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THE EVOLVING PARADIGM IN AGRICULTURAL RESEARCH AND EXTENSION - A COMPARATIVE ANALYSIS IN NEPAL AND THAILAND

By

Devendra Bajgain

A DISSERTATION

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ABSTRACT

THE EVOLVING PARADIGM IN AGRICULTURAL RESEARCH AND EXTENSION - A COMPARATIVE ANALYSIS IN NEPAL AND THAILAND

By

Devendra Bajgain

This study focuses on both conceptual and empirical aspects of the new systemic paradigm in agricultural research and extension. First, based on an extensive review of literature, the following six defining features or conceptual characteristics of the new systemic paradigm were identified: (1) systematic descriptions and analysis of the components of the farm and the linkages among them; (2) farm client partnership with researchers and extensionists; (3) collaborative multidisciplinary research; (4) environmental and common property integrity; (5) gender integration; and (6) sustainability considerations. Then, a field study was conducted to empirically test the extent to which the above six key conceptual dimensions of the new systemic paradigm have been operationalized by several farming systems research (FSR) organizations in Nepal and Thailand.

A survey of FSR programs of four organizations -- Central Farming Systems and Outreach Research Division (CFSORD) and Pakhribas Agricultural Center (PAC) in Nepal, and Farming Systems Research Institute (FSRI) and Khon Kaen University (KKU) Farming Systems Research Project (FSRP) in Thailand was conducted. Program documents and reports were also collected and a content

analysis was made of the identified key variables. Both qualitative and quantitative data analyses have been performed.

The results showed that all four FSR programs studied fit the ideal model of the new systemic paradigm only partially; but none of them totally fit the model. The actual situations in all four FSR programs seemed to partially fit the following four characteristics: (i) systematic description and analysis of the components of the farm and the linkages among them; (ii) farm client partnership with researchers and extensionists; (iii) collaborative multidisciplinary research; (iv) sustainability considerations. None of the actual situations in the four FSR programs seemed to include the other two variables: (v) environmental and common property integrity and (vi) gender integration.

These findings suggest that the new systemic paradigm in agricultural research and extension is struggling to emerge. It is unfolding gradually. However, the six conceptual dimensions of the new paradigm identified in this study seem to be workable dimensions of the paradigm.

Dedicated to my beloved parents:

Pashupati Nath Bajgain
and
Punya Devi Bajgain

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LIST OF ABBREVIATIONS

AEA:	Agro-Ecosystems Analysis
AFS:	Agro-Forestry Systems
CFSORD:	Central Farming Systems and Outreach Research Division
CSP:	Cropping Systems Program
DOA:	Department of Agriculture
EIA:	Environmental Impact Assessment
FSDRO:	Farming Systems Development Research Office
FSIR:	Farming Systems and Interdisciplinary Research
FSP:	Farming Systems Perspective
FSR:	Farming Systems Research
FSRE:	Farming Systems Research and Extension
FSRDD:	Farming Systems Research and Development Division
FSRI:	Farming Systems Research Institute
FSWG:	Farming Systems Working Group
FY:	Fiscal Year
IARC:	International Agricultural Research Center
ICP:	Integrated Cereals Project

IDRC:	International Development Research Council
IRRI:	International Rice Research Institute
IPM:	Integrated Pest Management
KKU:	Khon Kaen University
KKU-FSRP:	Khon Kaen University-Farming Systems Research Project
KU:	Kasetsart University
MOA:	Ministry of Agriculture
MOAC:	Ministry of Agriculture and Cooperatives
MUA:	Ministry of University Affairs
NARC:	National Agriculture Research Center
NARC:	Nepal Agricultural Research Council
NARES:	National Agricultural Research and Extension System
NARS:	National Agricultural Research System
ORP:	Outreach Research Program
PAC:	Pakhribas Agricultural Center
PSU:	Prince of Songkhla University
ODA:	Overseas Development Administration
USAID:	United States Agency for International Development

I. INTRODUCTION

This research involves: (1) conceptualizing a new systemic[1] paradigm[2] for agricultural research and extension in terms of its key defining characteristics and (2) empirical testing of the conceptualization.

Based on an extensive review of literature, the following six key defining features or conceptual characteristics of the new paradigm were identified: (i) systematic description and analysis of the components of the farm and the linkages among them; (ii) farm client partnership with researchers and extensionists; (iii) collaborative multidisciplinary research; (iv) environmental and common property integrity; (v) gender integration; and (vi) sustainability considerations.

An empirical study has then been conducted to compare the extent to which this current conceptualization fits the actual situations in formal farming systems research (FSR) organizations in Nepal and Thailand. More specifically, using the case study approach, four FSR programs (two from each country) have been studied in terms of the extent to which they have introduced, organized and applied the

[1] The term "systemic" in this dissertation is used synonymously with "systematic" or dealing with the significant components of the whole system being described.

[2] The term "paradigm" in conjunction with the word "new" or "systemic" is used in this dissertation to refer to a fundamental model or scheme that systematically conceptualizes the variables and issues relating to agricultural research and extension in terms of changing views, needs and requirements.

above six key defining dimensions of the new systemic paradigm.

1.1 Statement of the Problem:

The highly specialized or commodity-focused and productivity-centered agricultural research and extension systems have had a significant positive impact on total world food production. However, a number of problems related to environmental degradation, unsustainable production and socioeconomic disparity have emerged. The realization is increasing that some of the progress in agricultural productivity is being achieved at the cost of long-term degradation of biophysical environments. Thus, the prevailing reductionist, positivist, commodity-focused, and productivity-centered paradigm in agricultural research and technology transfer is becoming inadequate. Literature abounds explaining the drawbacks of the conventional models of technology transfer (e.g. the "top-down" centralized model) that have been used in many developing countries (Axinn, 1988; Chambers and Jiggins, 1987; Norman, 1986; Rogers, 1986; Roling, 1990; Whyte, 1986; Whyte, 1991).

Moreover, as pointed out by Axinn (1991a), the researcher-oriented paradigm has basically focused on large-scale, high-input, specialized, market-oriented commercial agriculture. The small-scale farmers who are responsible for the bulk of food production in most developing countries have been relatively neglected. Coward (1987) notes that the production increases based on intensive inputs have increasingly been ecologically and economically unsustainable over time. Further, as agriculture involves complex interactions between farming, environmental, socio-economic, cultural, political and technological systems, the potential of the positivist, reductionist approach -- one discipline at a time--may have run its course.

The prevailing paradigm is not sufficient to: i) consider the mixed-farming needs of the vast majority of small-scale resource poor farmers worldwide; ii) deal with the concepts of complexity and environmental diversity of farming systems; iii) comprehend the emerging environmental problems and issues of ecological stability and sustainability of production; and iv) deal with the interconnectedness of these needs, concepts, problems and issues. In this context, several scholars including Axinn (1991a); Bawden (1991); Coward (1987); Dahlberg (1986); and Wilson and Morren (1990) have clearly indicated an urgent need for development and application of a new systemic paradigm for agricultural research which identifies, analyzes, and comprehends the complexity and diversity of the ecological and socioeconomic conditions of farming clients.

The need for a new paradigm to deal with the above indicated problems, challenges, and changing needs has encouraged creative thinking and restructuring of agricultural research and extension systems in several countries. Moreover, the need is increasingly recognized as post-green revolution problems are recognized. A new paradigm based on a systems approach to include whole farming systems and their relationships to their environments may be needed. This new paradigm in agriculture research and extension is emerging throughout the world. For example, farming systems research-extension (FSRE) which is based on systems approaches is being developed and applied in many parts of the world. The Association for

Farming Systems Research/Extension (global) and the Asian Farming Systems Association are each publishing journals.

In this context of its early development, it is important to conceptualize the defining dimensions or characteristics of the new paradigm and to test how the conceptualization fits real world situations. This study of farming systems research and extension (FSRE) is a step toward these endeavors.

1.2 Rationale of the Study:

Since the new systemic paradigm is in an evolving stage, it is dynamic and has been defined, organized and applied in many different ways in different places. For example, although a systems approach is applied to FSRE, there are various models of FSRE, and components and criteria vary from place to place. Models of systems approaches to agriculture research and extension are being developed, applied and modified differently among Asian, African, European, Latin American and North American countries. A systems approach is also applied to agro-forestry systems (AFS) and agro-ecosystems analysis (AEA). In some countries, a new systemic approach for the application of science to agriculture is being developed which considers wholeness of the systems, environmental components, ecological stability and sustainability aspects of production, and participative, collaborative multi-disciplinary research systems.

Using the "episystemic" concept for systems thinking and practice in agriculture, "systems agriculture" has been developed at Hawkesbury College at the

University of Western Sydney in Australia. The essence of the Hawkesbury systems agriculture approach is the notion of the creation of "action researching systems" in which people collaborate to critically explore complex problematic situations with the aim of creating change that is socially desirable, culturally feasible, and ethically defensible (Bawden, 1991).

Conceptualization and identification of broadly applicable key components of the new systemic paradigm is the essence of this dissertation. Data from the field compares the extent to which the new paradigm has been introduced, organized and applied in various parts of the world. This study includes a comparative analysis of the new paradigm in agricultural research and extension in Nepal and in Thailand.

The study identifies and compares the components and criteria included, as well as institutional settings and strategies used for introducing, developing and applying the new paradigm in the two countries. Therefore, the findings can serve further development and improved application of the paradigm in these countries. The institutional characteristics which are identified in this study may be useful for future scholars to understand the institutionalization process over time. The findings may also be useful in introducing, organizing, and implementing farming systems approaches in other countries to better meet the needs of small scale mixed farming families and thus reduce rural poverty.

In sum, this study attempts to make both conceptual and empirical contributions.

1.3 Objectives of the Study:

The general objective of this study is to conceptualize a new systemic paradigm for agricultural research and extension, and to determine the extent to which it has been understood, experimented with, and implemented in formal organizations in Nepal and Thailand.

The specific objectives are:

(1) To define the new concept in terms of its most significant variables.

(2) To describe and analyze the performance dimensions of the paradigm among organizations in the two countries.

(3) To compare organizations with regard to such characteristics as the extent to which they have operationalized various components of the new paradigm.

1.4 Conceptualization of the New Paradigm:

As the post-green revolution problems are increasingly recognized in many countries, the highly specialized, commodity-focused and productivity-centered agricultural research and extension paradigm is becoming inadequate. Axinn (1991b) suggests there is a growing need for confronting widespread environmental problems and achieving ecological sustainability. There is also a need to maximize agriculture's internal resources to ensure affordable and sustainable gains in agricultural productivity with the implementation of new approaches. A new paradigm which includes whole agriculture systems and their relationships to their environments is emerging across the globe.

Traditionally, agricultural research and extension (i.e. agricultural technology generation and diffusion) have been organized separately. The essence of the new paradigm is a systems approach which includes participative, collaborative action research systems (Bawden, 1991) and involves a three-way team of farmers, researchers (from different disciplines) and extension workers (Axinn, 1991a). By involving farming clients as active participants and partners in research, extension, and information exchange processes, the new paradigm combines these two concepts (i.e. generation of technology and transfer of technology) and treats them as an integrated function.

The new paradigm posits that if farmers are to benefit, agricultural research must be farmer-oriented rather than researcher-oriented. It recognizes the need for a shift from "technology push" to responding to "farmer needs" (Conway, 1987). Here, the major concern is to conduct the entire research in farmers' fields involving farmers in the whole research process. This system not only avoids the "yield gap" (between research station and farmers' fields) but also promotes farmer-desired technological innovation and its transmission.

In the systemic paradigm, farming clients are not viewed as passive receivers of expert knowledge or technology developed by researchers. The role of researchers and extension workers changes from that assumption (which is most often found in "top-down" organizations). The new paradigm recognizes that the top-down "packaged" technology transfer system is inappropriate for sustainable evolution of agricultural technologies. The new approach, by integrating farmers into the whole research system and incorporating their criteria for judging technologies, not only greatly increases the probability for the adoption of new technologies, but makes the need of a separate technology transfer function less necessary. The systemic paradigm focuses on technology evolution and adoption, not just technology transfer. Here, the extensionist serves as a "carrier" of information and "facilitator" who will link client groups with researchers.

In other words, extension's primary function becomes "networking" to help achieve communication, awareness, coordination and cooperation between researchers, farming clients and relevant agencies. The networking between these groups contributes to problem identification, research program development and implementation. The new paradigm is also "centered on local governance" (Coward, 1987) and emphasizes the strategy of local empowerment. It creates ways for farmers to have substantial impact and control on the entire research system.

One of the major benefits of the new paradigm is that it eliminates the 'separate' traditional top-down technology transfer model by merging the technology generation and diffusion process together. By the time a technology is developed, it is already known, understood, experimented and experienced by farmers, both men and women. Because technological innovation is based on farmers' needs and criteria, farmers play an active role as problem identifiers, collaborators (in the research process), and experimenters, testers and evaluators of technological innovation. The traditional role of extensionists is technology transfer, diffusing researcher-oriented and research-station-developed technological innovation to farming clients. Here it changes to a role of networking and building collaborative relationships between farmers and researchers.

The new paradigm has the potential to contribute not only to rural-agricultural development but also to a more balanced urbanization in developing countries. Users of the paradigm may contribute to rural family livelihood by improving diversification and sustained productivity of small, mixed farms. This can strengthen rural-urban linkages, such as the flow of production surplus, labor utilization and income distribution.

In some developing countries, contemporary problems of rural-urban migration have been mitigated by the lack of an appropriate agricultural research system to address the problem of production in small, mixed farms -- practiced for survival by the majority of rural people. The large number of rural people who migrate to urban centers tend to be those who could not solve these problems. The commodity-focussed and productivity-centered paradigm in agricultural research has tended to provide benefit only to large scale, commercial farmers. This contributed to encouraging more small scale farmers to join the stream of rural-urban migration to big cities. The new systemic paradigm has the potential to reverse this trend by focussing on improving and sustaining production of small, mixed farms and thus creating profit and employment for rural people -- thereby reducing the need for migration to cities for employment and survival. In other words, since the new paradigm is oriented towards diversification, sustainability, equity and redistributive objectives, implementation of the new paradigm might lead to more balanced urbanization in some countries.

Moreover, the new paradigm has the potential to:

(1) recognize that consumption needs of the vast majority of small-scale farmers may be more appropriate goals than production targets;

(2) realize that improvements in diversified farming systems can be made in order to improve the consumption and production system of small-scale farmers and also to sustain ecological diversity;

(3) realize the need to maintain long-term production at a desired level as well as sustain ecological diversity;

(4) recognize that current agricultural practices as well as misuse of common property resources may have long-term negative impacts on biophysical environments; and

(5) recognize that women do much of the work on the world's farms, and therefore include gender roles and activities in analyzing the farming systems and especially in generating and implementing technological innovations.

The new paradigm differs from the prevailing approaches in a number of respects, but particularly in its capacity to comprehend the complexity and diversity of the whole farming system, including environmental and sustainability factors. As pointed out by Bawden (1991), the systemic ideal is for strategies of intervention that lead to improvements to whole systems and to their relationships with their environments. The new paradigm embraces the notions of wholeness, participative research with built-in technology development and transfer systems, integration of common property resources and environmental integrity, awareness of gender involvement, and focuses on the issues of stability and sustainability.

Based on an extensive review of relevant literature, the following six key conceptual characteristics or defining dimensions of the new paradigm have been identified as: i) systematic description and analysis of the components of the farm and the linkages among them; ii) farm client partnership with researchers and extensionists which usually includes on-farm activity; iii) collaborative multi-disciplinary research; iv) environmental and common property integrity; v) gender integration; and vi) sustainability considerations. These six components are identified here as a means of capturing "wholeness" of the systemic paradigm. These are also used as variables for the empirical part of this study which looks at how nearly the actual situations fit the conceptual dimensions indicated above.

1.5 Organization of the Dissertation:

Chapter one of this dissertation has included introductory information, statement of the problem, rationale of the study, the objectives of the study and the conceptual definition of the new paradigm. Chapter two reviews literature on the farming systems research (FSR) movement as well as on the key defining dimensions or conceptual characteristics and relevancy of the new paradigm. Chapter three describes the research design and methods including: study design, operational definitions and measures of the key variables, selections of research sites, data collection instruments, data collection process, and data analysis approach.

Chapter four presents descriptions of the four FSR cases. First, the chapter presents a general background of FSRE in Nepal and in Thailand. Then, it describes the four FSR organizations/programs studied for this dissertation: Central Farming Systems and Outreach Research Division (CFSORD), Pakhribas Agricultural Center (PAC), Farming Systems Research Institute (FSRI) and Khon Kaen University-Farming Systems Research Project (KKU-FSRP). Chapter five presents an analysis and discussion of the findings regarding these four cases.

Chapter six includes the summary, conclusions and limitations. Chapter seven contains implications for policy and recommendations for future research.

II. LITERATURE REVIEW

The objective of this chapter is to present the essence and conceptual details of the new paradigm as well as to generate information for operational definitions and measures of the six key variables for empirical testing.

This chapter is divided into two sections. The first section of this chapter reviews literature on the farming systems research (FSR) movement. As the empirical part of this study focuses on several FSRE programs, reviewing literature on FSR movement seem very relevant here. The second section reviews literature on the conceptual characteristics and relevancy of the new systemic paradigm. The focus is on further clarification of the six key conceptual characteristics or defining dimensions of the new paradigm identified in Chapter 1, which have been treated as the major variables in the empirical part of this study.

2.1 Farming Systems Research (FSR) Movement:

FSR is a part of a long history of rural development movements. It arrived on the scene after production campaigns to promote "modern agriculture", the community development movement and integrated rural development (Tripp, 1991).

The shift of emphasis toward farming systems and farmer participation began to develop in the 1960s in various areas of the developing world (Whyte, 1991). However, FSR as a strategy for conducting agricultural research began in the mid-1970s. The FSRE approach stemmed from the realization that: (i) the commodity improvement approach was not sufficient to increase peasant productivity, and thus, mixed cropping and intercropping had to be considered (Flora, 1992) especially for making small-farm agriculture more efficient; (ii) more Green Revolutions were not in prospect; and (iii) innovations proposed by agricultural researchers for extension were, rather often, simply not adopted or were adopted only in a partial or modified form (Simmonds, 1985). Moreover, as indicated by Tripp (1991), marked inefficiency in planned agricultural change became one of the principle reasons for the growth and development of the FSR movement. Research efforts in many parts of the world began to emphasize the complexity of local farming systems and the need to understand farmers' criteria in adopting or rejecting new technology (Tripp, 1991).

According to Flora (1992), although the origins and the emphases were different, based on the setting in which FSRE approach evolved, it was marked by a broad approach to identify potentials and limitations, with emphasis on the system rather than a single commodity. Further, concern was directed to limited resource farmers rather than large-scale commodity producers. In Asia, where land is a limiting factor, agronomists led the cropping systems approach, seeking to use the biological potential of the farm to increase total productivity on a given land area (Flora, 1992; Harwood, 1979). In Africa, climatic uncertainties led to increasing appreciation of complex strategies of risk reduction based on farmer knowledge

(Norman, 1971). And in Latin America, where peasants were more market oriented, a growing appreciation of peasant strategies to avoid market risk forced a radical rethinking of the development and extension of agricultural technology (Hildebrand, 1976; Flora, 1992).

Several concepts are included as key ideas in organizing and conducting FSR. For example, Merrill-Sands listed several key concepts in FSR: "(i) FSR is farmer-oriented, (ii) FSR is systems-oriented, (iii) FSR is a problem-solving approach, (iv) FSR is interdisciplinary, (v) FSR complements mainstream commodity and disciplinary agricultural research; it does not replace it, (vi) FSR tests technology in on-farm trails, and (vii) FSR provides feedback from farmers" (Merrill-Sands, 1986:89-91).

Tripp (1991) indicate that since the appearance of FSR in the mid-1970s as a strategy for conducting agricultural research,it has been taken up in various forms by international research organizations, donor agricultural programs and projects, and national agricultural research systems. Although the FSR principles and purposes (e.g. systems orientation, focus on resource-poor farmers, interdisciplinarity, farmer participation, on-farm activities) generally remain common, the methods used to pursue the goals differed greatly (Hildebrand and Waugh, 1986; Tripp et al. 1991). Additionally, the term "farming systems" was applied to several different activities being developed around the world (Hildebrand and Waugh, 1986). Consequently, various terms and synonyms have been used for institutional trademarking or other reasons. Plucknett et al. (1986:3) wrote: "there is a serious need for clarification and standardization of FSR terms, and the coinage of new terms should be avoided". Several other FSR scholars (e.g. Beets, 1990; Merrill-Sands, 1986; Simmonds 1985) have also expressed this need for clarification and standardization of FSR terms and concepts in order to avoid misconceptions and misinterpretations.

In recent years, several scholars (e.g. Axinn, 1991a; Gibbon, 1992; Norman, 1980; Plucknett et al. 1986; Tripp, 1991; Tripp et al. 1991) have recognized that the principles and practice of the systems approach, e.g. FSRE, are being gradually accepted into research and development systems. However, they also rightly point out that an important step forward has been the evolutionary development of the concepts and approach and the embracing of new directions and emphases. In other words, further clarification and conceptual characterization of systems elements (of the evolving paradigm) and their practical application in real world situations is essential.

In this regard, based on an extensive review of literature, this study in Chapter 1 identified the following as key conceptual characteristics of the emerging systemic paradigm for agricultural research and extension: (1) systematic descriptions and analysis of the components of the farm and the linkages among them; (2) farm client partnership with researchers and extensionists; (3) collaborative multidisciplinary research; (4) environmental and common property integrity; (5) gender integration; and (6) sustainability considerations. Literature reviewed in the following section of this chapter focuses on further definition and clarification of these six key characteristics of the new paradigm.

2.2 Conceptual Characteristics and Relevancy of the New Systemic Paradigm:

This section presents literature review related to the six conceptual characteristics of the new paradigm -- key variables of the empirical part of this study:

(1) Systematic Description and Analysis of the Components of the Farm and the Linkages Among Them:

Systems approach involves "studying a system as an entity made up of all its components and their interrelationships, together with relationships between the system and its environment" (Beets, 1990:727). Thus, in systems approach oriented research in agriculture -- FSR -- application of the systems perspective to the study of a farm (i.e. treating farms as integrated whole systems) seems obvious.

As indicated by Shaner et al. (1982), in order to search for ways to improve a system's functioning, thorough study and analysis of the major components of the system and the links both among the components within the system and between the system and its environment are crucial. The obvious rationale is that "we need to understand the existing system before attempting to improve upon or change it" (Castillo, 1992:16). Moreover, system-level analysis and synthesis of farming systems interactions can provide insights for assessing the sustainability of farming systems as well as ideas for sustainable farming system development.

As small-holder farms have quite complex systems, and diverse environments (Chambers et al., 1989), the determinants of such farming systems, according to Beets

(1990) include: (i) physical (climate, soil, topography, physical structure); (ii) biological (crops, livestock, weeds, pests, diseases); (iii) endogenous (family composition, health and nutrition, education, food preferences, risk aversion, attitudes/goals gender relations); and (iv) exogenous (population, tenure, off-farm opportunities, social infrastructure, credit, markets, prices, technology, input supply, extension, savings opportunities/factors).

The literature indicates that utilization of a systems approach in agricultural research begins with a high quality description and systematic analysis of the complexity of farming systems covering all relevant components (e.g. plant, animal, the human) and their linkages. Then, based on understanding the whole system such descriptions and analysis can help FSR practitioners to structure research and development strategies for those systems (Axinn 1991; Axinn, 1991a; Beets, 1990; McDowell and Hildebrand, 1986; Norman 1986; Shaner et al., 1982; Simmonds, 1985; Temple, 1986).

The need to consider the human component in describing and analyzing farming systems is constantly stressed by FSR scholars and practitioners. Moreover, several scholars (e.g. G. Axinn 1991a; N. Axinn, 1990; Castillo, 1992; Plucknett et al., 1986; Poats, 1990) have indicated that women's role in farming need to be analyzed in order to develop a more accurate picture of farming systems and to formulate appropriate and effective research objectives.

This study attempted to determine the extent to which the FSR programs have studied -- described and analyzed -- the following farming components and linkages:

(i) crops (grain crops, fruit crops, vegetable crops); (ii) livestock; (iii) people (by gender and age); (iv) inputs (credit, input price, input availability, labor price and availability); (v) outputs (output price, market, marketing channels); (vi) internal linkages (internal flow of materials and services), (vii) external linkages (flow of materials and services from off the farm); and (viii) consumption pattern and production data.

(2) Farm Client Partnership with Researchers and Extensionists:

A growing literature on systems approaches and participatory methodological innovations attest that if agricultural research is to be relevant to local farming needs and sustainability, a partnership between farmers, researchers and extensionists in the entire research process is of absolute necessity (Axinn, 1991a; Rhoades, 1989; Chambers et al. 1989; Galt and Mathema, 1986; Norman 1980).

Moreover, the proponents of FSR contend that the farmer/researcher partnership is needed because much of the "top-down" research in experiment stations has not given sufficient attention to the relevance of a technology in terms of the goals and resources of small farmers (Eicher, 1980). According to Flora (1988), a farming systems approach, based on diagnosis of what farmers actually do and why they do it and building on the strengths of the indigenous farming systems, will influence the research conducted, the problems that research addresses, and the mechanisms used in research and extension through the use of multidisciplinary teams which include farm families as key players. Reorienting research so that farmers are viewed as clients was identified by Norman (1980) as a defining feature of FSRE (Baker, 1992).

Many scholars point out that conventional research cannot meet the needs of resource-poor farmers (Chambers, 1989; Farrington and Martin, 1987; Rhoades and Booth, 1982; Richards, 1985). Various approaches are evolving world-wide to include farming clients as partners in the research and extension process and activities. Examples of such approaches include: the "farmer-first-and-last" approach (Chambers, 1983; Chambers and Ghildyal, 1985); the "farmer-back-to-farmer" approach (Rhoades and Booth, 1982; Rhoades and Potts, 1985); the "indigenous agricultural revolution approach" (Richards, 1985); and farmer participatory research (Farrington and Martin, 1987).

Although these participatory methodological innovations were derived and presented under different labels, all models seem to call for methodological reversals in agricultural research. The reversal notion specifies a shift away from a technology supply orientation and hypothesis deduction model to an emphasis on indigenous farmer knowledge, innovative behavior and farmer experimentation (Baker, 1991; Frankenberger and Coyle, 1992). As indicated by Rhoades (1989) and Frankenberger and Coyle (1992), many advocates of these models feel that farmer knowledge, inventiveness, and experimentation have long been undervalued, and that agricultural scientists should be partners with farmers in the research and extension process. Chambers et al. (1989), write that research should be based on problem analysis and the priorities of farmers, with farmers being the central experimenters.

"The partnership between researchers and farmers is seen as the critical component of participation that enables cost-effective design, implementation and dissemination of technology and that builds on indigenous technical knowledge -- new technology-developing systems" (Sriskandarajah et al., 1991:5).

This study attempts to determine the extent of farm client partnership with researchers and extensionists by measuring the extent of participation, involvement and influence (see 5.2 for definitions) of farmers and extensionists in the following aspects of the FSR process: (i) problem identification; (ii) inclusion of indigenous knowledge; (iii) technology selection; (iv) execution of the research; and (v) evaluation of the findings.

(3) Collaborative Multidisciplinary Research:

From a review of relevant literature, a unanimous agreement is apparent among advocates of the systems research approach (e.g. FSR) about the need and relevancy of multidisciplinary involvement in the research effort. Multidisciplinarity has been widely used in the current literature as one of the most distinguishing characteristics of systems research -- FSR.

For example, Hildebrand and Waugh (1986) indicate that the use of scientists and technicians from multiple disciplines as a means of understanding the farm as an entire system is one of the basic requirements for FSR. Many other scholars (e.g. Axinn, 1991a; Axinn, 1988; Norman, 1980; Temple 1986; Wilson and Morren, 1990) present similar conceptual rationale for collaborative multidisciplinary research in

FSR. Indeed, a concern with farming systems necessarily envisions the participation of various disciplines in the research effort (Tripp et al., 1991).

As indicated by Temple (1986), the disciplines which need to be included in the team may vary from country to country, and from agricultural system to agricultural system. However, (as also described by Beets, 1990) considering the smallholder farming system which generally consists of the household and other integrated sub-systems: crops (grain, vegetable and fruit crops), livestock (many kinds), and off-farm land (which provides fuelwood, construction materials), the basic requirement would be to include specialists from social science, agro-biological science, animal science, home science, economics and extension disciplines.

In addition involvement of systems science (for systems interaction modeling) and environmental science would also be essential. Axinn (1991a) states that FSRE must demonstrate application of systems science in the generation, storage, retrieval, and dissemination of relevant technological, economic, and social knowledge. The need for involvement of environmental science in systems research (e.g. FSR) has increasingly been discussed in recent literature.

Moreover, considering the sustainability aspect, Oram (1988) indicates that ecology, climatology, geography, ecophysiology, soil science, and other resource-based disciplines must play greater roles in sustainable agricultural research and development.

Literature indicates that achieving multidisciplinarity has been difficult, and many FSR efforts are still dominated by either social or biological scientists (Tripp et al. 1991; Chambers and Jiggins, 1986).

As indicated by Oram (1988), most work toward agricultural sustainability suffers from the lack of systematic integration of knowledge from different scientific and socioeconomic disciplines. Oram further adds that a conceptual framework to integrate different disciplines and to enable them to interact effectively is needed. According to Temple (1986), one of the most important concepts of systems research is that the disciplinary scientists working on a problem, who must be highly trained in their own disciplines, do not work in isolation. They must be trained to interact with one another on a team.

In this study, the extent of multidisciplinary research in four FSR programs is determined by the variety of different scientific disciplines actively represented in the following four stages: (i) deciding which data would be collected, (ii) the field work, (iii) data analysis, and (iv) reports of findings and recommendations.

(4) Environmental and Common Property Integrity:

The literature indicates that environmental degradation (e.g. erosion, salinization) and over exploitation of common property resources for forage/fodder, firewood, and fishing are causing serious threats to smallholder farming systems in many developing countries. According to Beets (1990), the best example of stress on the environment affecting productivity and sustainability is loss of soil through erosion. As common property resources are non-exclusive in ownership and rival in consumption (Tietinberg, 1988), they are abused. As indicated by Wallace (1983), even when people do not overconsume a commonly owned resource, they often consume the wrong mix of products from such a resource. A popular article "the Tragedy of the Commons" by Hardin (1968), depicts the depleting situations of common property resources and urges for their protection.

The concern for sustainability in agricultural systems increasingly demands both rational use of common property resources and environmental protection. "Agricultural production is dependent on natural resources and environmental conditions, and therefore relies on the sound use of resources, environmental protection and ecological improvement" (Likangmin, 1991:192). Future challenges to FSRE will be in rehabilitation and renewal of degraded environments, livelihood enrichment through diversification and common property resource utilization, and conservation of nature and biodiversity (Lightfoot and Pullin, 1991).

Developing and implementing a variety of viable research and extension activities which are likely to have positive impacts on common property resources and environmental/ecological sustainability (National Research Council, 1993) is an area of significant need and opportunity for FSR. Consistent with systems ideals, FSR needs to operationalize the concern for the larger environment of each farming system, including common property resources, and integrating environmental impact assessment into the program.

In this study, "environmental and common property integrity" in FSR programs is measured by: (i) the use of some type of environmental impact assessment (EIA) as an important decision criterion for technology evaluation; (ii) the extent of the inclusion of EIA in research documents; (iii) the extent to which 'environmental protection measures' are considered in the research performed; and (iv) the extent to which linkages between farming systems and components of the near environment are described and analyzed in the research.

(5) Gender Integration:

The new systemic paradigm recognizes the human component (i.e. the men, women and children on the farm) as an important part of the system to be included in the analysis of farming systems. As the human component is one of the key components of systems research in agriculture, the relevancy and need for gender integration follow automatically because many farm activities in developing countries are performed by female farmers.

For example, Shinawatra et al. (1987), in their study in Chiang Mai, Thailand, found that woman participate almost as equally as men in labor exchange, planting and harvesting of most crops, and they take more responsibility than men in feeding pigs and poultry. According to Kaul and Ali (1992), women in Africa contribute up to 70 percent of the labor involved in food production and nearly 100 percent in rural food processing. "Much of the agricultural production activities of South Asia involve women, frequently in a sex sequential productive pattern (men plow, women transplant, men harvest, women handle the post harvest work)" (Axinn and Axinn, 1993:11-12). Gibbon (1992), points out that more than 50 percent of the rural farming population are women. Thus, there is need to incorporate gender in agricultural research.

Recent literature discusses gender issues and illustrates the rationale for gender integration. For example, Axinn (1991a), writes:

> "If the research is to be relevant to the needs and interests of farming people, so that they will adopt it and use its findings, and if the technologies it generates are found sustainable by those people in their environment, then researchers must take into account which farm people perform which tasks....................If women have responsibility for seed selection and storage, for example, then agricultural scientists who ignore women's perspectives on which seed to select and how to store it are merely reducing the probability that anything they find will actually be utilized by farmers in their region" (Axinn, 1991a:73).

Axinn and Axinn (1993), argue that agricultural development activities are more likely to be sustainable if they transcend the gender barrier to tap the indigenous knowledge of peasant women.

It seems clear that women are an integral part of many farming systems. As the systems approaches treat farming systems as whole systems, the requirement for taking gender into consideration in describing and analyzing farming systems is very important. Indeed, active involvement of adequate number of experienced women farmers in the entire research process -- problem diagnosis, and technology selection, generation and evaluation is crucial in FSR programs. As pointed out by Poats (1990), "gender integration" for FSRE translates into involving women as collaborating farmers and using gender as an analytical variable in on-farm technology development.

Moreover, according to Poats (1990), there is a strong positive relationship between effectively reaching female farmers and having female professionals in the ranks of the National Agricultural Research and Extension Systems (NARES). This may also apply in FSRE. Having an adequate number of female scientists in FSR organizations can result in effective involvement of female farmers in FSR activities. Poats (1990:1), with several examples, writes: "for FSRE in particular, there are distinct benefits to the effectiveness and efficiency in reaching farmers and developing technology that result from engaging female professionals in on-farm research activities".

Therefore, it seems clear that integration of gender (as measured by the number and proportion of female scientists and female farmers) is essential in systems approach-oriented programs, such as FSRE. With this perspective, this study conceptualized and included "gender integration" as an important variable of the new paradigm, and attempted to measure the extent of its inclusion by: total number and proportion of female scientists in the FSR organizations studied, and percentage of female farmers participating in FSR activities.

(6) Sustainability Consideration:

There is widespread agreement among agricultural scientists on the importance of sustainability as an objective for research (Harrington, 1992). Sustainability concerns and considerations have been increasingly emphasized in the principles and conceptual objectives of the emerging systems approaches including FSRE. But, as 'sustainability' and sustainable agricultural development have been conceptualized and defined in numerous ways (Harrington, 1992; National Research

Council, 1993; Sriskandarajah et al., 1991), a problem for operationalization of the concept in real settings arises. Moreover, as pointed out by Axinn and Axinn (1993), sustainability is a temporal, holistic concept. Further, a focus on sustainable agriculture must have a systems perspective at different levels and varying scales (Castillo, 1992). As indicated by Sriskandarajah et al. (1991), although sustainable agriculture is often synonymous with low-input agriculture which involves maintaining production and profits without excessive use of purchased inputs, the need for an additional focus on ecological sustainability is increasingly stressed by scholars and practitioners in recent years. In other words, sustainable agriculture must also take into account the environment and its system (Sriskandarajah et al., 1991); it must encourage the regeneration of the ecosystem and enhance the quality of environment for future generations (Jodha, 1990). Ecological sustainability is crucial in achieving sustainable improvements in the quality of agricultural systems (National Research Council, 1993).

For the purposes of this study, the presence of research and extension activities in current FSR programs which encourage sustainable agroecosystems is basically conceptualized as "sustainability considerations". More specifically, sustainability considerations are defined in this study as inclusion of efforts for development, promotion and utilization of ecologically and economically sustainable inputs and farming practices in order to maintain long-term production at a desired level and sustain ecological diversity and other important aspects of the eco-system as well.

Also, as indicated by Dicks (1992), viable research and extension efforts are needed to promote sustainable agricultural practices in order to reduce the environmental damage caused by extant agricultural production processes and by natural forces. A recent publication of the National Research Council (1993) points out that an appropriate mixture of land uses and management strategies are needed in order to encourage and maintain the long term health and productivity of agroecosystems. The indigenous resource management techniques and systems developed and practiced by peasant farmers--men and women, which were often dismissed as primitive in the past are increasingly being recognized as sustainable strategies (Axinn and Axinn, 1993; National Research Council, 1993). Research and extension efforts on the use of integrated (e.g. livestock cum crop) farming, mixed-cropping, agro-forestry system, integrated pest management system, bio-inoculum, green manures, compost and other viable resource management techniques and sustainable land use systems could be initiated and implemented by FSR programs. These techniques and farming practices are widely recognized in the literature to have implications for improving both productivity and sustainability of farming systems (Beets, 1990; Harwood, 1979; Jones and Wallace, 1986; Mackay, 1989; National Research Council, 1993).

In this context, "sustainability considerations" are assessed in this study by: (a) the presence of research/extension efforts for application of indigenous knowledge, practices and resources/inputs; (b) the presence of such system linkage research/extension activities as: i) integrated pest management (IPM) system, ii) bio-fertilizers/inoculum, iii) green manuring, and iv) compost making and use; (c) the presence of such interdisciplinary research/extension efforts as: i) integrated (e.g. livestock cum crop) farming system, ii) mixed-cropping system, iii) inter-cropping system, and iv) agro-forestry system; and (d) considerations of water and fuelwood factors in the system.

The literature review presented in this chapter covered the FSR movement and focussed on clarifying the six defining conceptual characteristics (identified in Chapter 1) of the new paradigm in agricultural research and extension. The next chapter -- Chapter 3, describes the research design and methods used in this study for empirical testing of the current conceptualization.

III. RESEARCH DESIGN AND METHODS

The previous two chapters conceptualized the new paradigm for agricultural research and extension by reviewing the literature to identify and describe the six key conceptual characteristics. This chapter describes the research design and methods used in the empirical part of this study, including operational definitions and measures of the key variables[3]. The chapter then, proceeds with discussion about selection of research sites, data collection instruments, data collection process and the data analysis approach.

3.1 Study Design:

The research was carried on in six phases:

(1) Identification and clarification of the critical variables in the new paradigm.

(2) Preliminary identification of systems-approach-oriented, agricultural research organizations in Nepal and in Thailand through literature review and correspondence. From this, a list of potential cases were identified.

(3) From the list of potential cases, the following four agricultural research

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[3] The six conceptual characteristics of the new systemic paradigm for agricultural research and extension identified in Chapter 1 are treated as key variables for the empirical part of this study.

organizations with FSR programs were selected:

Nepal:

(i) Central Farming Systems and Outreach Research Division (CFSORD)
[A division of the Nepal Agricultural Research Council (NARC), Ministry of Agriculture (MOA)].

(ii) Pakhribas Agricultural Center (PAC)
[An agricultural research and resources center, funded by the British Government through Overseas Development Administration (ODA). Currently, its work is increasingly coordinated with the MOA's departments, particularly with NARC].

Thailand:

(i) Farming Systems Research Institute (FSRI)
[A division of the Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives (MOAC)].

(ii) Khon Kaen University (KKU)- Farming Systems Research Project (FSRP)
[KKU is under the Ministry of University Affairs (MUA)]

These four organizations fall under two different categories of agricultural research organizations: (i) straight-line-organizations of the Ministry of Agriculture -- CFSORD in Nepal and FSRI in Thailand; and (ii) outside of the line-Ministry of Agriculture -- PAC in Nepal and KKU-FSRP in Thailand.

(4) Funding support for the field study was explored with different international organizations. Financial support for the field data collection in Thailand was received from the Food and Agriculture Organization of the United Nations (FAO) at Rome, Italy.

(5) Data collection was carried out through a detailed survey of the FSR programs in the four selected agricultural research organizations.

Information for describing the four cases in terms of their initial and current organizational structure, staffing pattern, command area, program objectives and implementation strategies, etc. was derived basically from the program documents and other relevant published reports. Data obtained from interview responses of research personnel and key informants in the four FSR programs were utilized to test the extent to which the six key conceptual dimensions of the new paradigm have been implemented by these four FSR organizations.

(6) The final phase involved data processing and analysis, and the preparation of this document.

3.2 Operational Definitions and Measures of the Key Variables:

For the purpose of this dissertation research, an ideal model of the new systemic paradigm for agricultural research and extension is described as having the six conceptual characteristics described below. These are the key variables of this study. The larger the number of these variables which are being implemented by the selected agricultural research programs which have called themselves "farming systems" programs, the more these programs are considered to have applied the new paradigm.

The operational definitions and measures of the key variables are given below. The variables were assessed by interviewing the research staff (of the selected FSR programs) and reviewing (content analysis) available relevant documents.

(1) Systematic Description and Analysis of the Components of the Farm and the Linkages Among Them:

This variable is defined as the extent to which the description and analysis of farming systems include all of the significant components: plant, animal and human; relevant items within each of these components; and linkages among these components.

This variable is measured in this study by: (a) the variety of farming systems components and linkages described and analyzed by the program staff and considered in the research process; and (b) inclusion of both consumption patterns and production data.

(2) Farm Client Partnership with Researchers and Extensionists:

This variable is defined as the extent of participation, involvement and influence of farming clients (both male and female farmers) in the following aspects of the FSR process: (i) problem identification; (ii) inclusion of indigenous knowledge; (iii) technology selection (i.e. deciding on type of technology to be studied); (iv) execution of the research; and (v) evaluation of the findings.

'Farm client partnership' is measured by the extent of participation, involvement and influence of farmers in each of the above aspects of the FSR program.

(3) Collaborative Multi-disciplinary Research:

This variable is defined as the active involvement of researchers from different scientific disciplines potentially including: plant science, animal science, social science, engineering science, home science, environmental science and systems science in the entire process.

'Multi-disciplinary research' is measured by the variety of different scientific disciplines actively represented in the following four stages: (i) deciding which data would be collected, (ii) collecting data from the field, (iii) data analysis, and (iv) reports of findings and recommendations.

(4) Environmental and Common Property Integrity:

This variable is defined as concern with the larger near environment of each farm, including common property resources, and integration of some type of environmental impact assessment system in the program.

'Environmental and common property integrity' is measured by: (a) use of some type of environmental impact assessment (EIA) as an important decision criteria for technology evaluation; (b) the extent of the inclusion of EIA in research documents; (c) the extent to which "environmental protection measures" (e.g. protection of common property resources) are considered in the research performed; and (d) the extent to which linkages between farming systems and components of the near environment are described and analyzed in the research.

(5) Gender Integration:

Gender integration is defined as concern for and active involvement of female farmers, researchers and extensionists in all aspects of the FSR process.

'Gender integration' is measured by: (a) total number and proportion of female scientists in the FSR organization studied; (b) percentage of female farmers participating in FSR activities.

(6) Sustainability Considerations:

Sustainability considerations are defined in this study as inclusion of efforts for development, promotion and utilization of ecologically and economically sustainable inputs and farming practices in order to maintain long-term production at a desired level and sustain ecological diversity and other important aspects of the eco-system.

'Sustainability considerations' are assessed by: (a) the presence of research/extension efforts for application of indigenous knowledge, practices and resources/inputs; (b) the presence of such system linkage research/extension activities as: i) integrated pest management (IPM) system, ii) bio-fertilizers/inoculum, iii) green manuring, and iv) compost making and use; (c) the presence of such interdisciplinary research/extension efforts as: i) integrated (e.g. livestock cum crop) farming system, ii) mixed-cropping system, iii) inter-cropping system, and iv) agro-forestry system; and (d) considerations of water and fuelwood factors in the system.

Here, it is important to mention that the other five variables described above are also associated with and represent the "sustainability" concept. Moreover, as can be found in related literature, this study also recognizes that the sustainability component is difficult to measure. In this context, indirect measures, most of which generally represent the considerations of the "biological" aspect of sustainability, are used in this study. The main reason for including this "sustainability considerations" variable (in addition to the other five variables) separately in this study is for estimation of the extent sustainability is considered by the selected FSR programs. Here, the focus is on assessing whether the researchers are concerned about sustainability (based on the above indirect indicators), but not on measuring how sustainable the existing efforts are (in terms of time frame). The latter concern is beyond the scope of this study.

3.3 Selection of Research Sites:

The criteria used for the selection of the research sites included:

(1) availability of programs which are reputed (or named) as FSR, as part of the agricultural research systems in the country;

(2) accessibility to the author (researcher); and

(3) author's familiarity with the countries and languages.

3.4 Data Collection Instruments:

This study is based on both primary and secondary data. The case study approach, which included content analysis of relevant publications and field observation, was combined with research instruments to generate the data. An unstructured questionnaire was used to collect data from research personnel and key informants in the selected FSR programs in each country. Observation of the on-farm technology development process was also made. Photographs/slides were taken (e.g. of the existing cropping patterns, farming methods, livestock) in the field.

Data from secondary sources like program manual, annual plans, progress reports, research proposals, and other relevant documents were collected. A content analysis was made for the identified key variables.

3.5 Data Collection Process:

The data were collected from interviews with research personnel of the selected organizations, interviews with other personnel, and reports, records, and other relevant documents.

Sampling of respondents was not done; all FSR staff (both male and female) who were available during the set period of field study were interviewed. An attempt was made to interview as many staff as possible. Governed by the standard policy and procedures set by the University Committee on Research Involving Human Subjects (UCRIHS), personnel identifiable characteristics such as age, sex, position of the respondents were not explored in this dissertation research.

All the data in Nepal were collected by the author himself. In the case of Thailand, the data were collected by the author with the help of a local person (research assistant) who had good translating skill and interviewing experience. The local research assistant was provided with an intensive orientation. Interviewing the related FSR program personnel (e.g. researchers) and key informants was done by the author with translation assistance as required. Field visits and observations of on-farm research and farmers' fields were also made to gather relevant information.

In addition to interviewing the central level research staff of the selected FSR programs, regional/local site office staff were also interviewed at the Naldung/Kavre FSR site in Nepal-CFSORD, and the Suphanburi FSR Development Office and the Khon Kaen FSR Development Office in FSRI, Thailand. Relevant office documents and reports were also consulted.

3.6 Data Analysis Approach:

Both qualitative and quantitative data analyses have been performed. Descriptive statistics such as percentages, means and frequencies are used. Descriptive information are also presented qualitatively. Maps and figures have also been used for illustration and explanation.

IV. DESCRIPTION OF THE CASES

In order to determine the extent of evolution and application of the new systemic paradigm in agricultural research and extension, as described in Chapter 3, the empirical part of this research concentrated on the following two FSRE cases from Nepal and two from Thailand:

Nepal:

(1) Central Farming Systems and Outreach Research Division (CFSORD)

CFSORD is a division of the Nepal Agricultural Research Council (NARC) under the Ministry of Agriculture (MOA).

(2) Pakhribas Agricultural Center (PAC)

PAC is funded by the British Government through Overseas Development Administration (ODA). PAC's work is increasingly coordinated with the MOA's departments, particularly with NARC.

Thailand:

(1) Farming Systems Research Institute (FSRI)

FSRI is a division of the Department of Agriculture (DOA) under the Ministry of Agriculture and Cooperatives (MOAC).

(2) Khon Kaen University (KKU)- Farming Systems Research Project (FSRP)

KKU is under the Ministry of University Affairs (MUA). KKU-FSRP has been basically supported by international organizations/foundations.

Readers should note that these FSR organizations are relatively young. And their organizational structures (e.g. name, organizational chart) have been evolving and changing rapidly over time -- as might have been expected with a new paradigm.

The first section of this chapter presents a general background of FSRE in the Nepal and in Thailand. The second section describes the above four FSR programs studied in these countries.

4.1 FSRE in Nepal - General Background:

FSRE approach oriented models of different types have existed in Nepal since the late 1970s. The Agronomy Division under the Department of Agriculture initiated the Cropping Systems Program (CSP) in 1977 with support from the USAID funded Integrated Cereals Project. The basic objective of the program was to develop technology for the mixed systems of small-scale, resource-poor farmers, particularly in the agroecologically marginal hill regions. A standardized sequence of on-farm experiments and socioeconomic monitoring were carried out in six selected zones by interdisciplinary teams of five to twelve technicians and assistants (Ewell, 1988).

In 1985, the Farming Systems Research and Development Division (FSRDD) was formed through reorganization of the CSP. The FSRDD was formed as one of the divisions of the National Agricultural Research and Services Center (NARSC) under the Ministry of Agriculture. With the transition from "cropping systems research" to "farming systems research", research on livestock and agro-forestry (forestry and horticultural crops) were added. According to FSRDD Report (1987), the main objective of the FSRDD was to help increase farm production and income by developing a farming system research approach for the welfare of small-scale resource poor farmers. The Division aimed to meet this objective through the integration of research being done on the different components of Nepalese farming systems, e.g. crops, livestock, horticulture and agroforestry.

During the FY 1989/90, the organizational structure of NARSC was modified as the National Agricultural Research Center (NARC) [this name was again changed to "Nepal Agricultural Research Council (NARC) during the FY 1990/91]. The Outreach Unit of NARC was merged with FSRDD to form the Central Farming Systems and Outreach Research Division (CFSORD).

4.1.(a) Central Farming Systems and Outreach Research Division (CFSORD):

Since its establishment in 1985, the FSRDD continued and expanded the scope of the work initiated by the previous systems program. It also continued working at the following five FSR sites which more or less represent the mid-hills of each of the five development regions of the country (FSRDD, 1988):

(1) Khandbari Farming Systems Research Site (Sankhuwa Sabha District)

(2) Naldung Farming Systems Research Site (Kavre District)

(3) Pumdi Bhumdi Farming Systems research Site (Kaski District)

(4) Kotjahari Farming Systems Research Site (Rukum District)

(5) Baitadi Farming Systems Research Site (Baitadi District)

According to FSRDD's Annual Report (1988), during the first two years, 1985-1986, activities were focussed on developing methodology, known as Samuhik

Bhraman for setting research priorities and facilitating cooperative on-farm research. "Samuhik Bhraman" refers to a multidisciplinary group visit to FSR sites to closely interact with farmers, define their priorities and then plan and design a future research program with FSP" (FSRDD, 1988:1).

By FY 1989/90, as an effort to institutionalize the FSR approach, the FSRDD also started supporting and coordinating the farming systems based outreach program carried out by the Terai and hill research stations in their command areas.

In 1990, the outreach unit of the NARC was merged into the FSRDD and the CFSORD was created (see Figure 1 for the organizational structure of CFSORD). Since then, the CFSORD increasingly focussed toward supporting and coordinating outreach research programs (ORP) with a farming systems perspective (FSP) implemented by research stations in their specified command areas (Panth, 1991).

Work in the five FSR sites as well as support to research stations for their outreach programs continued even after the structural change of FSRDD to CFSORD during the FY 1990/91.

The CFSORD's core staff included: Division Chief, Agronomist, Soil Scientist, Agricultural Development Officer, Site coordinator and Junior Technician; a few US Peace Corps volunteers with relevant background (e.g. horticulture, animal science) were also involved. For example, as reported in CFSORD Annual Report (1991), during the FY 1990/91, there were total of 20 staff, which included: one Division Chief, five agronomists, one Soil Scientist, one Agricultural Development Officer, five site coordinators, five junior technicians (one Site Coordinator and one Junior

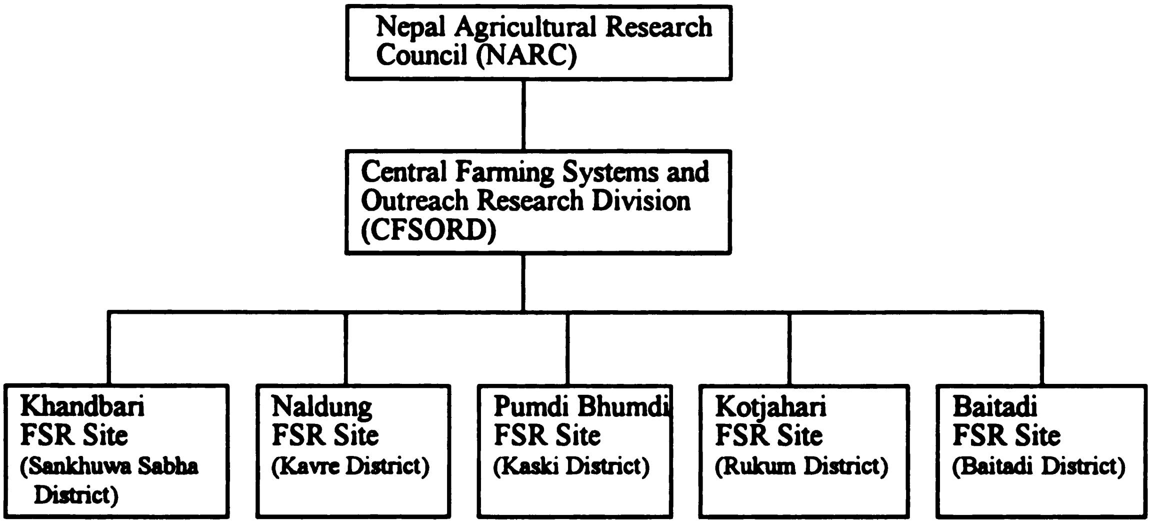

Figure 1. Organizational Structure of CFSORD.

Source: Derived from general description presented in the report: Annual Report (FY 1990/91). Central Farming Systems and Outreach Research Division, Nepal Agricultural Research Council, Khumaltar, Nepal.

Technician at each of the five FSR site offices) and two US Peace Corps volunteers (one Horticulturist at Naldung FSR site and one animal scientist at Khandbari FSR site).

4.1.(b) Pakhribas Agricultural Center (PAC):

Pakhribas Agricultural Center (PAC), principally funded by the Overseas Development Administration (ODA) of the British government, and established in 1972 is a multidisciplinary regional agricultural research center for the eastern hills of Nepal. The Center offers technical expertise in agronomy, horticulture, livestock, forestry and pasture, veterinary, seed technology, extension research, training, and socioeconomics. It introduces and develops technologies suitable for local environments, especially in the eastern hills region. The Center has both on-station and on-farm research programs, and research with a farming systems perspective is considerably emphasized. "A farming systems research perspective has been well established at PAC and the importance being accorded to this concept is seen in the growing number of interdisciplinary research activities. Nearly all PAC's sections have implemented a number of interdisciplinary activities and trials which address the problem of the major farming systems in the eastern hills in a more holistic way" (PAC - Annual Report, 1990: 13-14).

As illustrated in Figure 2 below, PAC has a range of specialist sections, including a Farming Systems and Interdisciplinary Research (FSIR) Section. As described in the PAC Annual Report (1990/91), these sections combine their expertise to form interdisciplinary working groups to address priority problem areas

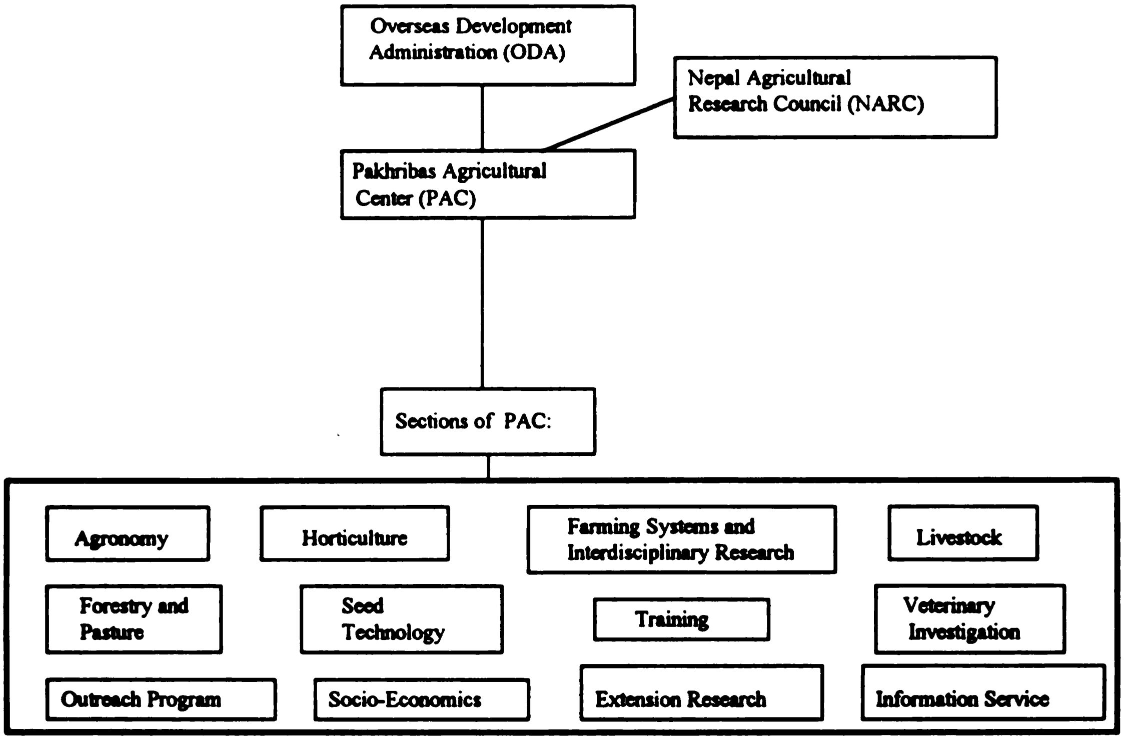

Figure 2. Organizational Structure of PAC.

Source: Derived from general description presented in: Annual Research Work Program Summary, 1990/1991. Pakhribas Agricultural Center, Dhankuta, Nepal.

such as farming systems, low-input alternative technologies, women's development, and fodder production in the dry season. The FSIR Section focuses on promoting collaborative studies between specialist sections in order to develop appropriate technologies for the eastern hills. The Section also provides technical support to the Outreach Research Section in implementing multidisciplinary programs. With the help of an FSR Adviser (expatriate), the Section has also conducted farming systems studies and systems demonstration activities as well as provided support for various working groups, including its Farming System Working Group (FSWG).

During FY 1990/91, "the research program at PAC went through a period of review, consolidation and re-focusing. Research activities were re-oriented to a revised set of project objectives which more clearly define the role of the Center in developing technologies for the eastern hills. The revised objectives address the issues of: (i) equity - ensuring that the needs and problems of disadvantaged groups and resource-poor farmers are addressed; (ii) sustainable production - that all technologies developed should be within the resource capacity of the eastern hill farmers; and (iii) institutional development - strengthening the ability of local institutions to carry out development activities using PAC generated technologies" (PAC, 1991:iv). PAC is now integrated into the government's national research system. It has a regional mandate to serve as the research and resource center under the NARC for the eleven hill districts of eastern Nepal, an area of 2.2 million hectares encompassing more than 252,000 farming households (Chand et. al., in Shrestha and Shrestha, 1992). PAC's research command area is shown in Figure 3.

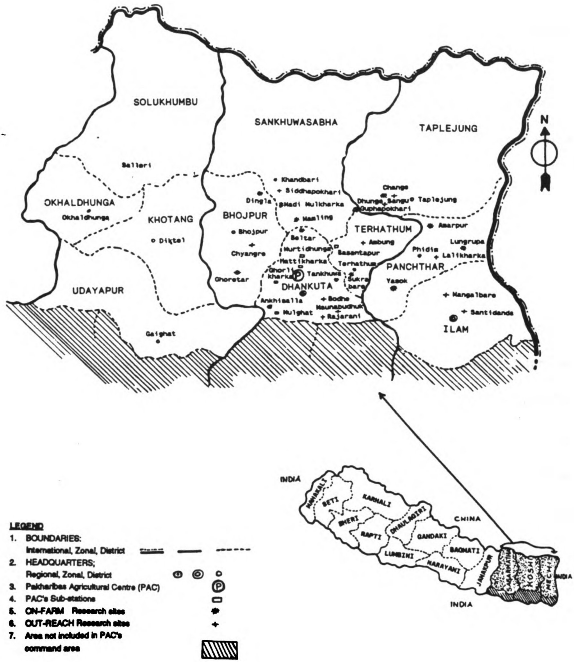

Figure 3. Map Showing PAC's Research Command Area.

Source: Annual Report: 1990 - 1991. Pakhribas Agricultural Center, Dhankuta, Nepal. July 1991.

4.2 FSRE in Thailand - General Background:

In Thailand, FSR has been conducted for over 20 years. The organizations actively involved in FSR are the Farming Systems Research Institute (FSRI) of the Ministry of Agriculture and Cooperatives (MOAC) and Universities with faculties of agriculture: Chiang Mai University, Khon Kaen University, Kasetsart University, and Prince of Songkhla University. With the Ford Foundation support, Chiang Mai and Khon Kaen Universities started their cropping systems programs in 1969 and 1975 respectively. Chiang Mai University focussed on cropping systems for irrigated areas, while drier rainfed cropping systems were the emphasis of Khon Kaen University. In 1976, the Rice Division of the Department of Agriculture (DOA/MOAC) launched a joint program with Kasetsart University (KU) on rice-based cropping systems with assistance from International Development Research Council (IDRC) and IRRI. With support from the French government, Prince of Songkhla University (PSU) also started a FSR project in 1982. Since 1982, when the DOA was reorganized under the Thai/World Bank National Agricultural Research Project, FSRI was established in order to incorporate FSR into the national agricultural research system.

4.2.(a) Farming Systems Research Institute (FSRI):

The Farming Systems Research Institute (FSRI) was established in 1982 as a result of the reorganization of DOA. "The role of the FSRI is to conduct on-farm interdisciplinary research, integrating specific discipline-based recommendations into a whole farm system, and feeding back problems identified on the farm to appropriate commodity research institutes or disciplinary research sections" (Charoenwatana, 1992). The FSRI also has a unique research role of its own, particularly in examining specific cropping patterns and integrated farming. The FSRI activities have been also expanded to include crop-animal integration as well (Charoenwatana, 1992).

As illustrated in Figure 4, the FSRI has four main sections -- administration, monitoring and evaluation, training and technical group, and seven regional offices. Each regional office, known as Farming Systems Development Research Office (FSDRO) has two main divisions -- Administration and Technical. The Administration Division consists of three sections: Correspondence Section, Account Section, and Store and Equipment Section. The Technical Division is composed of four major research sections, namely, Rainfed Farming Systems Research, Irrigated Farming Systems Research, Agro-Climatology Research, and Soil and Water Management Research. The number of staff by specific disciplinary fields[4] (e.g. agronomists, soil scientists, economists) varied among the seven FSDROs. A list of the seven FSDROs (regional offices) is presented below: (Please also see Figures 4 and 5):

(1) Chiang Mai Farming Systems Development Research Office (Upper Northern Region):

This FSR regional office covers nine provinces: Chiang Mai, Chiang Rai, Lampang, Lamphun, Maehongson, Phayao, Tak, Nan and Phrae.

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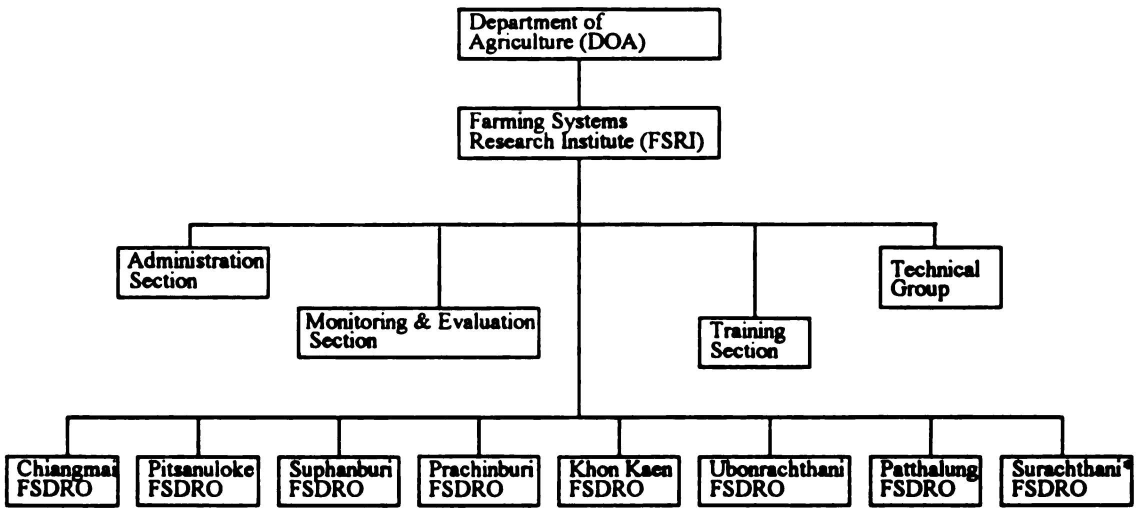
[4] The data regarding the exact number of staff by scientific disciplines at the seven FSDROs were not readily available during the author's field visit, and thus not reported here.



FSDRO = Farming Systems Development Research Office
* = Proposed

Figure 4. Organizational Structure of FSRI.

Source: Farming Systems Research Institute's Brochure, 1991. FSRI, Bangkok, Thailand.

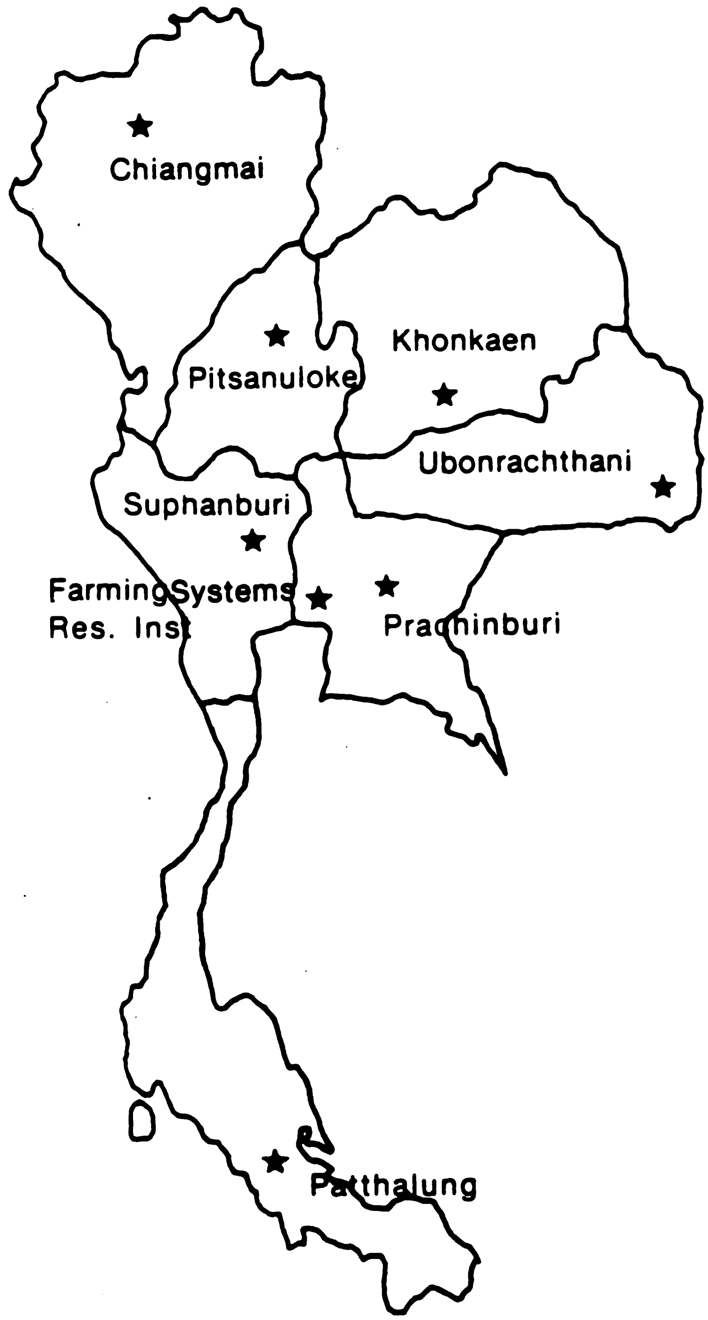


Figure 5. Map Showing Locations of Farming Systems Development Research Offices (FSRDOs) in Thailand.

Source: Farming Systems Research Institute's Brochure, 1991. Bangkok, Thailand.

(2) Phitsanulok Farming Systems Development Research Office (Lower Northern Region):

This office covers eight provinces: Phitsanulok, Uttaradit, Phichit, Sukhothai, Phetchabun, Kampaengpet, Nakorn Sawan and Uthaithani.

(3) Khon Kaen Farming Systems Development Research Office (Upper Northeastern Region):

This regional office covers nine provinces: Khon Kaen, Udonthani, Nong Khai, Loei, Chaiyaphum, Sakon Nakorn, Mahasarakham, Kalasin and Nakorn Phanom.

(4) Ubonratchathani Farming Systems Development Research Office (Lower Northeastern Region):

This FSR office covers eight provinces: Ubonratchathani, Mukdaharn, Nakorn Ratchasima, Roi Ed, Surin, Buriram, Srisaket and Yasothorn.

(5) Suphanburi Farming Systems Development Research Office (Central Region):

This FSR regional office covers twelve provinces: Suphanburi, Kanchanaburi, Phetburi, Samut Sakorn, Samut Songkram, Nakorn Pathom, Ratchburi, Ang Thong, Singburi, Chainat, Ayuthaya and Nonthaburi.

(6) Prachinburi Farming Systems Development Research Office (Eastern Region):

This office covers eleven provinces: Prachinburi, Lopburi, Saraburi, Nakorn Nayok, Chachoengsao, Cholburi, Rayong, Chantaburi, Trat, Samut Prakarn and Pathumthani.

(7) Phattalung Farming Systems Development Research Office (Southern Region):

This regional office covers fifteen provinces: Phattalung, Prachuabkirikhan, Chumpon, Ranong, Suratthani, Phangnga, Krabi, Phuket, Nakorn Sri Thammarat, Trang, Satun, Songkhla, Pattani, Yala and Narathiwat.

4.2.(b) Khon Kaen University (KKU) - Farming Systems Research Project (FSRP):

Khon Kaen University (KKU) is one of the pioneering institutions in FSR in Thailand. Work began in 1975 with the initiation of a Ford Foundation supported Cropping Systems Project (CSP) aiming at developing cropping systems for rainfed cultivated areas of Northeast Thailand. A multidisciplinary team approach was used, employing the concepts and methodology of farming systems research as they evolved (Patanothai, 1985). For example, the project adopted the concepts of human ecology and agroecosystems analysis to improve cross-disciplinary knowledge of the research team from a highly specialized to an interdisciplinary perspective.

In 1984, with financial assistance from the USAID, the project was expanded into a FSR Project; the scope was expanded to include the animal subsystem and broader participation of researchers from both natural science and social science disciplines (Charoenwatana, 1992). Later, the activities of the KKU-FSRP included: conducting both area based and technology based research, studying well established existing technologies as well as conducting specific studies and training (KKU-FSRP Report, 1989). As explained by Charoenwatana (1992), KKU has been playing an important role in spreading the FSR approach in Thailand and in incorporating additional concepts and methodologies, including human ecology, agroecosystems analysis, rapid rural appraisal (RRA), and anthropological study of farmers' practices into FSR.

Since KKU is primarily an education and research institution with no direct responsibility for area development, the KKU-FSRP usually focuses on generating appropriate agricultural technologies, FSR methodologies and information to be utilized by relevant action agencies. According to the KKU-FSRP Report (1989), the objectives of the KKU-FSRP included:

"(1) To develop and test farming technologies and define the type of farm systems and environments where the technologies will be suitable and beneficial.

(2) To derive classificatory information on agroecosystems and farming systems, their environments, and in terms of the types of problems and opportunities they have and how they allow or constrain various types of technological solutions.

(3) To develop and test methodologies for doing (1) and (2) and to put these in a form that can be used by action agencies and applied in the field.

(4) To promote training and communications with action agencies so that (1) and (2), and (3) are widely applied in Northeast Thailand and where appropriate elsewhere in the country" (KKU-FSRP, 1989:1).

The KKU-FSRP utilizes an interdisciplinary team approach involving researchers from crop, animal, and social science disciplines. More specifically, as illustrated in Figure 4 above, the project draws research personnel from various relevant divisions of KKU -- Crop Science, Soil Science, Animal Science, Social Science, and Economics.

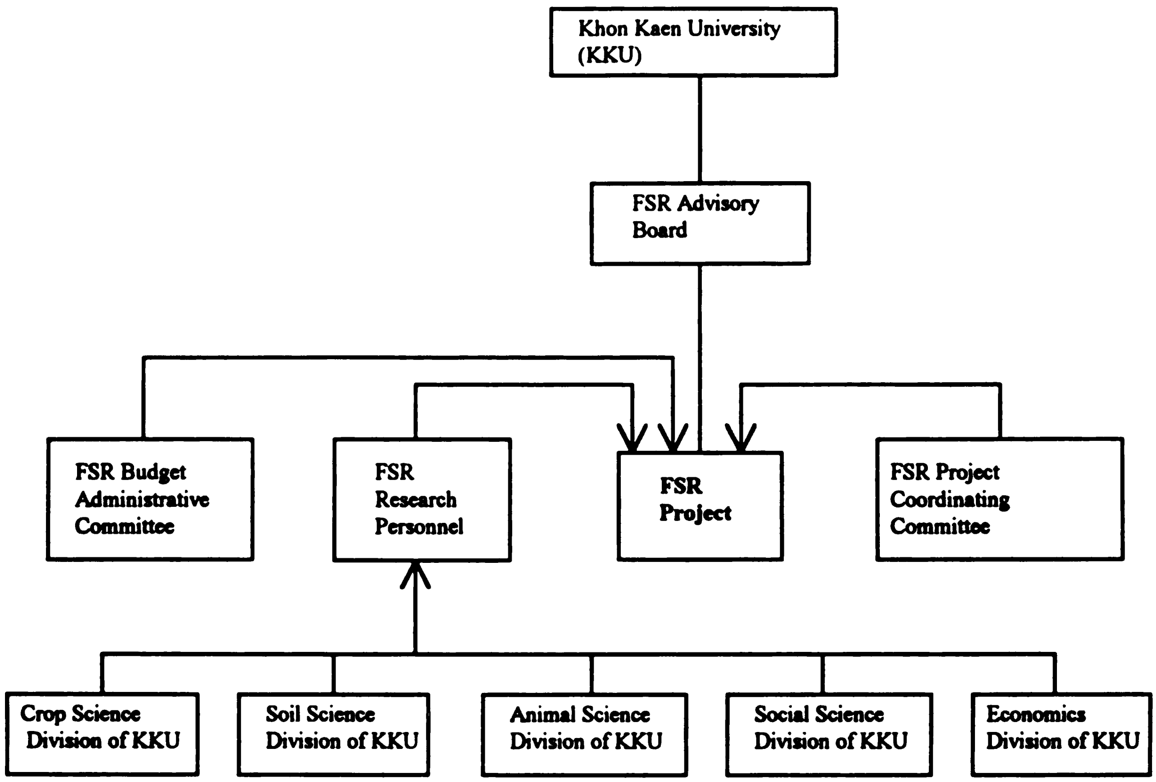


Figure 6. Organizational Structure of KKU-FSRP.

Source: Derived from general description presented in the report: Summary of Work for FY 1988 and Research Plan for FY 1989. Farming Systems Research Project, Khon Kaen University, Khon Kaen, Thailand.

Regarding the organizational structure of the KKU-FSRP, the project has: a FSR Advisory Board, a Budget Administrative Committee, a Project Coordinating Committee, and a Research Team/Group (see Figure 6 above).

This chapter is a description of the four FSR cases investigated for this study. Chapter 5, presents analysis of the four cases in terms of the extent to which these FSR programs have implemented the six conceptual characteristics of the new paradigm.

V. ANALYSIS OF THE CASES

This chapter presents analysis of the four FSR cases in terms of the extent to which they have implemented the following six conceptual characteristics of the new paradigm:

(i) Systematic description and analysis of the components of the farm and the linkages among them

(ii) Farm client partnership with researchers and extensionists

(iii) Collaborative multidisciplinary research

(iv) Environmental and common property integrity

(v) Gender integration

(vi) Sustainability considerations

These six conceptual variables were examined in the case studies, with a logic that the larger the number of these variables which are implemented in the research programs, the more these programs are likely to have applied the new paradigm.

This chapter is organized with analysis of data and discussion of findings for each of the six variables of the new paradigm. As stated in Chapter 3, the data for this part of the study were obtained from the responses of the research staff of the FSR programs studied; some data were also derived from content analysis of relevant published reports.

The respondents were staff members (research staff) of the FSR programs studied. In general, they were mid-career professionals with BS and MS (few with Ph. D.) degrees, mostly in agricultural science (e.g. crop, soil, livestock disciplines) and some in social science (e.g. sociology, economics). Sampling was not done, since all staff members (research/professional staff) who were available during the course of field study were interviewed irrespective of their sex, age and years of experience in the FSR program. The number of FSR staff interviewed were: 9 from CFSORD, 9 from PAC, 10 from FSRI and 9 from KKU-FSRP.

5.1 Systematic Description and Analysis of the Components of the Farm and the Linkages Among Them:

Analysis:

As any systems understanding starts from qualitative enumeration of components and their interaction (Simmonds, 1985), description and analysis of the internal and external components of the farm and the linkages among them are crucial if any research is to be classified as FSR. This research attempted, by interviewing researchers from the four programs described above, to determine the extent to which the analyses of farming systems conducted by each of these programs include all of the significant components (i.e. plant, animal and human) and linkages among them. In addition, the extent of inclusion of both consumption patterns and production data by these FSR programs was also assessed.

Responses of individual staff members regarding analysis of these farming systems components and linkages are summarized (using mean value) in Table 1 below (derived from Appendix A-Table 13). Responses of staff members regarding detailed relevant items (within each farming component and linkages) of their research are presented in Appendix A-Table 14. Detail sub-item and major category mean values of responses by country are estimated and presented in Appendix A-Tables 15 and 16.

Table 1. Responses (Mean Value*) of Individual Staff Members of Four FSR Organizations to Questions Regarding Components and Linkages Studied.

(Mean Value)*

Farming Components and Linkages	Nepal-CFSORD (n=9)		Nepal-PAC (n=9)		Thailand-FSRI (n=10)		Thailand-KKU-FSRP (n=9)	
	Yes	No	Yes	No	Yes	No	Yes	No
A. Crops	9	-	9	-	8.7	1.3	8	1
B. Livestock	9	-	9	-	8	2	8	-
C. People	4	5	4	5	5.5	4.5	8	1
D. Inputs	6	3	7	2	8	2	8	1
E. Outputs	7.7	1.3	8	1	8.7	1.3	7.7	1.3
F. Internal Linkages	6.5	2.5	6.5	2.5	7	3	8	1
G. External Linkages	7.5	1.5	8	1	8.5	1.5	9	-
H. Consumption Patterns and Production Data	9	-	9	-	10	-	9	-

* Derived from Appendix A-Table 13, by adding up the response values of all sub-items (e.g., grain crops, fruit crops and vegetable crops under the major category of "crops" as listed in Appendix A-Table 13) under each major category of components and linkages and then dividing the total value by the number of sub-items.

In general, as shown in Table 1 above, all of these components seemed to be included in the analysis of farming systems in all four FSR programs studied. However, the extent of inclusion of some components such as crops and livestock in the analysis was reported to be relatively higher than other components like credit and people by gender and age (see Appendix A Table 14).

As illustrated in Appendix A-Table 13, all the four FSR programs included plants/crops -- grain crops, fruit crops and vegetable crops in their analysis of farming systems. The animal/livestock component was also given relatively high priority by all four programs studied. The KKU-FSRP case included people -- by gender and by age -- in the analysis, more frequently than the other three cases. Among the other three cases, the FSRI case also seemed to have placed relatively more emphasis on gender analysis than either of the Nepal cases (i.e., CFSORD and PAC). But in terms of considering analysis of people by age, the FSRI case also appeared to have low emphasis (see Appendix A-Table 13). All four programs studied have included consumption patterns and production data in the current farming systems analysis (see Table 1 above).

Discussion:

It seems apparent that all four FSR programs have placed an increased emphasis on the systems approach rather than on a single commodity. But the integration of the human component -- analysis of people by sex and age -- is yet to be emphasized in FSR programs in Nepal, and in FSR program under DOA in

Thailand. Since FSR must include people of both genders (Axinn, 1991a; Castillo, 1992; Poats, 1990), inclusion of the human component in farming systems analysis is absolutely necessary. Analysis by gender can provide FSR practitioners with a more accurate picture about the roles of local women and men in farm activities. And such information could be very useful in framing gender sensitive FSR objectives and activities in order to appropriately and efficiently reach the total farmer clientele. Analysis by age can help FSR practitioners in assessing the availability and composition of existing agricultural labor force as well as in labor force forecasting for the future. In sum, without describing and analyzing the human component, an accurate picture of farming systems can not be obtained, and consequently, the appropriateness and effectiveness of FSR activities will be hampered.

5.2 Farm Client Partnership with Researchers and Extensionists:

Analysis:

Today, there is a general recognition that to be successful and meaningful FSR must involve farmers in all research activities -- problem diagnosis, technology selection, research execution and technology evaluation. In this regard, in order to determine the extent of farm client partnership with researchers[5], the research staff from the four programs were asked to provide their assessment of the extent of participation, involvement, and influence of farming clients in each of the following

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[5] The term "researchers" is used in this dissertation to refer to the research staff (i.e., the individual staff members who are involved in research activities) of the FSR programs studied.

aspects of the FSR process:

a) Problem identification

b) Inclusion of indigenous knowledge

c) Technology selection (deciding on type of technology to be studied)

d) Execution of the research

e) Evaluation of the findings

For this research purpose, farmers' participation was defined as participation of farmers through attending local/regional meetings, or observing the events and activities organized by the FSR staff without contributing significant input. Farmers' involvement was defined as involvement of farmers in events and thus, providing appropriate inputs in the decision making process, or by assuming significant responsibilities in relevant activities. And farmers' influence was defined as influence of farmers on the final decisions in activities related to problem identification, technology selection and generation, and technology evaluation.

Table 2 below (derived from Appendix B-Tables 16, 17, 18 and 19) presents a mean value for participation, involvement and influence of farmers in each of the four research programs based on researchers' response. As shown in Table 2, farmers' participation was reported to be relatively high in all four cases studied. But their actual involvement tends to be less. And the score for farmers' influence in final decisions relevant to the given activities appeared even lower than the scores given for their involvement in all four cases studied. In other words, the general trend is in decreasing order from participation, to involvement, to influence (see

Table 2 below). Countrywise estimation (of researchers' responses) and interpretation of results also follow the same trend (see Appendix B-Table 20).

In addition, the research staff were also asked to provide their assessment of extension workers' participation, involvement and influence in the entire process of technology selection, research execution and evaluation. In this regard, the author learned that none of the four organizations had their own extension unit; extension

Table 2. The Extent of Participation, Involvement and Influence of Farm Client with Researchers, from Researchers' Point of View:

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence **(Mean Value)***

Activity	Nepal-CFSORD (n=9)			Nepal-PAC (n=9)			Thailand-FSRI (n=10)			Thailand-KKU-FSRP (n=9)		
	P	Inv	Inf	P	Inv	Inf	P	Inv	Inf	P	Inv	Inf
a) Problem Identification	3.4	3.1	2.2	3.3	2.7	2.3	3.0	2.7	2.1	3.7	3.2	2.4
b) Inclusion of Indigenous Knowledge	3.4	2.8	2.3	3.1	2.3	2.1	2.9	2.7	2.4	3.7	3.2	2.7
c) Technology Selection (Deciding on Type of Technology to be Studied)	3.2	2.7	2.3	2.8	2.3	2.1	2.5	2.5	2.2	3.2	2.7	2.2
d) Execution of the Research	3.6	3.6	2.8	3.3	3.0	2.2	2.7	2.5	2.3	3.4	2.7	2.0
e) Evaluation of the Findings	2.8	2.8	2.2	2.9	2.8	2.9	3.2	3.1	3.0	3.7	3.2	2.4

* Derived from Appendix B-Tables 16 (CFSORD Case), 17 (PAC Case), 18 (FSRI Case), and 19 (KKU-FSRP Case) by multiplying the number of responses for each item with the originally assigned/selected (by respondent) corresponding value of preference (i.e., 1 = very low, 2 = low, 3 = high and 4 = very high) and then dividing the obtained value by the number of respondents in each case.

service is generally provided through a separate extension division under DOA. In this context, the FSR research staff were asked to provide their assessment of the participation, involvement and influence of the extension staff of the DOA-Extension

Table 3. The Extent of Participation, Involvement, and Influence of Extension Workers in Technology Development and Evaluation from Researchers' Point of View:

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence **(Mean Value)***

Activity	**Nepal-CFSORD (n=9)**			**Nepal-PAC (n=9)**			**Thailand** - FSRI (n=7)***		
	P	**Inv**	**Inf**	**P**	**Inv**	**Inf**	**P**	**Inv**	**Inf**
a) Problem Identification	2.6	2.3	2.1	2.7	2.1	1.9	3.3	3.0	2.4
b) Inclusion of Indigenous Knowledge	2.7	2.3	2.1	2.6	2.0	2.0	2.9	2.9	2.6
c) Technology Selection (Deciding on Type of Technology to be Studied)	2.2	2.2	2.0	2.3	2.0	2.0	2.9	2.9	2.3
d) Execution of the Research	2.1	2.0	2.0	2.3	1.9	1.9	2.9	2.9	2.4
e) Evaluation of the Findings	2.1	2.0	2.0	2.2	1.9	1.7	3.3	3.1	2.4

* Derived from Appendix C-Tables 21 (CFSORD case), 22 (PAC case), and 23 (FSRI case), by multiplying the number of responses for each item with the originally assigned/selected (by respondent) corresponding value of preference (i.e., 1 = very low, 2 = low, 3 = high and 4 =very high) and then dividing the obtained value by the number of respondents in each case.

** The staff members of KKU-FSRP interviewed felt that this item/question was not applicable to them (and thus KKU-FSRP case is not reported in this table) because there was no extension unit under KKU-FSRP. Moreover, the staff members also felt that they do not have adequate experience of working with the extension workers of the DOA, MOA in order to comment on their performance as asked in this study.

*** Three of the FSRI staff interviewed did not response to this particular question.

Division. Participation, involvement and influence of extension workers were also defined similarly to the farmers' case above. Responses of the FSR research staff are presented in Table 3 below (derived from Appendix C-Tables 21, 22 and 23).

As illustrated by the mean value(s) of the research staffs' responses to questions in Table 3 below, the influence of extension workers in various activities during the technology selection and development process was found to be relatively lower than their involvement and participation in all four cases studied. As in farmers' case above, the general trend here is also in a decreasing order -- from participation to involvement to influence. In other words, the level of extensionists' actual involvement was considered to be lower than their participation . And the level of their influence in the given activities was reported to be even less -- lower than their involvement. Basically, countrywise estimation (of researchers' responses) and interpretation of results also follow the same trend (see Appendix C-Table 24).

In conclusion, the low scores for 'influence' in both farmers' and extension workers' cases may imply that the researchers (i.e., the research staff of the FSR programs) still dominate in deciding the type of technology to be generated as well as the research process to be employed for technology generation.

Discussion:

These findings imply that although researchers have a general tendency to inform farmers and extension workers and secure their participation in research activities and process, final decisions about selection, generation and evaluation of technologies are made by the researchers. However, the limited involvement and influence of extension workers may perhaps be due to the lack of proper coordination mechanisms, as extension personnel were not part of the FSR organizations but personnel of a separate organization -- the Extension Division under DOA.

It seems that a change in the attitudes of researchers as to the potential value and relevancy of farmers' contributions is needed. Because "many NARS scientists..... ... have difficulty acceding to local farmers' views" (Baker, 1991:128). Chambers (1989) suggests that certain types of behavioral dispositions are required to put farmers first or to build real partnerships with farmers. Consistent with systems ideals, researchers need to realize that new technologies that have both relevance to local farming needs and sustainability can only be developed by involving farmer clientele as full partners in the entire research process.

Also, a change in the attitude of researchers as to the potential value and relevancy of extension workers' contributions is needed. "The staff of research institutions tend to think of themselves as superior to extension people, and are not noted for treating extensionists as professional partners" (Axinn, 1991a:76). The value of having extension workers who know the local clientele participate could be stressed and research scientists could learn to accept them as partners instead of feeling superior to them (and farmers).

5.3 Collaborative Multi-Disciplinary Research:

Analysis:

As mentioned in Chapter 3, "collaborative multidisciplinary research" was defined in this study as: active involvement of researchers from different scientific disciplines potentially including: plant science, animal science, social science, engineering science, home science, environmental science and systems science in the entire process. This component was measured by the number or variety of different scientific disciplines actively represented in the following four stages: (i) in deciding which data would be gathered, (ii) collecting data from the field, (iii) data analysis, and (iv) reports of findings and recommendations.

As presented in Appendix D-Table 25, multidisciplinary teams were involved in the first two phases (deciding what data to gather as well as during actual data gathering) in both Nepal cases, i.e. CFSORD and PAC. Both these cases utilized Samuhik Bhraman (group trek) in collecting data. The Samuhik Bhraman team in CFSORD case included representatives from the following disciplinary fields: agronomy, horticulture, soil science, plant pathology, entomology, animal science, social science, extension and economics. During the first and second stages, PAC basically included representatives from its major sections including: Agronomy, Horticulture, Forestry and Pasture, Livestock, Socioeconomics, Veterinary, Seed Technology and Outreach Research.

In both Thai cases also, multidisciplinary teams were involved in the first two stages (see Appendix D- Table 26). The major disciplines represented in the case of KKU - FSRP team were: crop science, soil science, social science, economics, plant protection, animal science and agro-climatology. In case of FSRI, the disciplines represented were: crop science, animal science, soil science, social science, plant protection, extension, economics and climatology/environmental science.

In all four cases, the research staff interviewed indicated that the number of scientific disciplines included tended to be less in the third and fourth stages (data analysis, and reports of findings and recommendations) than the previous two stages (deciding on type of data and data gathering). (See Appendix D-Tables 25 and 26). During the third and fourth stages, domination of agro-biological science was obvious. And social science input during these phases tended to be less. This was also confirmed from the content analysis of the relevant published reports.

It was also noted that there was no involvement of systems science, home science or engineering science in all four cases. Both Nepal cases also did not have representatives from environmental science. Although both Thai cases included environmental science during the first two phases, there was no representation of this discipline during the third and fourth stages. (See Appendix D-Tables 25 and 26).

Discussion:

The above findings suggest that while there was a multidisciplinary focus during initial stages, the focus tended to become more specialized in later stages. The social science input (as reflected in the reports of findings and recommendations) is typically weak. In general, FSR efforts are dominated by agro-biological science. This indicates a lack of appropriate linkages between disciplines. As systems scientists were not involved in the FSR team this resulted in lack of adequate work on syntheses of farming systems interactions and systems modeling. The absence of environmental scientists in the FSR teams in Nepal, and the lack of representation of environmental science beyond the initial stages in Thailand might be one of the reasons for the lack of formal environmental impact assessment, and low integration of environmental and common property resources in the current FSR programs in both countries.

As all four FSR programs also utilized inter-departmental staff (e.g. extensionists from the Department of Extension), the issues of extra work load and financial reward which impact on the effectiveness of the multidisciplinary team may seem apparent. Appropriate institutional mechanisms and reward systems are needed to develop and maintain effective linkages between the various disciplines. Disciplinary scientists must also be trained to interact with one another on a team.

5.4 Environmental and Common Property Integrity:

As discussed in Chapter 3, "environmental and common property integrity" was defined for the purpose of this study as: concern with the larger near environment of each farm, including common property resources, and integration of some type of environmental impact assessment (EIA) system in the FSR program. And this variable was measured by: (a) presence of technology selection system, and on farm technology trials; (b) use of some type of EIA as an important decision criteria for technology evaluation; (c) the extent of the inclusion of EIA in research documents;

(d) the extent to which "environment protection measures" (e.g. protection of common property resources) are considered in the research performed; and (e) the extent to which linkages between farming systems and components of the near environment are described and analyzed in the research.

As illustrated in Appendix E- Table 27, all the organizations studied in both the countries had a technology evaluation system, and conducted on-farm technology trials as well.

Regarding the use of some form of EIA as decision criteria for technology selection, none of the four FSR programs studied utilized such criteria. Although the EIA concept has been admired and considered informally by the farming systems researchers in both countries, none of the four program studied have utilized EIA as a direct decision criteria for technology evaluation. As illustrated in Table 4 below, the extent of the inclusion of EIA in research documents was found to be low in all cases. However, among the four cases, the KKU-FSRP staff more than the others, seemed to feel they had included EIA in research documents.

Table 4. Responses of Individual Staff Members Regarding the Extent of the Inclusion of EIA in Research Documents:

1 = Very Low 2 = Low 3 = High 4 = Very High

Nepal- CFSORD (n=9)				Nepal- PAC (n=9)				Thailand- FSRI (n=10)				Thailand- KKU-FSRP (n=9)			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	8	-	-	2	6	1	-	2	7	1	-	1	4	4	-

As presented in Appendix E-Tables 28 and 29, the most important criteria used to compare alternative technology in all four cases was "high yield". Other criteria considered by the researchers included: suitability of technology in the local farming systems and socioeconomic conditions; short duration and compatibility with the existing cropping system; low input requirement, high post harvest grain quality and good taste; and market price and marketability. EIA as such was not a major criterion, but the protection of natural environment was emphasized in all cases through reduced use of chemical inputs, and through increased use of local (non-chemical) inputs and conservation oriented improved practices (see Appendix E-Tables 28 and 29).

Regarding the extent to which environmental protection measures (e.g. common property resources) are considered in the research performed under the FSR program, all the four organizations reported to have low performance (see Table 5 below). However, as reported in Appendix E-Table 29, some relevant work, such as assessment of land quality (assessment of damage to the quality of soil), soil erosion control and correction of salinity problems were performed in Northeast Thailand by KKU-FSRP. PAC livestock unit has monitored the overgrazing problem in natural pasture lands. According to some researchers at FSRI, the environmental component is still difficult to incorporate into research projects due to current policy as well as budget constraints.

Furthermore, as shown in Table 6 below, the extent to which linkages between the farming system and components of the near environment are both described and

Table 5. The Extent to which "Environmental Protection Measures" (e.g., Common Property Resources) are Considered in the Research Performed Under the FSR programs:

1 = Very Low 2 = Low 3 = High 4 = Very High

Nepal-CFSORD (n=9)				**Nepal-PAC (n=9)**				**Thailand-FSRI (n=10)**				**Thailand-KKU-FSRP (n=9)**			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	8	-	-	2	6	1	-	4	6	-	-	1	5	3	-

analyzed in the research appeared to be low in both Nepal cases. Although the FSRI case also did not put significant emphasis on this aspect, it seemed to have relatively better consideration of it than either of the Nepal cases. The KKU-FSRP reported relatively high consideration of the linkage between farms and their near environment (see Table 6 below).

Table 6. An Assessment on the Extent to Which Linkages Between Farming System and Components of the Near Environment are Described and Analyzed in the Research:

1 = Very Low 2 = Low 3 = High 4 = Very High

Nepal-CFSORD (n=9)				**Nepal-PAC (n=9)**				**Thailand-FSRI (n=10)**				**Thailand-KKU-FSRP (n=9)**			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
-	6	3	-	-	7	2	-	1	5	4	-	-	4	4	1

Generally, as portrayed by Tables 4, 5 and 6 above, the (current) focus of FSR programs on "environmental and common property integrity" seems to be relatively low. However, as illustrated in Table 7, all the researchers interviewed in both countries indicated that the trend towards environmental awareness and consideration is increasing (but with a slow pace) during the last 2 - 3 years.

Table 7. A General Assessment on the Trend Towards Environmental Awareness and Consideration During the Last 2 - 3 Years.

1 = Trend in a Decreasing Order 2 = About the Same Trend 3 = An Increasing Trend but at a Slow Pace 4 = An Increasing Trend at a Rapid Pace

Nepal-CFSORD (n=9)				Nepal-PAC (n=9)				Thailand-FSRI (n=10)				Thailand-KKU-FSRP (n=9)			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
-	-	9	-	-	-	9	-	-	-	10	-	-	-	9	-

Discussion:

It seems that the philosophy of integrating environmental and common property resources into FSR is generally greeted with enthusiasm but in practice there is a lack of appropriate strategies and institutional mechanisms to accomplish such integration.

As the concern for sustainability in agricultural systems increasingly demands both rational use of common property resources and environmental protection, the use of an environmental impact assessment (EIA) as criterion for technology selection, and the consideration of environmental protection measures in FSR seems crucial. The lack of EIA and the low consideration of environmental protection measures in FSR in the present context, clearly indicate that work on integrating environmental components is still at an early stage. There is a crucial need and significant opportunity for an active involvement of environmental scientists in the entire FSR process.

Simplistic use of physical yield criterion for technology evaluation is inadequate as it fails to take account of the environmental component, and often ignores sustainability issues. More appropriate evaluative criteria involving considerations of environmental and common property resources are needed for research and extension activities.

5.5 Gender Integration:

Analysis:

"Gender integration" is defined here as the concern for and thus active involvement of female farmers, researchers and extensionists in all aspects of the agricultural research/extension process. This component was measured by: (a) total number and proportion of female scientists in the FSR organizations studied; and (b) percentage of female farmers participating in FSR activities and process.

As also reported in 5.3 above, the author learned that none of the four FSR organizations studied had their own extension unit. Thus, the question regarding the number of female extension workers did not apply in any of the cases.

As portrayed in Table 8 below, the number and percentage of female research scientists were reported to be 0 (0%) in CFSORD, 5 (8%) in PAC, 2 (22%) in FSRI, and 19 (33%) in KKU-FSRP.

Table 8. Total Number and Percentage of Female Research Scientists in the FSR Organization Studied:

F = Female (Number and Percentage) M = Male (Number and Percentage) T = Total Number

	Nepal-CFSORD			Nepal-PAC			Thailand-FSRI			Thailand-KKU-FSRP		
	F	M	T	F	M	T	F	M	T	F	M	T
Research-Scientists	0 0%	20 100%	20[a]	5 8%	60 92%	65[b]	2 22%	7 78%	9[c]	19 33%	38 67%	57[d]

a = Data for the FY 1990 - 1991 (including the five FSR sites).
(Source: CFSORD - Annual Report for the FY 1990/91).

b = Data for the FY 1990 - 1991.
(Source: PAC - Annual Report for the FY 1990/91).

c = Data for the FY 1991 - 1992 (for FSRI central office only).
(Source: Interview with the Director of FSRI).

d = Data for the FY 1988 - 1989.
(Source: KKU-FSRP's Report, 1989).

Regarding the percentage of female farmers included in the research process and activities (e.g. on-farm research), it was reported to be 11% in CFSORD, 19 % in PAC, 17.5 % in FSRI, and 13 % in KKU-FSRP (see Table 9 below). Considering the fact (as demonstrated in several references) that women in both Nepal and Thailand have the major responsibility for most areas of agricultural production, these data seem to indicate a low integration of the gender component in all four FSR programs studied.

Table 9. Responses of FSR Staff Regarding Percentage of Female Farmers Included in the Research Activities (e.g. On-Farm Research):

F = Female M = Male (Percentage)

	Nepal-CFSORD (n=9)		Nepal-PAC (n=9)		Thailand-FSRI (n=10)		Thailand-KKU-FSRP (n=9)	
	F	M	F	M	F	M	F	M
Farmers	11 %	89 %	19 %	81 %	17.5 %	83.5 %	30 %	70 %

NOTE: The percentage figures presented in the table reflect the average value of the total scores for each case, which was estimated by: (i) adding all the responses (percentages) for each case (e.g., 9 responses for CFSORD); and then (ii) by dividing the total score (obtained value) by the number of respondents (e.g. n = 9 in case CFSORD).

However, as illustrated in Table 10 below, all the researchers interviewed in both countries indicated that the trend towards gender integration in the agricultural research process has increased (but at a slow pace) during the last 2 to 3 years.

Table 10. A General Assessment On the Trend Towards Gender Integration in Agricultural Research Process During the Last 2 - 3 Years.

1 = Trend in a Decreasing Order 2 = About the Same Trend 3 = An Increasing Trend but at a Slow Pace 4 = An Increasing Trend at a Rapid Pace

Nepal-CFSORD (n=9)				Nepal-PAC (n=9)				Thailand-FSRI (n=10)				Thailand-KKU-FSRP (n=9)			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
-	-	9	-	-	-	9	-	-	-	10	-	-	-	9	-

Discussion:

These findings may imply that there is still passive resistance to gender integration in FSR programs. But as more than 50 percent of the rural farming population are women and the majority of farming activities are performed by women (see literature review in Chapter 2), the relevancy for gender integration into FSR seems absolutely necessary. The absence or low number and proportion of female scientists in FSR programs may raise concerns over the effectiveness of FSRE (as also indicated by Poats, 1990) in reaching the total farmer clientele and the efficient use of available human resources. Also the indigenous knowledge of women farmers (especially related to sustainability, e.g. IPM) could strengthen systems research.

Recognition of and attention to gender issues by FSR managers will need to increase in order to appropriately and efficiently reach the total farmer clientele. Without involving women as collaborating farmers and without using gender as an important analytical variable in on-farm technology development, systems ideals and underlying objectives of FSRE will remain incomplete.

5.6 Sustainability Considerations:

Analysis:

As mentioned in Chapter 3, "sustainability considerations" are defined in this study as the inclusion of research/extension efforts in FSR programs for development, promotion and utilization of ecologically and economically sustainable inputs and farming practices in order to maintain long-term production at a desired level and sustain ecological diversity and other important aspects of the eco-system. This component was assessed by:

(a) presence of research/extension efforts for application of indigenous knowledge, practices and resources/inputs;

(b) presence of such system linkage research/extension activities as: i) integrated pest management (IPM) system, ii) bio-fertilizers/inoculum, iii) green manuring, and iv) compost making and use;

(c) presence of such interdisciplinary research/extension efforts as: i) integrated (e.g. livestock cum crop) farming system, ii) mixed-cropping system, iii) inter-cropping system, and iv) agro-forestry system; and

(d) considerations of water and fuelwood factors in the system.

Readers should note that the above are indirect measures, most of which generally represent the considerations of the "biological" aspect of sustainability. As indicated in 3.1 (Chapter 3), these indirect measures are employed in this study because: firstly, growing numbers of literature suggest that the sustainability concept is difficult to measure directly. Secondly, although the other five variables and their measures included in this study are also associated with the sustainability concept, these measures (a - d above) can provide an estimation of the extent of considerations of the biological aspect of sustainability by the FSR programs.

As portrayed in Table 11 below, all four FSR programs studied seemed to have considered all of the above activities. However, the extent to which these activities are operationalized varies. For example, consideration of water and fuelwood factors in the system appeared to be relatively low in all four cases. Relatively low focus on green manuring activities was also noticed in all programs, except in the case of CFSORD. In all four cases, very high priority was given to research/extension efforts to use indigenous knowledge, practices and resources. In all cases, relatively high priority was also given to include interdisciplinary research efforts, such as mixed-cropping, inter-cropping and integrated (e.g. livestock cum crop) farming. The use of bio-inoculum and compost were also emphasized in all cases. The agro-forestry systems were also considered important in all four cases, and more importantly in Nepal cases. IPM system was also present in all four cases, but comparatively low emphasis was given to IPM by PAC. However, PAC has initiated some work on the use of local herbal insecticides. (See Table 11, below).

Table 11. Presence of Sustainability-Oriented Practices Under FSR Programs:

Presence of Efforts/ Activities	Nepal-CFSORD (n=9) Yes	No	Nepal-PAC (n=9) Yes	No	Thailand-FSRI (n=10) Yes	No	Thailand-KKU-FSRP (n=9) Yes	No
1. Presence of research/extension efforts for application of indigenous knowledge, practices, resources/inputs	9	-	9	-	10	-	9	-
2. Presence of such systems linkage research/extension activities as: a) Integrated pest management system;	7	2	5	4	8	2	7	2
b) Bio-inoculum	8	1	8	1	10	-	9	-
c) Green manuring;	7	2	5	4	5	5	5	4
d) Compost making & use	9	-	9	-	7	3	9	-
e) <u>Others</u>: Use of local herbal insecticides	-	-	6	3	-	-	-	-
3. Presence of such interdisciplinary research/ extension efforts as: a) Integrated (e.g. livestock cum crop) farming system;	9	-	9	-	9	1	9	-
b) Mixed-cropping system;	9	-	9	-	10	-	9	-
c) Inter-cropping system;	9	-	9	-	10	-	8	1
d) Agro-forestry system	9	-	9	-	7	3	7	2
4. Considerations of water and fuelwood factors in the system	3*	6	3*	6	2*	8	4*	5

* No specific/direct focus, but some indirect consideration only.

Discussion:

The current focus of FSR programs towards: (i) developing, promoting and utilizing indigenous knowledge, inputs and farming practices, (ii) interdisciplinary research/extension activities such as integrated farming, mixed-cropping, inter-cropping, agro-forestry system, and (iii) systems linkage research/extension activities, such as IPM, bio-inoculum, composting, green manuring is certainly encouraging. Because such activities and practices are known to have implications for both improving productivity and sustainablity of farming systems they are often recognized as very useful for encouraging agroecosystems and enhancing the quality of environment.

However, the low or absence of considerations of water and fuelwood factors in FSR indicate that awareness of the need and value of these factors in the system is still to be recognized among FSR practitioners. As the water and fuelwood factors are not only closely associated with the sustainability aspect, but also have implications for women's work loads in developing countries, integration of these factors into FSR is crucial.

VI. SUMMARY, CONCLUSIONS AND LIMITATIONS

The objective of this chapter is to summarize the four cases in order to estimate the emergence of the "new" systemic paradigm in agricultural research and extension in Nepal and in Thailand. The conclusions are based on the extent to which the six conceptual characteristics -- defining variables of the new paradigm are included/implemented by the FSR programs studied in the two countries.

The chapter is organized with a summary of findings and conclusion for each of the six defining variables of the new paradigm. Then a general conclusion is presented. Limitations of this study are discussed at the end of the chapter.

(1) Systematic Descriptions and Analysis of the Components of the Farm and the Linkages Among Them:

Summary of Findings:

The analysis of farming systems in all four cases studied included several farming components -- crops (grains, fruits and vegetables), livestock, the human (age and sex), inputs and outputs as well as linkages among these components (internal and external linkages). However, the extent of inclusion of the human component, i.e. analysis of people by age and sex appeared to be relatively low in all cases except the KKU-FSRP case. All four programs studied included consumption patterns and production data in their current farming systems analysis.

Conclusion:

Based on the assessment of these findings, one can conclude that all four cases have partially included the variable -- systemic descriptions and analysis of the components of the farm and the linkages among them -- as defined in this study.

(2) Farm Client Partnership with Researchers and Extensionists:

Summary of Findings:

Regarding the 'farm client partnership' which was defined as participation, involvement and influence of farmers in research activities -- problem diagnosis, technology selection, research execution and evaluation -- the involvement and influence remained low in all four cases studied. The involvement and influence of extension workers (from the Extension Division of DOA) was also reported to be low in all four cases. Participation of farmers by attendance in the local agricultural meetings and activities organized by the FSR program staff was considered to be relatively high in all cases.

Conclusion:

The actual situations found in all four cases do not seem to fit with the ideal definition of the variable -- farm client partnership with researchers and extensionists -- as defined and conceptualized in this study. However, considering the relatively high participation of farmers in relevant meetings and activities organized by the FSR program staff, one may say that the actual situations slightly fit the conceptual description of this variable.

(3) Collaborative Multi-disciplinary Research:

Summary of Findings:

The extent of application of "collaborative multidisciplinary research" system in the FSR programs was measured by the variety of different scientific disciplines actively represented in the following four stages: (i) deciding which data would be collected, (ii) collecting data from the field, (iii) data analysis, and (iv) reports of findings and recommendations. In all four cases, the major disciplines represented in the first two stages (deciding what types of data to gather and in collecting data from the field) included: plant/crop science, animal science, social science and economics. The FSRI and KKU-FSRP also included representatives from environmental science, but neither of the Nepal cases included this discipline. In all four cases, neither system science nor engineering science nor home science were represented in the team. In general, the research teams seemed to be dominated by agro-biological scientists.

In all four cases studied, the number of scientific disciplines represented tended to be less in the third and fourth stages (data analysis, and reports of findings and recommendations). This is also confirmed from the content analysis of the relevant published reports. Although the social science discipline is represented during the third and fourth stages, the extent of analyses, findings and recommendations related to this discipline is relatively low in most cases. Similar observation is made about the representation of animal science disciplines in both Thai cases.

Conclusion:

Based on the assessment of the above findings, it is concluded that the actual situations found in all four FSR programs partially fit the conceptual definition of the variable -- collaborative multidisciplinary research -- as defined in this study.

(4) Environmental and Common Property Integrity:

Summary of Findings:

No significant emphasis regarding the environmental and common property integrity was given by the FSR programs studied. The most important criterion used to compare alternative technology in all four programs was 'high yield'. Additionally, although the concept of environmental impact assessment (EIA) has been admired and considered informally in all four programs, EIA has not been utilized as an important formal decision criterion for any finding or recommendation in any of them. Environmental protection measures were not considered in the research performed. Furthermore, the extent to which linkages between the farming system and components of the near environment are described and analyzed in the research also appeared to be low in all cases, except in KKU-FSRP.

However, an increasing trend (but at a slow pace) towards environmental awareness and considerations during the last 2-3 years was reported in all cases. A general emphasis on protection of natural environment through reduced use of chemical inputs, and through increased use of local (non-chemical) inputs and conservation oriented improved practices was noted in all cases.

Conclusion:

On the basis of these findings, one can infer that these FSR programs are not integrating environmental and common property components into their research and extension systems. However, the existing attempts to intensify nonchemical-local inputs and to reduce the use of external-chemical inputs by the FSR programs in both countries may indicate a general concern towards protecting the natural environment as well as a concern for limited resource farmers.

(5) Gender Integration:

Summary of Findings:

The number and percentage of female scientists in all four organizations appeared to be extremely low. There were no female scientists in CFSORD. Among the four cases, the KKU-FSRP had the highest number (19) and percentage (33%) of female scientists. The proportion of female farmers included in the research activities also appeared to be low (less than 20%) in all four cases studied.

Conclusion:

Based on the above findings, the actual situations of all four cases studied do not fit the ideal definition of the variable -- gender integration-- as operationalized in this study.

(6) Sustainability Considerations:

Summary of Findings:

Sustainability considerations were assessed by using "indirect indicators such as: (a) the presence of research/extension efforts for application of indigenous knowledge, practices and resources/inputs; (b) the presence of such system linkage research/extension activities as: i) integrated pest management (IPM) system, ii) bio-inoculum, iii) green manuring, and iv) compost making and use; (c) the presence of such interdisciplinary research/extension efforts as: i) integrated (e.g. livestock cum crop) farming system, ii) mixed-cropping system, iii) inter-cropping system, and iv) agro-forestry system; and (d) considerations of water and fuelwood factors in the system under the FSR programs studied. In this regard, all four programs were reported to have considered all these efforts and activities to lesser or greater degree. Among these efforts, staff of all four programs reported placing a high emphasis on research/extension efforts for application of indigenous knowledge, practices and inputs as well as on interdisciplinary research/extension efforts. And systems linkage research/extension activities were also considered in all four programs. But consideration of water and fuelwood factors in the system appeared to be relatively low in all four cases.

Conclusion:

Based on these findings, it seems apparent that the actual situations in all four cases only partially fit the ideal definition of the variable--sustainability considerations --as operationalized in this study.

General Conclusion:

Overall, one can conclude that all four FSR programs partially fit the ideal model of the new systemic paradigm conceptualized in this study, but none of them totally fit the model. Table 12 below presents a summary regarding the degree of fit of the four FSR programs in terms of the ideal model. The actual situations in all four FSR programs seemed to have partial fit with the conceptual definitions (used in this study) of the following four variables: (i) systematic description and analysis of the components of the farm and the linkages among them; (ii) farm client partnership with researchers and extensionists; (iii) collaborative multidisciplinary research; (iv) sustainability considerations. The actual situations in all the four FSR programs did not seem to fit the conceptual definitions of the two variables -- environmental and common property integrity and gender integration.

These findings suggest that the new systemic paradigm in agricultural research and extension is struggling to emerge. It is unfolding gradually.

However, the six conceptual dimensions of the new paradigm identified in this study seem to be workable dimensions of the paradigm. Thus, replication of the empirical testing of all the six dimensions is recommended in other regions of the world.

Table 12. The Degree of Fit of the Four FSR Programs in Terms of the Ideal model of the new systemic Paradigm:

NF = No Fit PF = Partial Fit TF = Total Fit

Key Variables of the New Systemic Paradigm	Nepal-CFSORD			Nepal-PAC			Thailand-FSRI			Thailand-KKU-FSRP		
	NF	PF	TF	NF	PF	TF	NF	PF	TF	NF	PF	TF
(1) Systematic description and analysis of the components of the farm and the linkages among them.		X			X			X			X	
(2) Farm client partnership with researchers and extensionists.		X			X			X			X	
(3) Collaborative multi-disciplinary research.		X			X			X			X	
(4) Environmental and Common Property Integrity.	X			X			X			X		
(5) Gender Integration.	X			X			X			X		
(6) Sustainability considerations.		X			X			X			X	

Limitations of the Study:

While the conceptualization of a new paradigm for agricultural research and extension and the empirical testing of that conceptualization in this dissertation could provide useful insights for understanding the essence and practical implications of a systems approach for agricultural development, several limitations of this study can be noted:

(1) Due to time and financial constraints, this study concentrated in only two

countries in Asia. A broader comparative study involving several countries from different continents (e.g. Africa, Latin America, Europe, North America) would have been more useful in the present context of development and application of the systemic paradigm.

(2) It seems important to explore both researchers' (FSR staff) and farming clients' perspectives on the implementation of the new paradigm. But due to time constraints, this research concentrated only on FSR staff. Farmers' perspectives were not studied.

(3) There might be a relationship between the age, sex, position, number of years in service or academic background of respondents and their responses to survey questions. But this study did not explore the personal characteristics of the respondents.

(4) This study is only an early attempt in conceptualization and empirical testing of the various dimensions of the new paradigm. More studies may be needed to further refine this conceptualization.

VII. RECOMMENDATIONS

This chapter is divided into two sections. The first section presents recommendations for policy implications. The second section includes recommendations for future research.

7.1 Recommendations for Policy Implications:

If FSR policy makers, administrators and managers would like to implement FSR programs which fit the conceptualization used in this study, then based on the findings as well as observation and personal impression of the author, the following recommendations are made. Readers should note that implementation of these recommendations may require certain organizational and administrative changes in the current FSR organizations/programs.

(1) More emphasis and effort needs to be directed toward systematic description and analysis of the human component. As the human component is an integral part of a farming system, such analysis is crucial in FSR. Analysis of people by age and sex can provide indications of labor force composition and availability as well as of the composition of household/farming decision-makers by gender. Addition of staff representing social science, home science and systems science and thus providing enough time and manpower to carry out such analyses and modeling tasks are

suggested.

(2) The low influence of farmers (and high influence of researchers in final-decision making) in all four cases clearly indicates that FSR programs need to develop more appropriate and efficient methods for including farmers as decision-making partners in the research and extension processes. Real changes in the attitudes and orientation of researchers towards their clients and their needs are prerequisites for building a viable farm-client partnership with researchers. A reliable institutional mechanism to establish net-working and partnership between farmers, researchers and extensionists is needed. A change of attitude on the parts of both researchers and extensionists as to the potential value of farmers' contributions is essential.

Moreover, as all four FSR organizations studied did not have their own extension unit, and as involvement and influence of extensionists from separate departments (Department of Extension) was apparently low in all cases, formation of a extension unit within the FSR organization may be worth considering. This may help achieve better involvement, cooperation and contribution of extensionists in FSR activities and process. The attitude of research scientists toward extension also needs to be changed, i.e., they need to learn to treat extensionists as professional partners.

(3) All necessary systems components are not presently being addressed by FSR programs, especially in analysis and reports of findings and recommendations. So, integration of more disciplines into the research and extension process and activities will be required by FSR programs to incorporate various farming systems components. Involvement of systems science and formation of a "systems modeling"

group to analyze the data and produce "models" of the system is recommended. Integration of other disciplines such as environmental science, home science, and engineering science in the entire FSR process also seems essential.

(4) The findings indicated that work on integrating environmental and common property resources components is still at an early stage and much remains to be done by FSR programs. Awareness of the need for, and value of, environmental impact assessment (EIA) in FSR should be created among FSR practitioners. EIA needs to be considered as an important criterion for technology selection. More formal methods of assessing environmental impacts, and policy mandates to integrate the environmental component into FSR should be developed and implemented.

(5) The results of this study indicate a low integration of gender in FSR programs. Policies are needed to include gender variables while gathering and analyzing farming systems data as well as when designing FSR projects. Possibly a quota system or target goals for hiring female scientists as well as mandatory requirements for involving female farmers in FSR activities may be useful. When female scientists are in short supply within FSR organizations, short-term needs can be met through temporary contracts of female professionals from agricultural universities. The FSRE personnel need to intensify their efforts to understand and integrate female farmers into FSR activities. Male scientists need training to appreciate what women scientists can contribute and what women farmers know and do. Increased emphasis for gender integration is crucial, as the majority of farm activities in both of these countries (and in most developing countries) are performed by women.

(6) The findings also indicated that all FSR programs have ignored water and fuelwood factors in the system. As these factors are crucial and closely associated with the sustainability aspect as well as with women's work loads, especially in developing nations like Nepal, development and implementation of appropriate efforts and strategies to integrate these factors into FSR is suggested.

7.2 Recommendations for Future Research:

In recent years, much has been written about the evolution and increased application of the new systemic paradigm in agricultural research (e.g. FSRE, AFS, AEA), and the concept has been increasingly discussed at a wide range of seminars and forums. However, studies of the extent of practical application of the various systems elements of the new paradigm in current research organizations are relatively limited. This is one of the few studies about how nearly the real world situations fit the potentials of the new paradigm. Moreover, while the identification and conceptual definitions of the six key defining characteristics of the new systemic paradigm in this study may contribute in clarifying the essence and details of the systemic paradigm, further testing of this conceptualization in different regions is needed.

Since this study is limited in scope, more extensive studies would be desirable. The following are recommendations for future research:

(1) Considering the regional variations and their implications, replication of the empirical part of this research is needed in Africa, Latin America, Europe and North

America.

(2) Research on how effectively sustainability concerns are incorporated in the existing systems approach-oriented agricultural research programs (e.g. FSRE) might be useful.

(3) Study of the issues in institutionalizing a systems research approach (e.g. FSR) in the existing national agricultural research system would be valuable.

(4) Study to examine the detailed nature and extent of participation of different disciplines in actual research work is needed to identify ways to increase this.

(5) Research is recommended to examine the constraints which limited wider use of systems (e.g. FSRE) methods, or caused implementation to be less than ideal.

(6) Studies producing substantive research results about farming systems interactions, and analysis of impact of systems research (e.g. FSR) on farm level over time may be useful.

(7) Studies of the impact of FSR projects on the larger agricultural research systems of which they are a part would also be valuable.

APPENDICES

APPENDIX A

RESPONSES OF INDIVIDUAL STAFF MEMBERS OF FOUR FSR ORGANIZATIONS TO QUESTIONS REGARDING COMPONENTS AND LINKAGES STUDIED:

Table 13. Responses of Individual Staff Members of Four FSR Organizations to Questions Regarding Components and Linkages Studied:

Farming Components	**Nepal-CFSORD (n=9)**		**Nepal-PAC (n=9)**		**Thailand-FSRI (n=10)**		**Thailand-KKU-FSRP (n=9)**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
A. Crops: i) Grain Crops	9	-	9	-	10	-	9	-
ii) Fruit Crops	9	-	9	-	9	1	8	1
iii) Vegetable Crops	9	-	9	-	7	3	7	2
B. Livestock:	9	-	9	-	8	2	9	-
C. People: i) By Gender	3	6	6	3	7	3	9	-
ii) By Age	5	4	2	7	4	6	7	2
D. Inputs: i) Credit	3	6	7	2	5	5	7	2
ii) Input Price	7	2	7	2	9	1	8	1
iii) Input Availability	7	2	7	2	9	1	8	1
iv) Labor Price & Availability	7	2	7	2	9	1	9	-
E. Outputs: i) Output Price	7	2	7	2	10	-	9	-
ii) Market	8	1	8	1	8	2	7	2
iii) Marketing Channels	8	1	9	-	8	2	7	2
F. Internal Linkages: a) Internal Flow of Materials	8	1	8	1	8	2	9	-
b) Internal Flow of Services	5	4	5	4	6	4	7	2
G. External Linkages: a) Flow of Materials from Off the Farm	8	1	8	1	8	2	9	-
b) Flow of Services from Off the Farm	7	2	8	1	9	1	9	-
H. Consumption Patterns and Production Data:	9	-	9	-	10	-	9	-

Table 14. Responses (**Mean Value**)* of Individual Staff Members of FSR Organizations (**by Country**) to Questions Regarding Components and Linkages Studied.

Farming Components	**Nepal (n=18)**		**Thailand (n=19)**		**Total (N=37)**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
A. Crops: i) Grain Crops	18	-	19	-	37	-
ii) Fruit Crops	18	-	17	2	35	2
iii) Vegetable Crops	18	-	14	5	32	5
B. Livestock:	18	-	17	2	35	2
C. People: (i) By Gender	9	9	16	3	25	12
(ii) By Age	7	11	11	8	18	19
D. Inputs: (i) Credit	10	8	12	7	22	15
(ii) Input Price	14	4	17	2	31	6
(iii) Input Availability	14	4	17	2	31	6
(iv) Labor Price & Availability	14	4	18	1	32	5
E. Outputs: (i) output Price	14	4	19	-	33	4
(ii) Market	16	2	15	4	31	6
(iii) Marketing Channels	17	1	15	4	32	5
F. Internal Linkages: (i) Internal Flow of Materials	16	2	17	2	33	4
(ii) Internal Flow of Services	10	8	13	6	23	14
G. External Linkages: (i) Flow of Materials from Off the Farm	16	2	17	2	33	4
(ii) Flow of Services from Off the Farm	15	3	18	1	33	4
H. Consumption Patterns and Production Data:	18	-	18	19	37	-

*** Derived from Appendix A-Table 13 above, by adding up the scores (for each item) of two cases for each country and then dividing the obtained value by two i.e. number of cases in each country). The "total" value in the table is derived by adding up the scores of two countries.**

Table 15. Responses (**Mean Value**)* of Individual Staff Members of FSR Organizations (**by Country**) to Questions Regarding Components and Linkages (**Major Categories**) Studied.

(Mean Value)*

Farming Components and Linkages	**Nepal (n=18)** Yes	No	**Thailand (n=19)** Yes	No	**Total (N=37)** Yes	No
A. Crops	18	-	17	2	35	2
B. Livestock	18	-	17	2	35	2
C. People	8	10	13.5	5.5	21.5	15.5
D. Inputs	13	5	16	3	29	8
E. Outputs	16	2	16.5	2.5	32.5	4.5
F. Internal Linkages	13	5	15	4	28	9
G. External Linkages	15.5	2.5	17.5	1.5	33	4
H. Consumption Patterns and Production Data	18	-	19	-	37	-

* Derived from Appendix A- Table 14 above by adding the values/scores of sub items under each major category (e.g., crops, people, internal linkages) and calculating the mean value (by dividing the total value by number of sub items) for each category.

APPENDIX B

THE EXTENT OF PARTICIPATION, INVOLVEMENT AND INFLUENCE OF FARM CLIENT WITH RESEARCHERS, FROM RESEARCHERS' POINT OF VIEW:

Table 16. The Extent of Participation, Involvement and Influence of Farm Client With Researchers, from Researchers' Point of View - **Nepal-CFSORD Case:**

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence (n=9)

Activity	Participation				Involvement				Influence			
	1	2	3	4	1	2	3	4	1	2	3	4
a) Problem Identification	-	-	5	4	-	-	8	1	1	5	3	-
b) Inclusion of Indigenous Knowledge	-	-	5	4	-	2	7	-	-	6	3	-
c) Technology Selection (Deciding on Type of Technology to be Studied)	-	1	5	3	-	3	6	-	-	7	1	1
d) Execution of the Research	-	-	4	5	-	-	4	5	-	2	7	-
e) Evaluation of the Findings	-	3	5	1	1	3	6	-	1	6	1	1

Table 17. The Extent of Participation, Involvement and Influence of Farm Client With Researchers, from Researchers' Point of View - **Nepal-PAC Case:**

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence (n = 9)

Activity	Participation				Involvement				Influence			
	1	2	3	4	1	2	3	4	1	2	3	4
a) Problem Identification	-	1	4	4	-	3	6	-	2	2	5	-
b) Inclusion of Indigenous Knowledge	-	1	6	2	-	6	3	-	1	6	2	-
c) Technology Selection (Deciding on Type of Technology to be Studied)	-	3	5	1	2	2	5	-	2	4	3	-
d) Execution of the Research	-	1	4	4	-	1	7	1	1	3	3	1
e) Evaluation of the Findings	-	1	8	-	-	2	7	-	-	2	6	1

Table 18. The Extent of Participation, Involvement and Influence of Farm Client With Researchers, from Researchers' Point of View - **Thailand-FSRI Case:**

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence (n = 10)

Activity	**Participation**				**Involvement**				**Influence**			
	1	2	3	4	1	2	3	4	1	2	3	4
a) Problem Identification	-	1	8	1	-	4	5	1	2	5	3	-
b) Inclusion of Indigenous Knowledge	1	2	5	2	-	4	5	1	1	4	5	-
c) Technology Selection (Deciding on Type of Technology to be Studied)	1	4	4	1	-	6	3	1	1	6	3	-
d) Execution of the Research	1	2	6	1	1	3	6	-	1	5	4	-
e) Evaluation of the Findings	-	1	6	3	-	1	7	2	-	2	6	2

Table 19. **The Extent of Participation, Involvement and Influence of Farm Client With Researchers, from Researchers' Point of View - Thailand-KKU-FSRP Case:**

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence (n = 9)

Activity	Participation				Involvement				Influence			
	1	2	3	4	1	2	3	4	1	2	3	4
a) Problem Identification	-	-	3	6	-	1	5	3	1	5	1	2
b) Inclusion of Indigenous Knowledge	-	-	3	6	-	-	7	2	-	4	4	1
c) Technology Selection (Deciding on Type of Technology to be Studied)	-	2	3	4	1	2	5	1	2	4	2	1
d) Execution of the Research	-	1	3	5	-	3	6	-	2	5	2	-
e) Evaluation of the Findings	-	-	3	6	-	-	7	2	1	3	5	-

Table 20. The Extent of Participation, Involvement and Influence of Farm Client with Researchers, from Researchers' Point of View (**Countrywise Presentation**):

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence **(Mean Value)***

Activity	**Nepal (n=18)** P	Inv	Inf	**Thailand (n=19)** P	Inv	Inf	**Total (N=39)** P	Inv	Inf
a) Problem Identification	3.4	2.9	2.3	3.3	2.9	2.3	3.4	2.9	2.3
b) Inclusion of Indigenous Knowledge	3.3	2.6	2.2	3.2	2.9	2.5	3.2	2.8	2.4
c) Technology Selection (Deciding on Type of Technology to be Studied)	3.0	2.5	2.2	2.8	2.6	2.2	2.9	2.5	2.2
d) Execution of the Research	3.4	3.3	2.5	3.1	2.6	2.2	3.2	2.9	2.3
e) Evaluation of the Findings	2.8	2.8	2.6	3.4	3.2	2.7	3.1	3.0	2.6

* Derived from Appendix B - Tables 16, 17, 18 and 19, by multiplying the number of responses for each item (of each case) with the originally assigned/selected (by respondent) corresponding value of preference (i.e., 1 = very low, 2 = low, 3 = high, and 4 = very high), and then adding the obtained itemwise value/score of two cases (e.g., CFSORD and PAC) together and finally dividing the itemwise total score (of each country) by the number of respondents (e.g., 18 in Nepal's case).

APPENDIX C

THE EXTENT OF PARTICIPATION, INVOLVEMENT AND INFLUENCE OF **EXTENSION WORKERS**, FROM RESEARCHERS' POINT OF VIEW:

Table 21. Extent of Participation, Involvement and Influence of **Extension Workers** from Researcher' Point of View - **Nepal-CFSORD Case:**

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence (n=9)

Activity	**Participation**				**Involvement**				**Influence**			
	1	2	3	4	1	2	3	4	1	2	3	4
a) Problem Identification	-	4	5	-	1	4	4	-	1	6	2	-
b) Inclusion of Indigenous Knowledge	-	4	4	1	1	4	4	-	1	6	2	-
c) Technology Selection (Deciding on Type of Technology to be Studied)	1	5	3	-	1	5	3	-	1	7	1	-
d) Execution of the Research	2	4	3	-	2	5	2	-	1	7	1	-
e) Evaluation of the Findings	2	4	3	-	2	5	2	-	1	7	1	-

Table 22. Extent of Participation, Involvement and Influence of **Extension Workers** from Researcher' Point of View - **Nepal-PAC Case:**

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence (n=9)

Activity	Participation				Involvement				Influence			
	1	2	3	4	1	2	3	4	1	2	3	4
a) Problem Identification	-	4	4	1	1	6	2	-	2	6	1	-
b) Inclusion of Indigenous Knowledge	-	4	5	-	2	5	2	-	2	5	2	-
c) Technology Selection (Deciding on Type of Technology to be Studied)	1	4	4	-	1	7	1	-	1	7	1	-
d) Execution of the Research	1	4	4	-	2	6	1	-	2	6	1	-
e) Evaluation of the Findings	1	5	3	-	3	4	2	-	3	6	-	-

Table 23. Extent of Participation, Involvement and Influence of **Extension Workers** from Researcher' Point of View - **Thailand-FSRI Case:**

1 = Very Low; 2 = Low; 3 = High; 4 = Very High

P = Participation; Inv = Involvement; Inf = Influence (n = 7)*

Activity	Participation 1	2	3	4	Involvement 1	2	3	4	Influence 1	2	3	4
a) Problem Identification	-	1	3	3	-	1	5	1	-	4	3	-
b) Inclusion of Indigenous Knowledge	-	2	4	1	-	2	4	1	-	4	2	1
c) Technology Selection (Deciding on Type of Technology to be Studied)	-	2	4	1	-	2	4	1	-	5	2	-
d) Execution of the Research	-	2	4	1	-	1	6	-	-	4	3	-
e) Evaluation of the Findings	-	1	3	3	-	-	6	1	-	4	3	-

* Three of the staff members (of FSRI) interviewed did not response to this question.

Table 24. Extent of Participation, Involvement, and Influence of **Extension Workers** from Researchers' Point of View (**Countrywise Presentation**):

1 = very low; 2 = low; 3 = high; 4 = very high)

P = Participation; Inv = Involvement; Inf = Influence **(Mean Value)***

Activity	**Nepal (n=18)**			**Thailand** (n=7)**			**Total (N=25)**		
	P	**Inv**	**Inf**	**P**	**Inv**	**Inf**	**P**	**Inv**	**Inf**
a) Problem Identification	2.6	2.2	2.0	3.3	3.0	2.4	2.8	2.4	2.1
b) Inclusion of Indigenous Knowledge	2.6	2.2	2.1	2.9	2.9	2.6	2.7	2.4	2.2
c) Technology Selection (Deciding on Type of Technology to be Studied)	2.3	2.1	2.0	2.9	2.9	2.3	2.4	2.3	2.1
d) Execution of the Research	2.2	1.9	1.9	2.9	2.9	2.4	2.4	2.2	2.1
e) Evaluation of the Findings	2.2	1.9	1.8	3.3	3.1	2.4	2.5	2.3	2.0

* Derived from Appendix C- Tables 21, 22 and 23 by multiplying the number of responses for each item (of each case) with the originally assigned/selected (by respondent) corresponding value of preference (i.e., 1 = very low, 2 = low, 3 = high, and 4 = very high), and then adding the obtained itemwise value/score of two cases (e.g., CFSORD and PAC) together and finally dividing the itemwise total score (of each country) by the number of respondents (e.g., 18 in Nepal's case).

** Low responses (n=7) in Thai case was due to the fact that the staff members of KKU-FSRP interviewed felt that this question/item was not applicable to them (and thus KKU-FSRP case is not reported here). Moreover, three of the staff members (of FSRI) interviewed did not response to this question.

APPENDIX D

VARIETY OF DIFFERENT SCIENTIFIC DISCIPLINES ACTIVELY REPRESENTED IN FSR STAGES:

Table 25. Variety of Different Scientific Disciplines Actively Represented in FSR Stages - **Nepal Cases -- CFSORD and PAC:**

Stages	**Variety of Different Scientific Disciplines Activity Represented**	
	Nepal-CFSORD (n=9)	**Nepal-PAC (n=9)**
(a) Deciding which Data to Gather:	1. Agronomy 2. Horticulture 3. Soil Science 4. Plant Pathology 5. Entomology 6. Social Science 7. Extension 8. Economics 9. Animal Science [Samuhik Bhraman (Group Trek) Team]	1. Agronomy 2. Horticulture 3. Livestock 4. Forestry and Pasture 5. Socioeconomics 6. Veterinary 7. Seed Technology 8. Outreach Research (Samuhik Bhraman Team involving the above major sections of PAC)
(b) Collecting Data from the Field:	1. Agronomy 2. Horticulture 3. Soil Science 4. Plant Pathology 5. Entomology 6. Social Science 7. Extension 8. Economics 9. Animal Science (Samuhik Bhraman Team)	1. Agronomy 2. Horticulture 3. Livestock 4. Forestry and Pasture 5. Socioeconomics 6. Veterinary 7. Seed Technology 8. Outreach Research (Samuhik Bhraman Team)
(c) Data Analysis:	1. Agronomy 2. Horticulture 3. Soil Science* 4. Animal Science 5. Social Science*	1. Agronomy 2. Horticulture 3. Livestock 4. Forestry and Pasture 5. Socioeconomics*
(d) Reports of Findings and Recommendations:	1. Agronomy 2. Horticulture 3. Soil Science* 4. Animal Science 5. Social Science*	1. Agronomy 2. Horticulture 3. Livestock 4. Forestry and Pasture 5. Socioeconomics*

NOTE: The number of disciplines during the stages (c) and (d) are also confirmed from the content analysis of the relevant published reports.
* The extent of details (analysis, findings and recommendations) is relatively low.

Table 26. Variety of Different Scientific Disciplines Actively Represented in FSR Stages - **Thailand Cases -- FSRI and KKU-FSRP:**

Stages	**Variety of Different Scientific Disciplines Activity Represented** **Thailand-FSRI (n=10)**	 **Thailand-KKU-FSRP (n=9)**
(a) Deciding which Data to Gather:	1. Crop Science 2. Animal Science 3. Soil Science 4. Social Science 5. Plant Protection 6. Extension 7. Economics 8. Climatology/Environmental Science (Multidisciplinary team involving FSRI and DOA's other interdivisional staff)	1. Crop Science 2. Soil Science 3. Plant Protection 4. Economics 5. Animal Science 6. Social Science 7. Agro-Climatology (Multidisciplinary team involving KKU's interdepartmental staff)
(b) Collecting Data from the Field:	1. Crop Science 2. Animal Science 3. Soil Science 4. Social Science 5. Plant Protection 6. Extension 7. Economics 8. Climatology/Environmental Science (Multidisciplinary team involving FSRI and DOA's other interdivisional staff)	1. Crop Science 2. Soil Science 3. Plant Protection 4. Economics 5. Animal Science 6. Social Science 7. Agro-Climatology (Multidisciplinary team involving KKU's interdepartmental staff)
(c) Data Analysis:	1. Crop Science 2. Animal Science* 3. Social Science* 4. Climatology	1. Crop Science 2. Animal Science* 3. Social Science 4. Economics*
(d) Reports of Findings and Recommendations:	1. Crop Science 2. Animal Science* 3. Social Science* 4. Climatology	1. Crop Science 2. Animal Science* 3. Social Science 4. Economics*

NOTE: The number of disciplines during the stages (c) and (d) are also confirmed from the content analysis of the relevant published reports.

* The extent of details (analysis, findings and recommendations) is relatively low.

APPENDIX E

TECHNOLOGY SELECTION SYSTEM AND CRITERIA:

Table 27. Presence of Technology Selection System, and On-Farm Technology Trial:

	Nepal-CFSORD (n=9)		**Nepal-PAC (n=9)**		**Thailand-FSRI (n=10)**		**Thailand-KKU-FSRP (n=9)**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
a) Did they get into technology selection?	9	-	9	-	10	-	9	-
b) Did they do on-farm technology trial?	9	-	9	-	10	-	9	-

Table 28. Criteria Used to Compare Alternative Technology - **Nepal Cases-CFSORD and PAC:**

(What criteria (e.g. EIA?) was used to compare alternative technology?).

Nepal-CFSORD (n=9)	**Nepal-PAC (n=9)**
1. High yield*/output. 2. Short duration and compatibility with existing cropping pattern. 3. Post harvest grain quality and good taste. 4. High market price and marketability. 5. No formal EIA criteria is used in FSR. However, environmental considerations are emphasized through increased utilization of non-chemical-inputs (local inputs), and through the increased use of improved conservation practices.	1. High yield* (grain & Straw). 2. Adaptability to the local farming systems and socioeconomic conditions. 3. Low input alternative technology. 4. Superior (to local) post-harvest quality and marketability. 5. EIA is not used as an evaluative criteria for technology selection. But in recent years, the focus has been to encourage: the use of local inputs/resources (e.g. compost, herbal insecticides) and conservation oriented cultural practices. 6. Increased awareness and consideration for the protection of natural environment in recent years (e.g. PAC livestock unit is monitoring the overgrazing problem).

* "High yield" was the highest priority criteria mentioned by <u>all</u> respondents.

NOTE: The comments presented in this table are the most frequently mentioned by the respondents (staff members of the FSR programs studied).

Table 29. Criteria Used to Compare Alternative Technology - **Thailand Cases-FSRI and KKU-FSRP:**

(What criteria (e.g. EIA?) was used to compare alternative technology?).

Thailand-FSRI (n=10)	**Thailand-KKU-FSRP (n=9)**
1. High yield*.	1. High yield* (focus on input-output model).
2. Suitability of technology to local socio-economic condition.	2. Productivity, stability and sustainability.
3. Formal EIA criteria is not applied yet. But emphasis is being placed on developing and promoting non-chemical, local inputs and alternative technologies.	3. Environmental concerns are increasingly emphasized in recent years. However, EIA has not been utilized as an evaluative criteria.
4. Impact of cropping pattern on local natural environment is being considered to some extent.	4. Effect of technology on environment is considered to some extent, e.g. assessment of land quality (damage to the quality of soil).
5. Environmental component is still difficult to incorporate into research projects due to current policies, mandates and budget constraints.	5. No direct environmental protection focus in current FSR activities. But efforts such as, reduced use of chemicals, promotion of organic fertilizers, manures, compost making and use, IPM practices, conservation practices for soil erosion control, correction of salinity etc. are being considered.
6. Long term economic growth and environmental protection is being focussed in recent years.	6. Increased reliance on indigenous inputs and knowledge system in recent years.

* "High yield" was the highest priority criteria mentioned by all respondents.

NOTE: The comments presented in this table are the most frequently mentioned by the respondents (staff members of the FSR programs studied).

APPENDIX F

DATA GATHERING GUIDE
(USED IN THE FIELD STUDY)

Date: ___________

DATA GATHERING GUIDE:

I. Systematic Description and Analysis of the Internal and External Components of the Farm and the Linkages Among Them:

(The extent to which the analysis of farming systems include all of the significant components: plant, animal and human, relevant items within each of these components, and linkages among these components).

Q-1. What types of farming components are operationalized in the actual research process?

Farming Components		Yes	No
A. Crops:	i) Grain Crops		
	ii) Fruit Crops		
	iii) Vegetable Crops		
B. Livestock:			
C. People:	i) By Gender		
	ii) By Age		
D. Inputs:	i) Credit		
	ii) Input Price		
	iii) Input Availability		
	iv) Labor Price & Availability		
E. Outputs:	i) Output Price		
	ii) Market		
	iii) Marketing Channels		
F. Internal Linkages:	i) Internal Flow of Materials		
	ii) Internal Flow of Services		
G. External Linkages:	i) Flow of Materials From Off the Farm		
	ii) Flow of Services From off the Farm		
H. Consumption Patterns and Production Data:			

II. Farm Client Partnership with Researchers and Extensionists:

Q-2. Extent of participation, involvement, and influence of farming clients in each of the following cases:

(Circle one for each)
(1 = very low; 2 = low; 3 = high; 4 = very high)

	Participation				Involvement				Influence			
(a) Problem Identification	1	2	3	4	1	2	3	4	1	2	3	4
(b) Inclusion of Indigenous Knowledge	1	2	3	4	1	2	3	4	1	2	3	4
(c) Technology Selection (Deciding on Type of Technology to be Studied)	1	2	3	4	1	2	3	4	1	2	3	4
(d) Execution of the Research	1	2	3	4	1	2	3	4	1	2	3	4
(e) Evaluation of the Findings	1	2	3	4	1	2	3	4	1	2	3	4

Q-3. Extent of participation, involvement, and influence of extension workers in each of the following cases:

(Circle one for each)
(1 = very low; 2 = low; 3 = high; 4 = very high)

	Participation				Involvement				Influence			
(a) Problem Identification	1	2	3	4	1	2	3	4	1	2	3	4
(b) Inclusion of Indigenous Knowledge	1	2	3	4	1	2	3	4	1	2	3	4
(c) Technology Selection (Deciding on Type of Technology to be Studied)	1	2	3	4	1	2	3	4	1	2	3	4
(d) Execution of the Research	1	2	3	4	1	2	3	4	1	2	3	4
(e) Evaluation of the Findings	1	2	3	4	1	2	3	4	1	2	3	4

III. Collaborative Multidisciplinary Research:

(Active involvement of researchers from different scientific disciplines potentially including: plant science, animal science, social science, environmental science and systems science in the entire process of technological development).

Q-4. Variety of different scientific disciplines actively represented in the following FSR Stages:

Stages:	Variety of Different Scientific Disciplines Actively Represented:
(a) Deciding Which Data to Gather:	____________ ____________ ____________ ____________
(b) Collecting Data from the Field:	____________ ____________ ____________ ____________
(c) Data Analysis:	____________ ____________ ____________ ____________
(d) Reports of Findings and recommendations:	____________ ____________ ____________ ____________

IV. <u>Environmental and Common Property Integrity</u>:

Q-5. Use of environmental impact assessment (EIA) as an important (formal) decision criteria for technology selection:

(a) Did they get into technology selection? Yes --- No ---

(b) Did they do on-farm technology trail? Yes --- No ---

(c) What Criteria did they use to compare alternative technology?

e.g. EIA? ____________________

____

____

Q-6. Extent of the inclusion of EIA in research documents:

(Circle one number)

1	2	3	4
(very low)	(low)	(high)	(very high)

Q-7. The extent to which "environmental protection measures" (e.g. common property resources) are considered in the research performed under your (FSRE) organization/program:

(Circle one number)

1	2	3	4
(very low)	(low)	(high)	(very high)

Q-8. An assessment on the extent to which linkages between farming system and components of the near environment are described and analyzed in the research:

(Circle one number)

1	2	3	4
(very low)	(low)	(high)	(very high)

Q-9. A general assessment on the trend towards environmental awareness and consideration during the last 2 -3 years:

(Circle one number)

1	2	3	4
(Trend in a increasing order)	(About the same trend)	(An increasing trend but at a slow pace)	(An increasing trend at a rapid pace)

V. Gender Integration:

(Concern for and thus active involvement of female farmers, researchers and extensionists in all aspects of the agricultural research/extension process).

Q-10. Total number and percentage of female research scientists, extensionists in the FSR organization:

	Male (# and %)	Female (# and %)	Total Number
Research Scientists			
Extensionists			

Q-11. Percentage/proportion of female farmers included in the research activities (e.g. on-farm research):

	Male	Female	Total
Farmers			

Q-12. A general assessment on the trend towards gender integration in agricultural research process during the last 2 -3 years:

(Circle one number)

1	2	3	4
(Trend in a increasing order)	(About the same trend)	(An increasing trend but at a slow pace)	(An increasing trend at a rapid pace)

VI. **Sustainability Considerations:**

(Inclusion of efforts for development, promotion and utilization of ecologically and economically sustainable inputs and farming practices in order to maintain long-term production at a desired level and sustain ecological diversity and other important aspects of the eco-system as well).

Q-13. **Presence of the following efforts/practices under the current FSRE system of your organization/program:**

Presence of Efforts/Activities:	**Yes**	**No**	**Remarks**
1. Presence of Research/Extension Efforts for Application of Indigenous Knowledge, Practices and Resources/Inputs			
2. Presence of Such Systems Linkage Research/Extension Activities As: **(a)** Integrated Pest Management (IPM) System;			
(b) Bio-Inoculum/Fertilizers;			
(c) Green Manuring; and			
(d) Compost Making and Use			
(d) Others			
3. Presence of Such Interdisciplinary Research/Extension Efforts As: **(a)** Integrated (e.g. Livestock Cum Crop) Farming System;			
(b) Mixed-Cropping System;			
(c) Inter-Cropping System;			
(d) Agro-Forestry System			
(e) Others			
4. Considerations of Water and Fuelwood Factors in the System			

General Information About the FSRE Organization/Program:

1. Name of the Organization/Program: ______________________

2. Date of Establishment: ______________________

3. Address: ______________________

4. Telephone: ______________ Fax: ______________

5. Total Number of Research Personnel: ______________________

6. Total Number of Extension Personnel: ______________________

7. Total Number of Administrative Personnel: ______________

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BIBLIOGRAPHY

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