according to farmers' productive resources among 10 APS in Sathing Phra area between 1982-83 and 1987-88 crop years.

worker in agriculture) and the physical labor productivity in rice between 1982-83 and 1987-88. The accumulation threshold gives an idea of the level of labor productivity which seemed to be necessary to reach, in 1982-83, in order to guarantee the possibility for the APS to continue in the near future. APS located under this threshold can diseappear because of changes in the economic local conditions (this was the case for farmer No.10 whose duck rearing system went bankrupt in 1984 after the price of feeding increased) or in the farmer's objectives, especially when children take over the APS from the old farmer (this is the case for palm sugar producer No.9 whose situation has deteriorated during the last five years, as his sons will not continue this laborious activity, much will depend for the future of the APS on the availability of off-farm jobs and the evolution of the wage level, which determine the position of the accumulation threshold). APS Nos.5, 6 and 7 will also face similar situations in the near future, if division of land among the children occurs, they will give birth to several type A production systems where off-farm and non-rice activities will be dominant. Having few opportunities of that kind, farmer No.8, who is living far from the main road, is trying to improve the status of his APS by renting in more land for production of good quality market paddy. But generally, the graph shows the disaffection of the types C and D of APS for rice production during the last five years due to low market price of paddy. Farmers belonging to type D are growing rice on smaller areas and invest in other activities (commerce, children education). The case of Farmer No.4 shows that even Type C is not so secure a situation when children having received vocational training come back to the APS. Palm sugar production has to be started again in order to ensure full employment of the family labor available.

This example illustrates the role of such a model of evolution of the local APS for planning original and adapted agricultural development policies. It shows also that refinements of the typology and model have to occur continuously.

CONCLUSION

Even if it requires qualified personnel as well as funds to carry out the APS surveys, the typology of APS based on the study of their functioning and history is a very valuable investment to increase the efficiency and impact of agricultural services agencies at the small regional level. The elaboration of such typology leads to the following kinds of outputs :

- Planning : a model of evolution of the regional agriculture.
- Research ; a list of needed relevant agricultural technical references which are not yet available.
- Extension : graded and adapted topics for technical advice per type of APS.
- Training : past experience has proved that the elaboration of such classification of the farmers is a powerful tool for training at various levels (researcher, student, planner,extensionist).

But progress still has to be made in the rapidity of the elaboration of the typology. Decreasing the size of the sample of APS to be studied is of limited interest because of the necessity, in this kind of approach, to include the whole diversity of farmers' situations in order to be able later on to identify all the possible trajectories of evolution for each type of APS. By using a very limited sample of APS, the danger of unwarranted extrapolation of a result specific to one APS is also more important while other key parameters which cannot be observed in the sample go unnoticed. So the rigor of the conclusions could rapidly be at risk.

Finally, theoretical refinements are needed in order to improve the assessment and grading of farmers' objectives, as well as to modelize the functioning of complex farmer's managed systems.

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