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Farming and Rural Systems

- State of the Art in Research and Development -

Werner Doppler

Farming systems research and extension have been given increasing attention in the last 30 years. In the 80's it was felt, that there was an increasing need for exchange of different concepts and experiences among scientists all over the world. International Symposia on farming systems were held in the United States of America. As a consequence of this, in 1988 the International Association of Farming Systems Research and Extension (AFSR+E) was founded. Today on all continents, regional associations or groups are active and follow common goals as follows:

- a) to overcome the methodological bottlenecks of strictly disciplinary approaches and high level specialisation in research by strengthening the potential of synthesis of different methodologies developed and applied to different disciplines (e.g. natural sciences, social sciences) towards a systems methodology which internalises the interrelationships between sectors of disciplines.
- b) to overcome the empirical bottlenecks resulting from a gap between the results of disciplinary-based research and farmers' behaviour and decision-making by integrating farmers (target groups) and institutions related to agricultural development at various levels of research towards finding solutions to problems.

These common goals have evolved in a long historical development and reflect wide differentiation in the discussions of the last 30 years. Nowadays, it seems as if the academic community working in farming and rural systems research and extension, would have come to a more common and consistent view. The common features in this development and the current state of the art will be discussed in the following sections.

Historical development of the farming systems view

The farming systems view has an old tradition. In the first half of this century, the systems concept intensively contributed to agricultural development. Most of which was achieved in this period seemed to be forgotten when a new development of farming systems research started in the last 40 years. Lessons can be learnt for the future.

The history over centuries

Pre-scientific period (1570 to 1800)

During the pre-scientific period, books were published by priests (COLER, J., HERESBACH, K.) in which the "house" was understood to be the unit in which the needs of the family had to be met and decisions about farming were made in light of subsistence requirements of the family.

The economic period (1800 to 1850)

At the beginning of the 19th century, the relevance of markets and cash surplus on farms played an increasing role in Europe especially in areas with large-scale farms (e.g. East Germany, Poland, Ukraine). Influenced by liberalism, the farm and farming has increasingly come to be understood as an economic element in a market oriented environment. In addition to this macro view, THAER, A. D. (1805-1812 and 1810) showed from a micro point of view that farmers' decisions are of a long-term nature and are made in the context of a complex interrelationship on a farm. The importance of improving income was recognised. It was in during this period when VON THÜNEN, H. (1826) developed basic economic principles derived from farms and farmers' decision-making.

The natural sciences period (1850 to 1900)

This period is characterised by comprehensive inventions and innovations in the natural sciences leading to a rapid increase in agricultural production in Europe. Amongst crop and livestock scientists, the role of the physical environment and the need for sustainable benefit have been understood to be of central importance and led to the development of innovations in cropping systems and in the use of legumes, mineral and organic fertiliser. It resulted in an intensification of production. In spite of the development of crop specific innovation, the integrative elements of livestock and crop production very soon played an increasing role in smallholdings. Production systems evolved and research was not commodity oriented. It was complemented by principles of spatial distribution of production and its relation to transport and markets as well as the principles of farm organisation applied to comparative types of analyses.

The period of comprehensive farming systems views (1900 to 1950)

This period consists of two basic developments: the integration of crops, livestock and economic disciplines and methodology within the farm (organic system) and the extension of

the systems view to farm, household and family as the system which determines decision-making.

a) The farm as an organic system

The long-term use of natural resources appeared to be a central issue of discussion. AEREBOE, F. (1905, 1917) and BRINKMANN, T. (1922) combined the view of livestock scientists and agronomists with the economic view at the farm, market and national levels and considered the farm to be an "organic system" in which the principles of crop rotation, the introduction of technical innovations in crops and livestock and the long-term use of resources and their relationship to the socio-economic needs of whole farm development were considered as key elements. They distinguished between internal and external driving forces of farming system development. The rationale of farmers' decision-making was assumed to be the optimal allocation of production factors and inputs in production. However, since they concentrated mainly on large scale systems the household was excluded.

b) The family, the household and the farm as a system

It was TSCHAJANOW, A.W. (1923) who considered the farm, the household and the family as belonging to one system. His research focused on smallholdings and family farms. Based on empirical results the theory of subjectively rational farm family decision criteria was defined. The use of the family labour force over time was optimised by dividing it into profit-making activities and leisure. Thus, the neo-classical view was extended by including preferences for leisure. TSCHAJONOW' s concept consists of a multiple objective situation, based on a production-consumption equilibrium.

Development towards today's farming systems view

The period of specialisation in industrialised countries

The development in agricultural research in industrialised countries between 1950 and today has been characterised by an extremely high level of differentiation between disciplines and specialisation within them. This has been associated with a dominant role of quantitative research and the increasing importance of modelling development processes. Agricultural research has been related to extension services with a high level of professionalism and increasing knowledge of information systems. Farmers' knowledge and education has increased and they have asked for more specific solutions to problems. The objectives have tended towards single goals with economic benefits in the foreground. Partial approaches have been of growing importance with the increasing specialisation.

New developments indicate that extreme specialisation will be combined with systems approaches to better quantify the socio-economic and managerial impacts of changes (innovations) in the future for the families. At the same time, there is increasing awareness of the need to include social aspects as well as the role of institutions and administration at the village and regional levels when implementing a region-wide strategy for farming and rural development. As a consequence linkages between different disciplines are considered increasingly important. This has led to a new definition of farming systems development in

industrialised countries and an increasing implementation of this concept in countries of transformation such as in Eastern Europe.

Farming systems development in developing countries

Agricultural development in most of the developing countries in the period between 1950 and today did not start with systems approaches in research, but with a single commodity strategy. A descriptive farming systems analysis led to an agronomic determined approach followed by farmers decision-oriented concepts including resource availability and use, and this was finally extended to farmers participation.

a) Commodity orientation

During the colonial period, there was a clear distinction between commercialised farms (often with only a single type of crop) and smallholdings. The first one was meant to satisfy the commodity demand, in the latter, subsistence production was a dominant feature. On commercialised farms such as plantations or ranches, colonial institutions in research and extension focused on the commercialised farms and applied, in most cases, a commodity-oriented approach. After independence, the local research institutions often applied the commodity-oriented approach also for smallholdings neglecting the appropriateness of the systems approach for these smallholdings. The philosophy of the commodity approach can even be found today in the understanding of quite a number agricultural scientists in developing countries and often hinders the introduction of farming systems concepts.

b) Descriptive farming systems analyses

Parallel to this development, the increasing feeling of the inappropriateness of such partial and commodity-oriented approaches for smallholder development has led to the development of descriptive type of farming system analysis to at least, better understand the genesis of small scale farming and the rationale of smallholders' decision-making. ANDREAE, B. (1964), DUCKHAM, A.N. and MASEFIELD, G.B. (1970), GRIGG, D.B. (1974), RUTHENBERG, H. (1980), and DOPPLER, W. (1991) proposed a descriptive type of farming systems analysis consisting of (i) analysing the genesis of different systems and (ii) carrying out a comparative analysis to find out the determinants of development.

c) Period of agronomic dominance

In the 1960s and 1970s the international agricultural research centres started to work in the field of farming systems research. The concept was basically an agronomic approach which has been transformed over time into a more complex view in some of the centres. Basic elements of the philosophy can be described as „on-station research“ and „on-farm research“. The objective was to increase production volume and later productivity. Main emphasis was given to the improvement of varieties and/or the introduction of new types of crops. In a later stage, the measurement of the benefits for the farmers under practical conditions gained importance. This was aimed directly at the extension services for dissemination to farmers. This research concept was followed by many local research institutions and external organisations from the 70's until today.

At the beginning of the 80's the concept of production systems allowed the consideration of a wider scale of complexity of production. ILCA for example, followed a production systems approach (JAHNKE, 1982) in livestock, which extended the approach from investigating a single animal to an entire herd and finally to the family which owns the herd. ICRAF (RAINTREE and TORRES, 1987) went a step further and gave special consideration to resources and socio-economic subsystems.

Comprehensive farming systems approaches

The driving force behind the continuous change of what has been understood as the farming systems view in history was the intention of considering the complexity of the real world in which farmers and farm families live and make decisions. There have been many different definitions of the term „farming systems approach“ in the past which have created confusion amongst many scientists but can be explained by the following:

- a) Different levels of systems have been considered, e. g. the micro-biological system in the soil, the soil-water-plant relationship, the cropping system, the crop production system, the farm system, the farm-household system or the village system.
- b) Different levels of complexity have been applied mainly due to a discipline-orientated view, a single commodity, a single objective, a single resource or national objectives approach neglecting farm families' objectives, as well as focusing on production rather than on other areas relevant to the families.

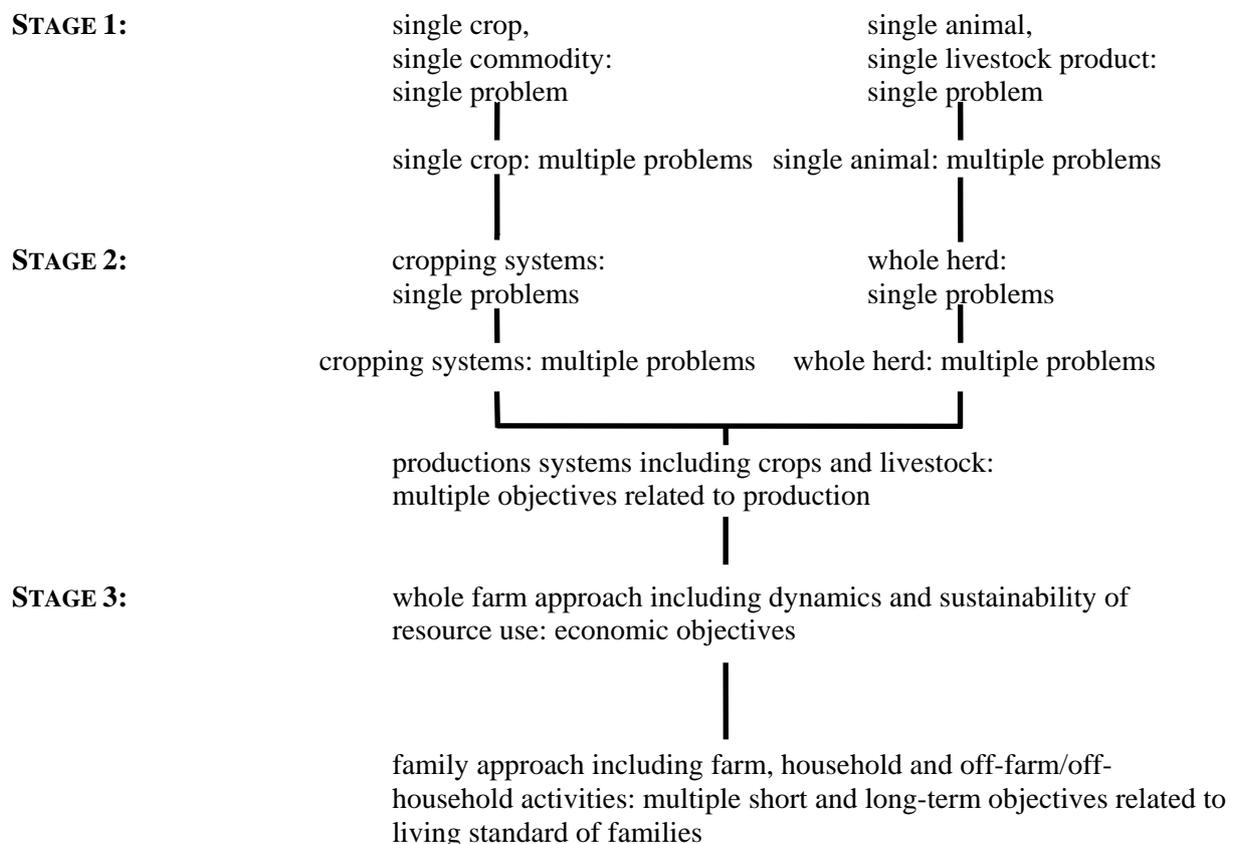
The development in the last 40 years is illustrated in Table 1. Crop or livestock based research developed into a more complex view and is integrated in a farming system which develops in a larger system at various levels over time.

This development of research methodology in the last 40 years has been influenced by strong emphasis on quantitative methods which have contributed much to an increasing degree of separation between highly specialised disciplines. Very soon practical experiences, especially in the tropics, raised the question of who the beneficiaries are, the farmers or the researchers? This was the driving force for a new beginning of a farming systems era. The outcome in the last 40 years shows three main results:

- Crop production experiments were extended to on-farm research and commodity-oriented research shifted to cropping systems followed by production systems including crops and livestock. The whole farm approach showed the relevance of the decision-maker and consequently the discussion included the household, gender issues and external relationships of the family. The importance of the resources and the sustainability of the systems have added another dimension to farming systems research: a vertical dimension starting with the family, then to the village and finally the regional level.
- Parallel to this development the number of disciplines involved in farming systems research has increased and are today far beyond the classical agricultural disciplines. There is no other movement in research, which integrates such different disciplines as for example soil sciences and anthropology.

- Another line of development from the past is the increasing awareness of the role of the farmers. While farmers were excluded at the beginning of farming systems research our discussion of today focus on the issue of participation.
- The clearer these lessons of the past turned out, the more the decision-orientated farming systems approach was developed towards farmers' needs and participation. Systems and systems terminology.

Table 1: From partial to systems approaches: increasing degree of complexity and interdisciplinary



Systems and systems hierarchy

A system is characterised by its elements, their interrelationships and by the definition of the boundary of the system. Under real conditions of agricultural development, open systems are of relevance and this means, that the external relationships of the system under consideration are also included. In reality, systems at each level are inter-linked and often are subsystems of a more general system.

Defining systems in agricultural and rural development requires a clear understanding of the hierarchy of systems. Table 2 gives a rough classification of systems, which will have to be more specific in any type of analysis. This hierarchy indicates that there is a need for taking

into consideration that any system defined will have certain relationships to others. Some of them may have different target groups and hence different objectives. To understand decisions at the family (micro) level, one may need to analyse the setting of the macro environment and vice versa. The cropping system may depend on a certain extent to the microbiological system in the soil and may have specific impacts on the socio-economic system.

Due to this relationships different disciplines have defined „systems“ according to their disciplinary need and it is for that reason, that the term „farming systems“ has been used in the past for a large variety of „systems“. This has often been criticised as a chaotic basis for research, but has also been considered a great potential for allowing different disciplines to come together under one umbrella. It illustrates the openness of systems approaches where researchers from different backgrounds may define the systems from different angles. Reality also may sometimes need a stronger agronomic and sometimes a stronger anthropological component. What is important is a common goal and providing a forum for discussion where disciplines may learn from each other.

What should be considered in defining future systems research methodology?

- (1) There seems to be a need for an holistic approach in which human beings (individuals, society) are at the center. Consequently, all technical subsystems are tools and do not create needs by themselves. The hierarchy of systems will have to be defined accordingly, dominated by the problems and needs of people. This could result in family livelihood systems, village livelihood systems and deal with the livelihood of a region.
- (2) There seems to be an urgent need to give special attention to individuals and institutions that make decisions. They represent the gate to change the real world. Their relationship is of special importance not only in allocation and use of resources but also in the social and cultural sectors. It is not enough to focus on technical innovations only to increase the volume of production. Social and administrative innovations are also needed.
- (2) Livelihood concepts at family, village and regional levels cannot exclude the non-farming community. If farming systems research and extension would follow this strategy we would have to expect a change in future research which would at least be as comprehensive as that which we have experienced in the last 20 years.

Definition of systems in research

Today, the term „system“ in agricultural research and development is used in a very wide sense. Increasingly, there is a common understanding, that farming and rural systems research should focus on those types of systems which consider human beings (individuals and society) as central to the system. Technical systems (e.g. soil sciences, crop production, livestock) are considered as important sub-systems of a wider system in which human beings determine the objectives and decide about the action taken in a system. Thus, the evaluation of any sub-system (e.g. technical system) is based upon its contribution to the benefit of people.

There is not always a clear distinction between the different types of systems in agricultural research and development and this has led to a terminology which often seems confusing. The

following systems seem to be an appropriate set of systems for most of the tasks in agricultural research, extension and development:

Table 2: Hierarchy of systems and research disciplines/fields

Macro systems international (e.g. regional, interregional, national systems)	institutional and agricultural policy, markets and infrastructure, rural development, resource economics, environmental issues
Meso systems (e.g. rural systems, resource-based systems, village livelihood systems)	market, institutional, economic, social and resource development, ecological implications, decision-making, behavioural sciences
Micro systems (e.g. family, farm, household livelihood systems)	behavioural sciences, economics and natural sciences. Integration of sub-systems and of families
Sub-systems (e.g. crop production, livestock production systems)	dominated by natural sciences, especially agronomy, soil sciences and animal husbandry. Integrative elements in crops and livestock
Specific sub-systems (e.g. soil fertility systems)	all disciplines, high levels of specialisation, partial approaches

Family systems

In a family system the family (household head, other individuals or husband and wife, etc.) make decisions according to their objectives. Their decisions are based on their resources and are relevant in sectors where resources are used, for example in the farm (farming community), the household, job outside the household (permanent, seasonal), non-farming enterprise or social activities in the (e.g. village or tribal) society. Family systems are relevant to the farming as well as the non-farming community and are often used as a sub-system of farming and village livelihood systems.

Farming systems

Farming systems are composed of family systems within the farming community and combine the family, village and regional levels. Central to the farming systems philosophy is the decision-making level of the farming families as well as social bodies/institutions of the society at the village and regional levels. As a consequence, all disciplines related to farming will have to contribute while final decisions will be based on the needs of people (individuals and society).

Village livelihood systems

Village livelihood systems are composed of family systems for farming and non-farming families and include the social level and institutions in a small community as well as its relationship to the families. Resource availability and allocation, infra-structural constraints and potentials in a village, social organisations (e.g. self-help groups) as well as socio-cultural regulations and values are fields which relate the individual family to the village community and determine decision-making processes at either level.

Rural systems

Rural systems are composed of family systems and village livelihood systems and include all institutional and administrative bodies at the regional level as well as social organisations and socio-cultural regulations. Rural systems comprise the farming and non farming community. Like village livelihood systems, rural systems consider resource availability and allocation at the regional level (e.g. irrigation water in a perimeter), infra-structural constraints and potentials (e.g. roads, electricity, access to land), social organisations (e.g. self help groups, local markets, local landownership regulations) as well as socio-cultural regulations and values as the framework in which families make decisions and are related to the decisions of institutions in the rural area.

Agricultural systems

The definition of agricultural systems ranges from all kinds of systems in agriculture at all levels to restriction to crop production only. Since the term „Systeme Agraire“ in the franco-phone zone is more equivalent to farming and rural systems, agricultural systems will be defined here as those closely related to production. Following this, agricultural systems comprise crop and livestock production at the farm level, production systems aggregated at the village, regional and national level, include marketing at the regional and national level and deal with the contribution of agricultural production to the national food supply and economy. Agricultural systems deal with agriculture only and focus strongly on production and on national market aspects. As compared to farming systems, the socio-economic behaviour and decision-making at family and village level is neglected. Agronomy, livestock, marketing and national economics are the dominant disciplines.

Common to all systems are the following three dimensions:

- the vertical dimension includes levels from farm to family to village to region and to the national level,
- the horizontal dimension includes linkages between production, subsistence consumption, markets for inputs, outputs and resources,
- the development over time includes aspects of sustainability

Terminology in systems research and extension

The terminology in farming systems research often led to some confusion in the past. FAO and authors of FAO publications (1989, 1992 and FRIEDRICH and HALL, 1990) present a consistent terminology which is practicable and meanwhile often used.

Farming/rural systems development (FSD/RSD):

This terminology refers to practical development e.g. in the real world of a development projects. It is not considered a terminology in research.

Farming/rural systems approach (FSA/RSA):

The systems approach provides the philosophy, the concept and the strategy for developing and introducing solutions offered to families, communal and regional decision-making bodies to solve problems at farm, household, family, village and regional levels. Analyses of development of these systems, the development of solutions to problems and the modelling and measuring of future impacts of changes requires the combination and integration of approaches and methods developed at various levels. This terminology is used in research as well as in extension under practical conditions, e.g. in development projects.

Farming/rural systems methodology:

These terms refer to the methodology in research. Farming/rural systems analysis (FSA/RSA): *This* comprises the analysis of past development and the current situation to better understand the development, the reasons for the specific development and the problems which exist today and should be solved in the future. An important part of FSA/RSA is the view of the people concerned (target groups) with respect to their problems, their priorities to solve these problems and their possible contributions. Farming/rural systems planning (FSP/RSP): This term refers also to the methodology. It comprises the future development. Modelling and planning the development of farms, families' benefit and rural resource use are central issues. Systems impact analysis (SIA): This term refers to methodology too. It comprises the measurement of the impact of solutions developed for solving problems of target groups on the living standard of individuals and the socio-economic development of the society. It often comprises the modelling and simulation of future development with and without intervention.

Farming/rural systems activity levels:

This terminology refers to institutions, which carry out activities in systems research and extension following systems approach and methodology.

Farming/rural systems research (FSR/RSR): Research institutions or researchers follow the systems approach and apply the respective methodology in their research. It is expected that the results will be provided to the extension service.

Farming/rural systems extension (FSE/RSE): An extension service follows a systems approach. It is expected that the service uses the results of the research institutions.

Farming/rural systems management (FSM/RSM): Systems research as well as systems extension is combined in one institution, which is equally responsible for research and extension.

Farming and rural systems

The rationale

The development of a region is heavily determined by decisions at the micro (family), village (or similar sub-regions) and regional levels. Decisions are made in light of the needs and objectives of the decision-makers and the availability of resources and constraints. Differences between the three levels in these issues can lead to conflicts which are often related to objectives and resource use. To understand and model the decisions and linkages at and between all levels, an integration of the micro, village and regional level in a systems concept is suggested. Such a concept has to be an interdisciplinary approach. As far as this concept includes only the farming community we deal with a *farming system*. As soon as the concept is extended to include the non-farming population as an internal part of the system, we consider this as a *rural system*.

Since human beings with their objectives and decision-making are central to this philosophy it can be defined as a decision-oriented farming systems view. The approach can be described as follows:

- a) It is a *holistic approach* which applies and uses knowledge and experience in systems theory and existing practical knowledge and the experience of the local people concerned (e.g. target groups). It includes the following:
 - *horizontal relations*: farm, household and off-farm/off-household activities are tools of the families which make decisions according to their needs;
 - *vertical relations*: decisions are made at family, village, regional and national levels and are related to each other especially with respect to resources, administrative regulations and social norms;
 - the *relation to time (dynamics)* of the systems relate to sustainability and improvement of the living standard,
- b) It is a *behavioural approach* which takes into account the objectives and values of the farm families and their decision-making process. It includes the following:
 - structure and responsibility of *decision-making* within a family and its relation to village (or clan, tribal) and regional level decisions

- *objectives* and decisions: families make decisions according to their objectives which result from their view of their problems under the physical, economic, social and cultural conditions given. Gender issues play specific roles.
- a *participatory element*: this ensures that the needs and objectives of the target group will be considered when problems are defined and solutions are developed, tested and evaluated for their impact on rural development. Such a view surpasses the top-down concept and gives room for a bottom-up strategy or elements of it.

An ideal concept helps to clarify the definition and the objectives of the concept, but has to be seen under the conditions of the real world. The farming/rural systems approach is meant to move towards an ideal situation and concept. The reality may never reach the ideal situation but can be defined according to the stages and levels reached (see DOPPLER, W. 1994, page 69). At least it allows defining areas of deficit in the farming systems concept. The farming and rural systems consist of three sub-systems: the farm family system, the village livelihood system and the regional system.

Farm family system

Decision-making oriented research considers the family, the farm and household as one system. Those who make decisions about the farm and the household do so in light of their problems and objectives. The family owns resources (e.g. family labour, land, own assets). Allocation of resources follows the objectives and refers to the use on the farm, the household or off-farm/off-household activities (Figure 1). The different sectors where the family makes decisions are defined by its internal relationships (Figure 2).

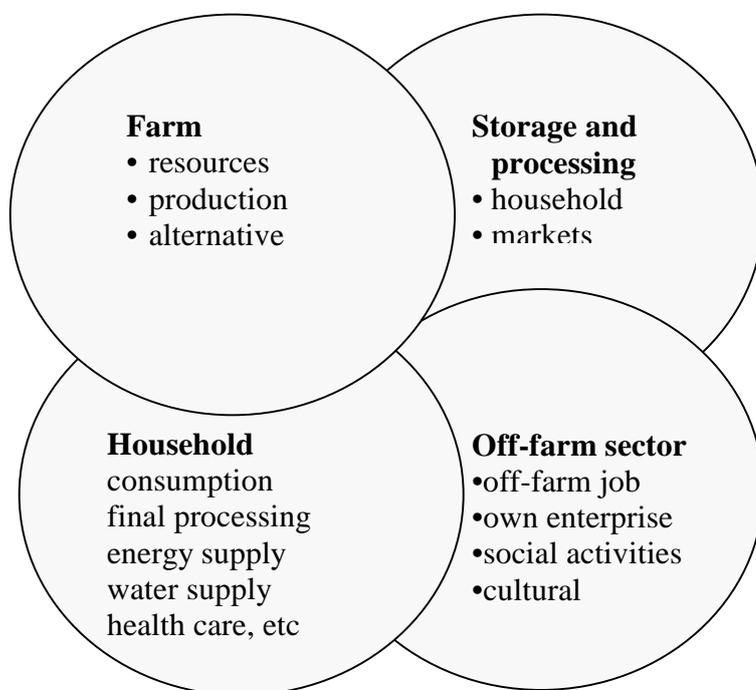


Figure 1: Sectors of family decision-making and resource allocation

Furthermore, the family may be able to acquire resources from outside or give resources to the outside world. Inputs for production, processing, storage, household and family supply may come from the outside world and products and services may go out of the farm and family. This is characterised by the external relationships of the family as given in Figure 3.

Any assessment of innovations or problem-solving strategy must measure its impact on the needs of the decision-makers. Sustainability of development is only feasible if innovations, activities and measures meet the short and long-term objectives of the decision-makers. Uncertainties when making decisions and risk as soon as actions are taken are central issues of the assessment.

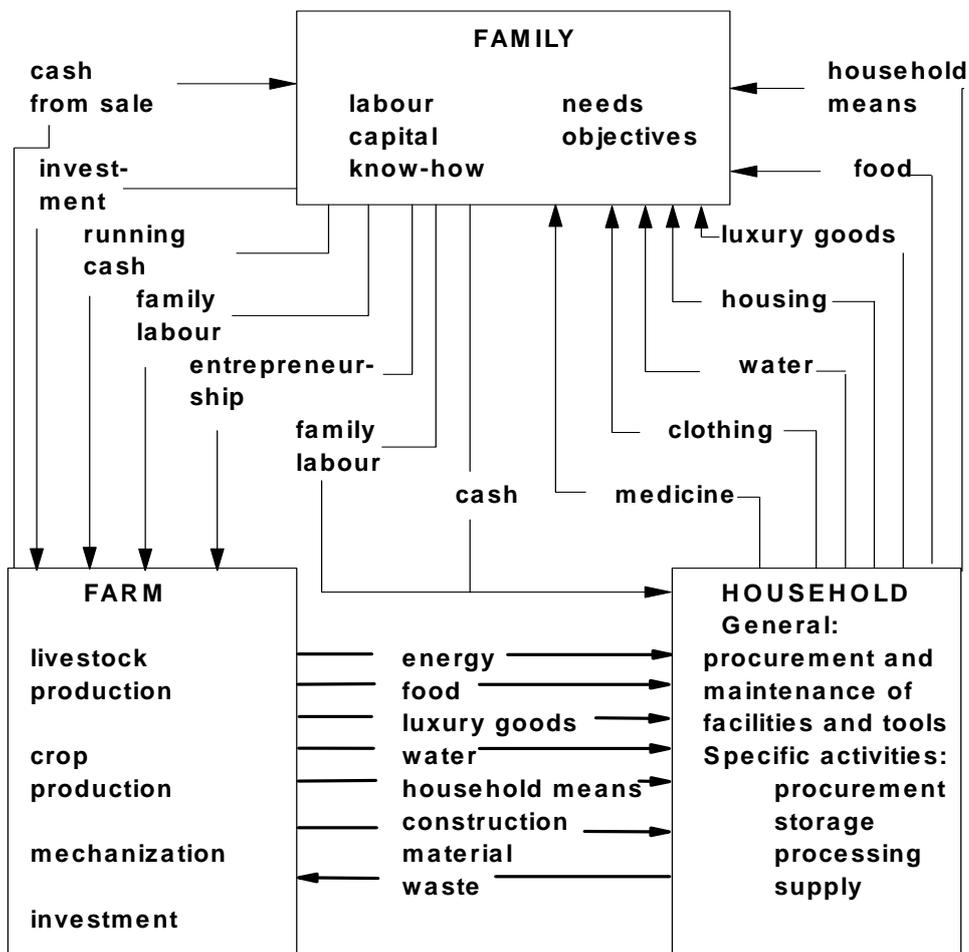


Figure 2: The internal relationships in a farm-household-family system

Village livelihood system

The village system is higher in hierarchy than farming systems and lower than regional systems. The central components are as follows:

Living standard of individual families

The village or communal system comprises all families living in the location. The village systems approach deals with the village livelihood systems by focusing on the living standard of the single family as well as on a comparative approach of the different social groups in the village. The farming systems approach, therefore, has to be extended to non-farming families who may run a company or private business, work as permanent labourers or officers in services (Figure. 4). The same principles are relevant as described in the farming systems approach.

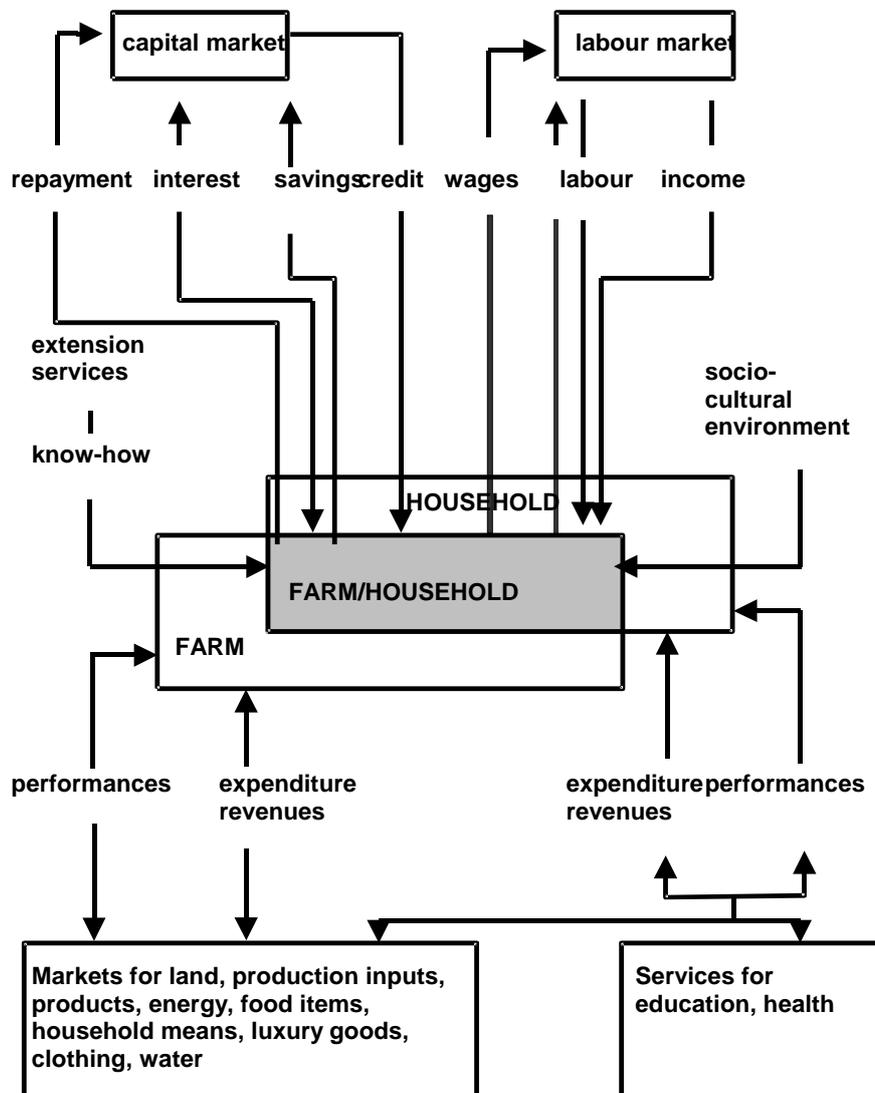


Figure 3: The external relationships in a farm-household-family system

Common village resources

Common village resources comprise the physical, socio-economic and social infrastructure, including rights of access to resources, services and markets (Figure 4). Decision-making concerning investment and changes, as well as on the use of the resources at village level is the responsibility of the village society. Who represents the society depends on socio-cultural and political conditions.

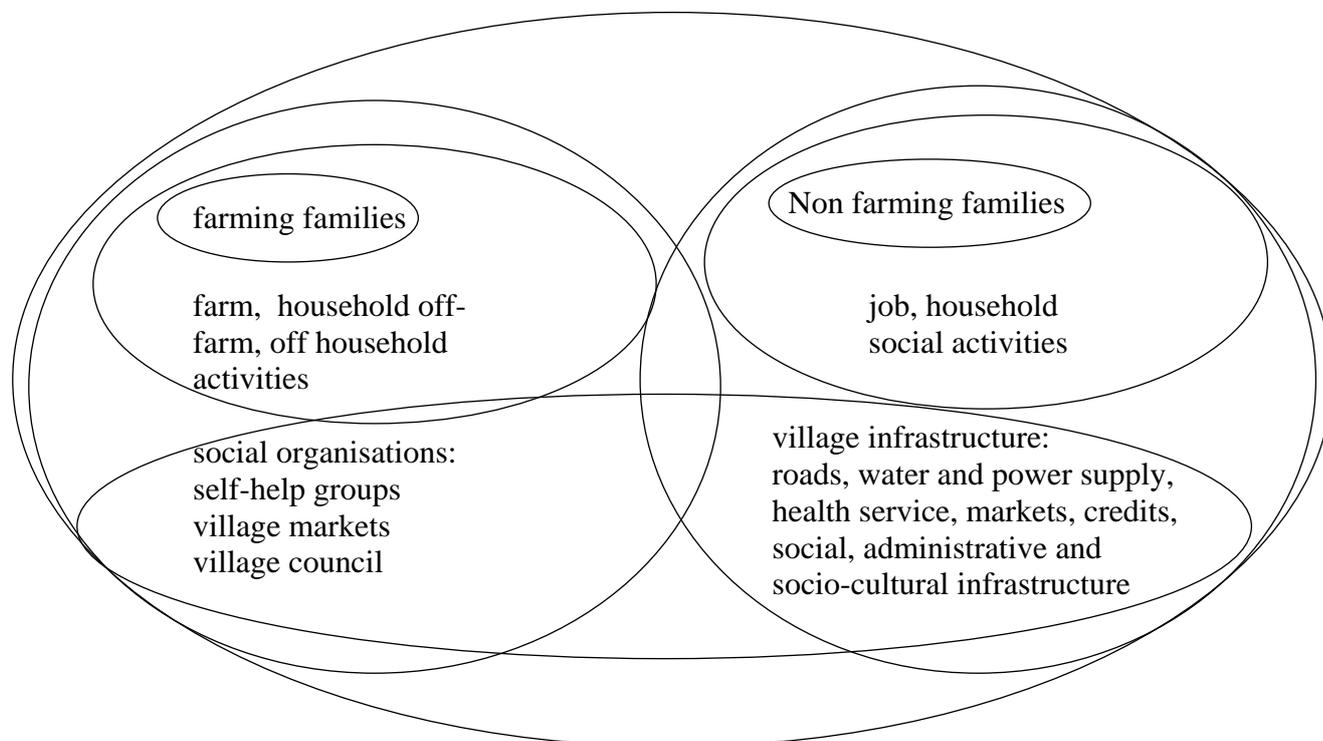


Figure 4: The village system

The analysis of village resources, their use, their relationship to individual families as well as their linkage to the regional level, includes availability, use and responsibility for village resources such as physical infrastructure (e.g. water supply, electricity supply, irrigation water distribution network), socio-economic infrastructure (e.g. local marketing system, communication system) and the social infrastructure (e.g. child care, health care). In addition, organisations (e.g. self-help groups, non-governmental organisations, services, co-operatives, water users associations, social groups), institutions (e.g. religious groups, extension services, communal administration, banks) as well as socio-cultural regulations such as norms, sanctions, taboos and religious, ritual and spiritual celebrations will have to be considered as desirable or given constraints.

Regional and rural systems and decision-oriented approaches

Most of what have been considered as regional approaches in the past are in fact partial approaches. Land use systems approaches, regional water management approaches or regional organisation of services are typical examples in which a single resource dominates. Modern regional systems include physical, economic, social, administrative and cultural aspects in a complex concept that can be compared with the decision-oriented farming systems approach

at a higher aggregation level. As a consequence, a decision-oriented regional development approach includes:

- the three levels of decision-making: families, village and regional decision bodies;
- all resources relevant simultaneously;
- a wide range of different disciplines.

Regional systems include village and farming systems as subsystems and are at the same time subsystems of the national system. The definition of a region is flexible and may refer to a geographical, administrative, tribal or rural zone. The central components of a regional systems approach are as follows (Figure 5):

- Aggregation of all village systems in the region as described above including the relationships and linkages between them.
- Regional markets, physical, social and administrative infrastructure, private companies and organisations and their linkages to the communal societies, resource availability and use as well as external regulations.
- Regional environmental systems and resource availability and use with reference to the level or social group which decides on resources. Different needs and objectives at the family, village and regional level may lead to conflicting situations in allocation and use of resources which may result in restrictions in the degree of freedom of decisions at different levels.

In analysing these components and their relationships within a systems approach, it is possible to capture the living standard of individual families and livelihood in the society, resource management and sustainable resource use as well as regional development policies. Farming systems development has to be seen as a part of regional development from the micro as well as from the macro point of view. In reality, in a region various types of farming systems will be found which can be analysed following farming systems research *sensu stricto*. Their quantification of the impact of innovations on various groups of systems allows the elimination of negative effects of certain innovations on specific farming systems and an estimation of the potential innovation and system with the highest possible adoption.

Constraints and potentials

The most relevant *constraints* in applying such system approaches are as follows:

- a) Systems approaches require comprehensive information. If the traditional way of collecting information is followed, the input required may often be too expensive to provide. The following would be needed:
 - reduction of the volume of information per family by clear definition of methodology used, by applying informal surveys before comprehensive collection of information and by differentiation in key information and those of second importance.
 - reduction of number of families interviewed by following multi-stage strategies and reducing numbers of interviews when the information is of less importance.

- b) Systems approaches and the complexity of methodological and empirical knowledge require comprehensive knowledge in the methodology of quite a number of disciplines. Training is required to widen the scope of methodological knowledge.

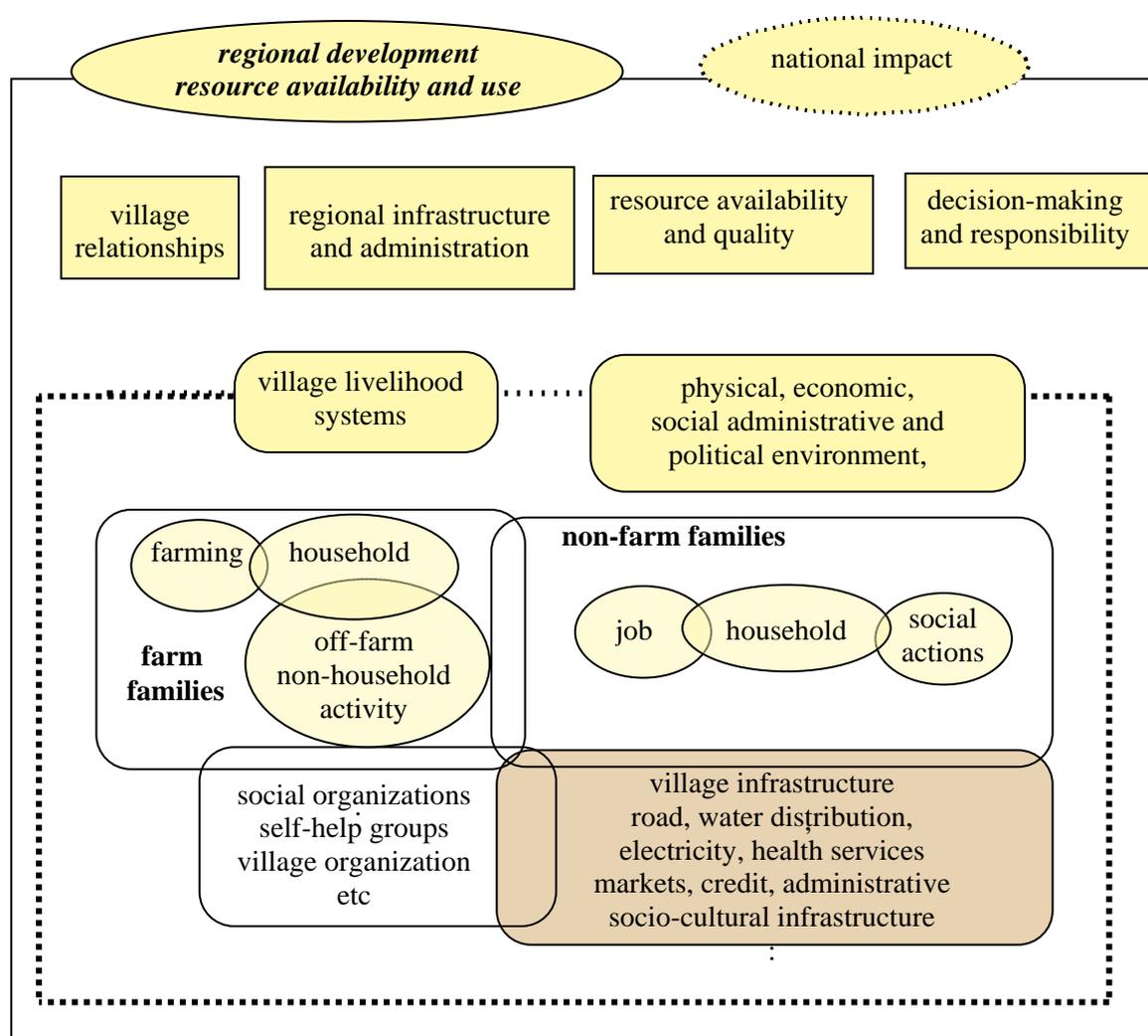


Figure 5: Components and hierarchy of systems in rural development

The *potentials* of the farming/rural systems approach can be considered as follows (see DOPPLER, W., 1994, p. 75ff):

- Better understanding of the decision-making process in a farm family and consequently extension services will offer more realistic solutions to farmers whose adoption rate of innovations provided will increase.
- Better understanding of farmers' environment and relations to conditions determined at the village and regional level with special reference to resource availability, allocation and infrastructure.
- Policy impact analyses provides more realistic information about farmers' reaction to alternative policy decisions.

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