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# FARMING SYSTEMS RESEARCH AND EXTENSION IN SOUTH AFRICA: LESSONS OF EXPERIENCE

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**Abstract**

Agricultural researchers, extension workers and developers are faced with the problem that modern improved technology is often rejected by smallholder farmers in developing areas all over the world. The paper analyses the South African problem within the context of the needs and constraints facing smallholder farmers and rural dwellers in developing areas to secure access to markets. Development strategies are briefly proposed arguing the need for comprehensive farmer support programmes. Farming Systems Research and Extension (FSR/E) is identified as an important element of any Farmer Support Programme (FSP). The role of FSR/E in the proposed development strategy is analysed and it is concluded that FSR/E should have as its ultimate goal, the promotion of economic, social and structural change induced by technological transformation at all levels in the rural community. Lessons from five FSR/E studies in South Africa are highlighted emphasizing: a) identification for research into farmer support systems, community support systems, farmer settlement systems, and commercial farming systems; b) differences in respect of decision-making responsibilities of individuals, groups and households, vis-a-vis implementation responsibilities; c) support specifically structured toward women; d) position and role of livestock and multiple cropping systems and risk avoidance; and e) the need for development goals to be clearly defined and principles and criteria to be followed when considering FSR/E projects. It is further argued that the present South African initiatives in developing a new research policy offers an unique opportunity to restructure research linking institutions in a network where appropriate technological innovation and delivery is attended to.

**Samevatting**

Landbounavorsers, voorligters en ontwikkelaars kom voor die probleem te staan dat moderne tegnologie dikwels deur kleinhoewe boere dwarsoor die ontwikkelende wêreld, verwerp word. Die referaat ontleed die Suid-Afrikaanse probleem binne die konteks van die behoeftes en beperkinge wat kleinhoewe boere en landelike gemeenskappe ondervind om toegang tot markte te verkry. Boerdery Ondersteunings Programme (BOP) word voorgestel as 'n toepaslike ontwikkelings strategie. Boerdery Stelsels Navorsing en Voorligtig (BSN-V) word as 'n belangrike element van enige BOP geidentifiseer. Die rol van BSN-V in die voorgestelde strategie word ontleed en daar word tot die gevolgtrekking gekom dat BSN-V as uiteindelike doel die bevordering van ekonomiese, sosiale en strukturele veranderinge, wat deur tegnologiese vernuwing op alle vlakke in die landelike gemeenskap teweeg gebring word, daar moet stel. Lesse uit vyf BSN-V studies beklemtoon: (a) identifisering van navorsing ten opsigte van klein-boer ondersteuningstelsels, gemeenskap ondersteuningstelsels, boerevestigingstelsels en kommersiele boerderystelsels; b) verskille in besluitnemings verantwoordelikhede van individue, groepe en huishoudings ten opsigte van implementerings verantwoordelikhede; c) ondersteuning wat spesifiek tot vrouens in landbou gerig is; d) die posisie van vee en veelvoudige gewasproduksiesisteme en risiko; en e) die vereiste dat doelwitte duidelik uitgestip word en begingsel en kriteria nagekom word wanneer BSN-V projekte oorweeg word. Daar word tot die slotsom gekom dat die huidige Suid-Afrikaanse innisiatiewe om 'n nuwe navorsingsbeleid te ontwikkel 'n unieke geleentheid bied om navorsing te herstruktureer deur alle landbou instellings in 'n netwerk waar toepaslike tegnologiese innovasie en lewering aandag geniet, in te skakel.

## 1. Introduction

The emphasis placed by the present economic development policies in South Africa on the application of sound economic principles and criteria, on the devolution of decision making and responsibilities and on support to private sector activities, and the future incorporation of Blacks as landright holders would focus pertinent attention and affirmative action towards emerging black farmers (full or part-time). It would be important to design agricultural policies, strategies and farmer models with support to and settlement of farmers as major objectives (Van Rooyen, Vink and Christodoulou, 1987). This approach calls for the re-direction of present agricultural development policies towards opening access for farmers and all users of agricultural resources to the common input and product markets. This further implies emphasis on farmer support programmes (FSP) as well as agricultural interaction and economic cooperation within and between regions in South Africa. These features should be considered as important within the design of a South African food policy as they deal pertinently with resource allocation on macro as well as micro levels (van Rooyen and van Zyl, 1990).

In order to provide access and entitlements to all categories of farmers and structure investment in an efficient and effective manner in this process, the following pertinent elements (van Rooyen, Vink and Christodoulou 1987) need to be attended to:

i) the acquisition by individuals of *de facto* rights to production which would include land security, rents, contracts and quotas;

ii) The adequate provision of appropriate inputs and on-farm infrastructure, and the funding thereof (credit), to the farmer;

iii) the provision of mechanization services, which cater for all aspects of, land preparation, planting and cultivation (harvesting and transport to storage may also be required), as well as the maintenance of machinery, implements and infrastructure;

iv) the provision of marketing channels and services should this become necessary (ie grading, storage, packaging and transport);

v) specific development related research to ensure that maximum opportunity can be made of existing and new technology and the provision of adequate extension, information and demonstration thereof;

vi) the provision of training and management support to facilitate the development of managerial skills needed, both on the farm and at an institutional level;

vii) the provision of off-farm agricultural infrastructure necessary to support FSP. The provision of this element differs to that of on-farm fixed improvements and is seldom paid for directly by the farmer.

A deficiency in any one of the above or in the synergy between any two could cause sufficient distortion in the system to result in failure. A pertinent planning activity would, therefore, be the harmonization of the above elements in a systematic manner. Sufficient evidence exists that a farming systems approach is central to any policy formulation on FSP (Harwood, 1979; van Rooyen, 1984; Rose and Tapson, 1984; Bembridge, 1982).

In this context, appropriate research, technology development, and the demonstration and extension thereof can be identified as one of the strategic elements in addressing development problems. A farming systems research and extension (FSR/E) approach is proposed as the most appropriate strategy in this regard (Stilwell, van Rooyen and Gouws, 1988; van Rooyen and Stilwell, 1989). Within a FSP policy framework, it is evident that FSR/E would address the whole spectrum of operational support elements, ie production inputs, production practices, appropriate equipment, training and extension, marketing and infrastructure, as well as appropriate policy.

As an integral part of the development process, the role of FSR/E in development policy and strategy warrants further detail consideration.

The goals of FSR/E should be in harmony with the overall development policy objectives of a particular state or region, and its role should be to support overall development policy. It should thus focus on national objectives and the farmers' requirements for improved technologies (Gamble, 1984). Goal incongruancy between any two of the national objectives, farmer objective functions and FSR/E objectives, would result in FSR/E not being applied as a coherent coordinated strategy, and result in unproductive research efforts.

The expected future emphasis on smallholder farming will have a substantial impact on the structuring of a agricultural research and technology system supporting the newly instituted Agricultural Research Council. Some suggestions on this topic will be made at the end of this paper.

## 2. The concept of FSR/E

It should not be argued that FSR/E be subordinated to national agricultural objectives as this may unnecessarily restrict its role. Rather, FSR/E should be viewed as supportive of national objectives in developing the necessary perspectives on farmers' objective functions and proposing appropriate technological, institutional and economic interventions that should be adopted into national or regional policy formulation and objective statements.

FSR/E is primarily oriented toward solving the problems, situations and needs faced in farming through diagnostic applied and adaptive research. Another way of distinguishing this orientation is to note how research is linked to dissemination and adoption by the farmer. Diagnostic, applied and adaptive research are linked because they are problem directed while basic research is not. Further, adaptive research is linked directly while diagnostic and applied research are linked through a chain of events or mediating steps. This implies adaptive research should be on-farm and linked to extension efforts.

From the above, it is also argued that diagnostic, applied and adaptive research are considered appropriate for development situations as their orientation is problem directed and can contribute positively to overall development policy objectives (Stilwell and van Rooyen, 1989).

South Africa has command over a considerable body of knowledge generated by diagnostic and applied research which needs to be taken and adapted to specific South African environments within which smallholders operate through on-farm testing and adaptation. A case can thus be made for a radical re-orientation of thought and the structure of research and technology development in South Africa, if the demand for appropriate technology in both the commercial and small farm sectors is taken into account.

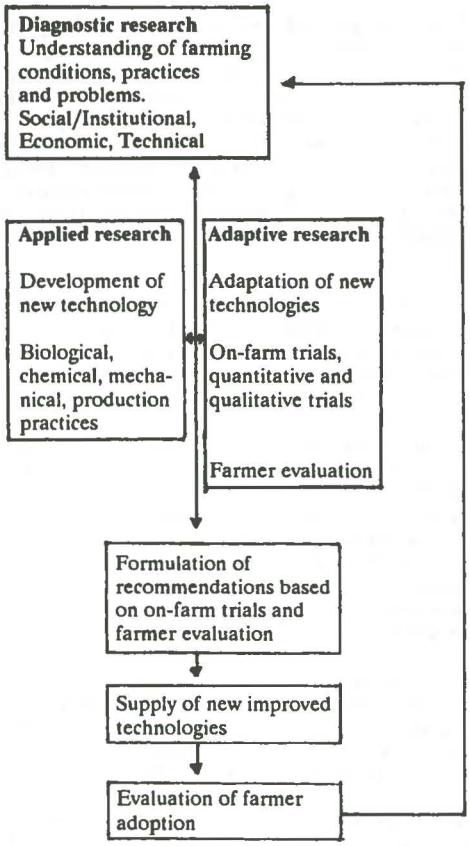
The farming systems research and extension (FSR/E) approach further offers a methodology that lends itself to integrating diagnostic, applied and adaptive research with extension in a comprehensive technology delivery system to the farmer (van Rooyen and Stilwell, 1989).

This research approach is recognised in commercial farming in the United States of America, as well as in the World Bank sponsored CGIAR's worldwide network of research centres (eg CIMMYT, CIAT, IRRI, ICRASAT, etc) that focus on the development of especially small farm technologies (CGIAR, 1980; Eckert, 1988). These centres endeavour to place existing farming systems on a more productive footing or to develop new farming systems within the resource endowments that will improve productivity.

The value of FSR/E as a technique arises from the fact that it is directed at problems, situations and needs in farming; is multi-disciplinary by nature; addresses the farming system in its entirety; and lastly, is goal orientated and systematic in the transfer of new improved technologies (Shanner, Phillip and Schmehl, 1981). Farming activities and farming decision-making are defined as an important sub-system of the household economics (Low, 1984) and institutional, physical/biological and socio-economic environments within which they operate (Shanner, et al, 1981). FSR/E offers a structured and systematic methodology to the "discovery" and solving of problems that farmers experience in this environment.

Figure 1 indicates the FSR/E process schematically. The goal orientation, integrative and interactive nature linking the various types of research activities into a technology delivery system are illustrated. The linkage with extension is also emphasised while the contact between farming and diagnostic and applied research emphasises a radically improved approach to traditional agricultural research. The importance of a well managed structured link between research and the farmer should not be under-estimated. Development in biotechnology has, for example, contributed dramatically to increased productivity by smallholders in the production of crops such as rice, coffee, coconuts, tea and sisal (ILO, 1989).

Figure 1: The farming systems' research and extension process




Source: Adopted from Rose and Tapson, 1984

### 3. FSR/E in practice in South Africa

Within the above framework, the ultimate goal of FSR/E should be to structure agricultural change towards the promotion of economic, social and structural change in smallholder farming induced by technological transformation.

#### 3.1 Case studies

The FSR/E approach toward development has only been introduced into South Africa fairly recently. At a seminar on FSR/E at DBSA, a number of case studies were analysed:

#### i) Ciskei Small Farm Systems Research (SFSR)

The researchers, the Agricultural and Rural Development Research Institute (ARDRI), University of Fort Hare, considered that an appropriate research model should have three basic phases, as adapted from the Cornell University farm systems research programmes (Rose and Tapson, 1984; Rose and Williams, 1988; Eckert, Rose and Williams, 1988):

- diagnostic phase;
- research phase; and
- implementation phase.

Because of the critical lack of detailed knowledge of the realities of rural areas, the diagnostic phase was based on two techniques. Firstly, benchmark surveys to establish the status quo in, and constraints imposed upon, the community by both technical and human elements. Secondly, felt needs surveys to determine the goals and aspirations of rural people and the perceived problems and development priorities.

The research phase would compromise research station research and on-farm research in the farmers' fields by way of adaptive research to address the needs and constraints faced by people.

Lastly, it is intended to implement promising practices by extension to surrounding farmers and extension agents (Rose and Williams, 1988).

Rose and Williams (1988) reported that to date the focus has been primarily on the diagnostic phase. Some of the relevant features of the rural profile are:

- nearly one half of household heads are older than 60 years of age;
- a high portion (30-40%) of de facto heads of rural household are women;
- of the heads of household younger than 60 years, two-thirds are employed off-farm;
- 21% of wives are also involved in the off-farm labour force;
- only half the household have arable land (3hectares average) and only 42% of that land is cultivated at any one time; and
- 94% of household income (US$1100 average per annum) is non-agricultural in origin.

The researchers found that agricultural needs only ranked sixth in household felt needs and were superseded by needs such as *inter alia* water, roads and employment.

Eckert, Rose and Williams (1988) report that the problem facing researchers is to identify smallholders who are "farmers" and for whom farming is of significant interest. This may embrace only 15-20% of rural households. In identifying such farmers in case of the Ciskei SFSR, significant correlations ($P<0,1$) were found between various agricultural enterprises. The researchers found that farmers with a larger hectarage also have larger areas of winter crops, most animal species, farm implements, etc. The researchers also argue that while most farming systems research programmes concentrate on median farmers, the task differs conceptually in the Ciskei as most landholders are only passively interested in agriculture, and research should therefore be concentrated on "progressive" farmers as the only smallholders interested in agriculture.

Eckert, Rose and Williams (1988) conclude that the two most effective classification system in identifying active smallholder agriculturalists as those possessing four or more stock species, or those possessing cattle.

#### ii) The Biyela Integrated Rural Development Project (Biyela)

The approach taken by the researchers, the Institute of Natural Resources (INR), University of Pietermaritzburg, differs significantly from that taken by ARDRI.

At the outset, development committees representative of the local communities were formed. A pilot project scheme was developed comprising of two small dairy farms, three broiler units, three egg units, six afforestation units and a community garden (Pollet, 1988).

Pollet (1988) reports that although the egg unit proved to be a viable enterprise (US$1492 over 341days net farm income), few local people have expressed interest in becoming egg producers, and the simpler broiler production system with a quick turnover is preferred and several requests have been received from members of the local community for assistance to establish similar units.

The two small dairy units have failed due to the advanced technology employed (eg oestrus synchronization) and resultant demotivation of participants. However, another local smallholder on observing the dairy trials has initiated a dairy farm on his own accord and has subsequently approached the INR for assistance.

The community garden operated collectively by a local women's group has been successful and positive institution-building aspects have resulted.

Initially, there was doubt as to whether the afforestation on the steep uplands would be acceptable to the local community. The interesting aspect is that after initiating individual afforestation plots with 6 smallholders in 1987, the demand has increased phenomenally by another 153 applications at present.

**iii) Dry Bean Research Project (D.B.R)**

The researchers, the Department of Crop Science, Faculty of Agriculture, University of Natal, state that the objective of the research is to improve bean production among smallholder farmers in through the development and introduction of high yielding, disease resistant cultivars (Mellis, 1988).

Observation of KwaZulu farmers' production systems revealed that their dry bean yields were mainly affected by rust (Uromyces appendiculatus) and bean common mosaic virus (BCMV). Materials made available by the Centro International de Agricultura Tropical (CIAT, Colombia) and introduced into local breeding programmes has resulted in the development of disease-resistant, high-yielding cultivars adapted to the local conditions (Mkuzi, Vulindlela, Loteni, Enseleni and Pongola). These cultivars were released through farmers' days, courses for extension officers, demonstration plots and distribution of a thousand 200 gm packets of seed among farmers. The objective was to introduce the farmers to the new cultivars and give them the opportunity to compare these with their traditional cultivars. Agricultural extension officers and farmers were asked to give a report back on the performance of the new cultivars. Mellis (1988) reports that the new cultivars have been well accepted with farmers making seed available to their neighbours. Also, a commercial seed company (Agri-Aid) has taken over the distribution of seed on a national scale. An analysis of the impact of the improved technology on complementary, supplementary and competitive relations within the farming system has not been conducted.

**iv) The Malekutu Dryland Project (M.D.P.)**

The Malekutu community identified that with pressure on land and resultant decreasing bush, fallow periods and the shortage of individual family labour, the traditional system of agriculture no longer provided a reasonable return. In 1983, the Malekutu community approached the KaNgwane Department of Agriculture and Forestry (KDAF) for assistance and advice. KDAF, in collaboration with a private company, Chemserve Stein Hall (Pty) Ltd (CSH) initiated the development. The community formed the Thuthukani Farmers Association (TFA) to coordinate development. A research and demonstration farm was set up on the farmers' land to teach the principles of soil conservation and to identify suitable cultivars and fertilizer practices for the Malekutu area (Beck, 1988).

Beck (1988) reports that the research clearly demonstrated significant yield increases of maize and ground nut yields when planted in an inter-cropping system. Research into tillage practices emphasizing moisture conservation and rain harvesting further contributed to yield increases. The new farming systems were readily adopted and by 1985, these systems were established on 170 farms. Committee members have undertaken that if they are satisfied with the new systems, they would teach the new methods to other farmers. At present, there are 276 farmers participating at Malekutu, of which all grew maize, 85% planted ground nuts and 10% planted guar, 68% intercropped and 64% used fertilizer. There have also been changes in the committee structure, initially a group of respected elders were elected, now it is controlled by members with financial acumen and organizing ability.

**v) Resource Allocation in KwaZulu (R.A.)**

A mathematical programming model of rural KwaZulu, excluding three northern districts, was used to simulate the effects of various economic scenarios on resource allocation. The model aggregated enterprise levels predicted for four representative household types, two located in areas of low agricultural potential and two in areas of high cropping potential (Lyne, Ortmann and Vink, 1989)

The model included off-farm wage earning activities and accounted for differences in the wage earning potentials of individual household members.

The researchers conclude that as the main interest of this study centres on production responses, the programming approach was considered to be appropriate.

Policies advocated to improve African food security often assume that most farmers are net sellers of food and that emphasis on cash crops endangers food security. Less than 17 per cent of KwaZulu were self sufficient in grains and less than five per cent of the Gcumisa sample households sold surplus maize. An increase in the consumer price of a staple such as maize is therefore expected to harm large numbers of households in urban and rural areas. The rural situation is demonstrated in the scenario where a ten per cent relative increase in retail and producer cereal prices reduced the welfare of all households modeled, even though cash incomes increased.

A similar increase in the price of sugar-cane on the other hand, improves the welfare of households in areas where the crop can be grown. If a land rental market existed, land rents would be visible and the welfare of all market participants would increase.

Emphasis on a cash crop does not necessarily undermine food security as risk aversion may result in complementarity of cash and food crops.

Since KwaZulu has access to reliable food sources in Natal, affordability is more important than accessibility. Relative increases in cash crop prices are therefore more likely to improve than worsen nutritional status. Subsidization of inputs would improve the welfare and output of rural households.

Decreasing off-farm wage employment stimulates agricultural production for market and non-market purposes but leaves households worse off. Negative relationships between off-farm employment and food production (food imports) have been observed throughout South Africa. Increased production resulting from rising unemployment is not a success story for agriculture and policy-makers should not overlook the opportunity cost of labour in implementing agricultural projects or in determining appropriate technology.

### 3.2 Observations and lessons of experience

Lessons from the five implemented FSR/E projects can be gained:

i) All five research models tend to neglect one or more phases of the FSR/E model. The Ciskei SFSR has not proceeded past the diagnostic phase. In the Dry Bean Research and Malekutu projects all the phases were implemented, ie. diagnostic, on-station/ on-farm research (technology development) and farmer extension and adoption. Researchers however only subjected the technical research to statistical analysis in contrast to both the Ciskei SFSR and KwaZulu RA where valuable insights on policy perspectives and farmer problems were gained through analysis of the demographic, social, economic and natural environment within which rural households operate. The Biyela project was supply driven without any diagnosis, however, significant farmer/community responses are observed to the various technologies. These responses require empirical analysis in order to arrive at any meaningful conclusions.

ii) A different perspective to the one taken by ARDRI on the SFSR project on the issue to identify "farmers" could render their research on the topic inappropriate. If farmers are viewed as all rural dwellers utilizing resources to produce agricultural commodities, focus is directed towards establishing a system which would promote access to farming and community support systems and extend the area of choice to all rural smallholders (van Rooyen, Vink and Stacey, 1988).

The structuring of FSR/E to accommodate this type of "supply" approach is strongly advocated as operationally a more useful approach than efforts to identify smallholder farmers alone.

iii) In all the case studies with the exception of KwaZulu RA, it appears as if too little cognisance is taken of the relation between household economics, and smallholder farming in developing areas (Low, 1984). In both the Malekutu and Biyela projects, farming was pursued as a sustainable system, while the dry bean project did not investigate integration within the farming system.

It is strongly proposed that the sustainability of systems is broadened in terms of the wider household context, assessing the impact of technological innovation within the household economy of resource use and vice versa.

iv) In both the Malekutu and Biyela project, strong grass-roots farmers committees have lead to collective action in requesting assistance while risk-taking and decision-making on implementation was at the individual (household) level.

The lack of an effective grass-roots committee system in the Ciskei SFSR has resulted in no on-farm research being established as of date. The collective action institution operating at grass-roots level need to be pertinently integrated into the FSR/E design.

v) The findings of the Ciskei SFSR in respect of the large portion of women heads of household is indicative of the hitherto neglected need to research and structure support specifically toward women "farmers" and their role in household decision making.

vi) The positive correlations between the number of farm enterprises as a system of classifying effective farmers, as reported in the Ciskei SFSR and, in particular, the number of types of livestock kept indicates the role of livestock in the farming system.

vii) The degree of risk avoidance practiced by the farmer is illustrated in the KwaZulu RA. The large portion of farmers adopting inter-cropping systems at Malekutu is also indicative of the risk avoidance strategies followed by farmers.

viii) The KwaZulu RA illustrates that the whole farming system including labour and household income should be considered when considering pricing policies. It further proposed that the same would apply when introducing different technologies, eg. biological, chemical, mechanical etc. It would be important to determine who were net winners and losers (Pinstrup-Andersen, 1982).

In conclusion, it can be stated that FSR/E in South Africa needs to be directed towards addressing the problems faced by farmers in an integrated farm and household systems, rather than directing it at a single crop system, unless the economic and social cost of adopting new technology is minimal as in the case of neutral technologies eg. in the case of introducing new improved seeds. Further, given the large number of women heads of household and the large number of households not in the position to exploit farming opportunities as a main economic activity, Community Support Systems Research should receive particular attention (Stilwell, van Rooyen and Gouws, 1988)

### 3.3 The design of future FSR/E projects

It is argued that it would be an important and necessary condition for progress to structure FSR/E according to a definite set of criteria and principles.

#### 3.3.1 Principles

The following principles are proposed:

a) An overarching goal of FSR/E should be to bring about transformation in the rural system through farming, leading to technical, economic, social and structural change where benefits are larger than the costs.

b) A household economics view to be structured as basic framework of reference to determine the impact of technical innovation on household economics and resource use and vice versa.

c) FSR/E should be viewed as one element of a comprehensive Farmer Support System, and planners and designers should ensure that upon adoption by farmers, the other elements are in place.

d) FSR/E should assist policy makers and planners in the design of farmer orientated national and regional development policy and plans, and be project-related in solving problems experienced by farmers within their natural/physical and socio/economic environments.

e) In the design of a FSR/E programme, a milestone approach should be followed, identifying specific objectives to be reached during each step.

### 3.3.2 Criteria

The following criteria should be considered:

a) Farmers are defined as all those using resources for the production of agricultural commodities.

b) FSR/E should be directed at solving the farming problems faced by the rural households.

c) FSR/E should primarily be designed within those constraints faced by the farmer, over which he has control.

d) FSR/E should be adaptable enough to allow for a "learning by doing" approach to be followed by farmers and researchers.

e) The FSR/E approach should be multi-disciplinary and take into account the social, technical, environmental, financial and economic variables operating in rural communities, as well as within the wider economy where the rural : urban interface should be pertinently emphasized.

f) FSR/E should seek to follow an evolutionary, rather than a radical approach to technological innovation.

g) In the event of radical technological change being adopted by planners as the only alternative, FSR/E should seek to minimize the associated economic and social risks.

### 3.3.3 Differing Farming Systems

South Africa is and will most probably continue to be characterized by different farming systems over the long-run.

Within various development strategies, ie. Community Support Programmes (CSP), and Farmer Support Programmes (FSP), Farmer Settlement (FS) including commercial farming (CF), it would be necessary to identify research systems to address the particular needs of these various domains.

Community Support Systems Research (CSSR) would be targeted at that large portion of rural households that do not have access to productive land or are not interested in farming and would consist of benchmark and felt needs surveys, analysis of these needs, the formulation of appropriate community support programmes and obtaining commitment and participation of the community to implement those plans, eg village water supply projects, community gardens, sewing clubs, clinics, schools, etc.

Farmer Settlement Model Research (FSMR) would be directed at the description, design and testing of optimal institutional, technical and socio-economic arrangements that would support individual farmer settlement and participation within formal agricultural development projects.

Farm Systems Research and Extension (FSRE) would consist of the identification and study of present farming systems, the identification of major problem areas, design of the appropriate on-farm experiments and related strategies, the implementation and testing thereof by extension staff and farmers and the further extension of the acceptable findings within the broader smallholder farming community as part of a comprehensive Farmer Support Programme.

Commercial Farming Systems Research (CFSR) would be targeted at fully commercial farmers and study their present farming systems, identify major problem areas, design multidisciplinary research station experiments, on-farm testing and extension thereof to the broader commercial farming community. The value of FSR/E in commercial situations should not be under estimated.

Present FSR/E studies only address the active smallholder farmer's requirements and attention is needed in respect of CSP, FS and CF.

## 4. Institutional requirements

In order to ensure that national and regional development policy is promoted and the technological requirements of all farmers are addressed in a coherent manner, an effective institutional structure is required. Provision should be made for linking of policy and decision-making processes at regional, national and local level with a technology delivery system of research and extension responsive to the registered needs of both commercial and smallholder farmers.

The present South African initiatives in developing a new research policy by the re-structuring of agriculture from an "own affairs" to a "general affairs" institution and the promotion of an Agricultural Research Council provide an unique opportunity for reviewing and re-structuring the agricultural research and technology delivery system (Stilwell, van Rooyen, 1989). Given policy movements away from "Own Affairs" to one agriculture, as well as the regional nature of agriculture in terms of homogeneous farming areas, Regional Development Centres are proposed that attend to all levels of research, ie. CSPR, SFSR, FSR and CFSR in an integrated economic policy framework. These centres should be staffed by multidisciplinary teams attending to policy and farming systems analysis, technical research and the extension of new improved technologies.

It would be important to create an institutional framework that accommodates both private and public sectors, as well as accommodating policy-makers, researchers, extensioners and farmers. A network linking, research stations, research centres such as SIRRI, CSFRI, etc and even CIMMYT (south-east African region) and universities with agricultural faculties in a network where appropriate technological innovation and delivery is attended to must be actively promoted (vanRooyen and Stilwell, 1989). Figure 2 presents a schematic representation of the proposed institutional structure making a efficient technology delivery system possible.

## 5. Conclusions

FSR/E should not be viewed as an academic exercise to get involved in development, but rather as one element of a comprehensive support strategy directed towards smallholder farmers, households and communities in resource-poor situations.

FSR/E should set as its ultimate goal the promotion of technological transformation in rural households through farming systems, by addressing the constraints and needs faced by the smallholder farmer, thus equipping him for the challenges of a more efficient farming system. Within the important integrated rural development context, it is required that FSR/E be approached within a household economic framework of reference and extended to accommodate Community Support Systems Research, and Commercial Farming Systems Research and Extension, Farmer Settlement Model Research and Extension to test new systems and, in particular, make provision for the women.

Public sector has an important role to play in funding FSR/E and a high return on investment can be expected. However, such research should be related to the development of national policy and strategies, and be based on sound principles and design criteria.

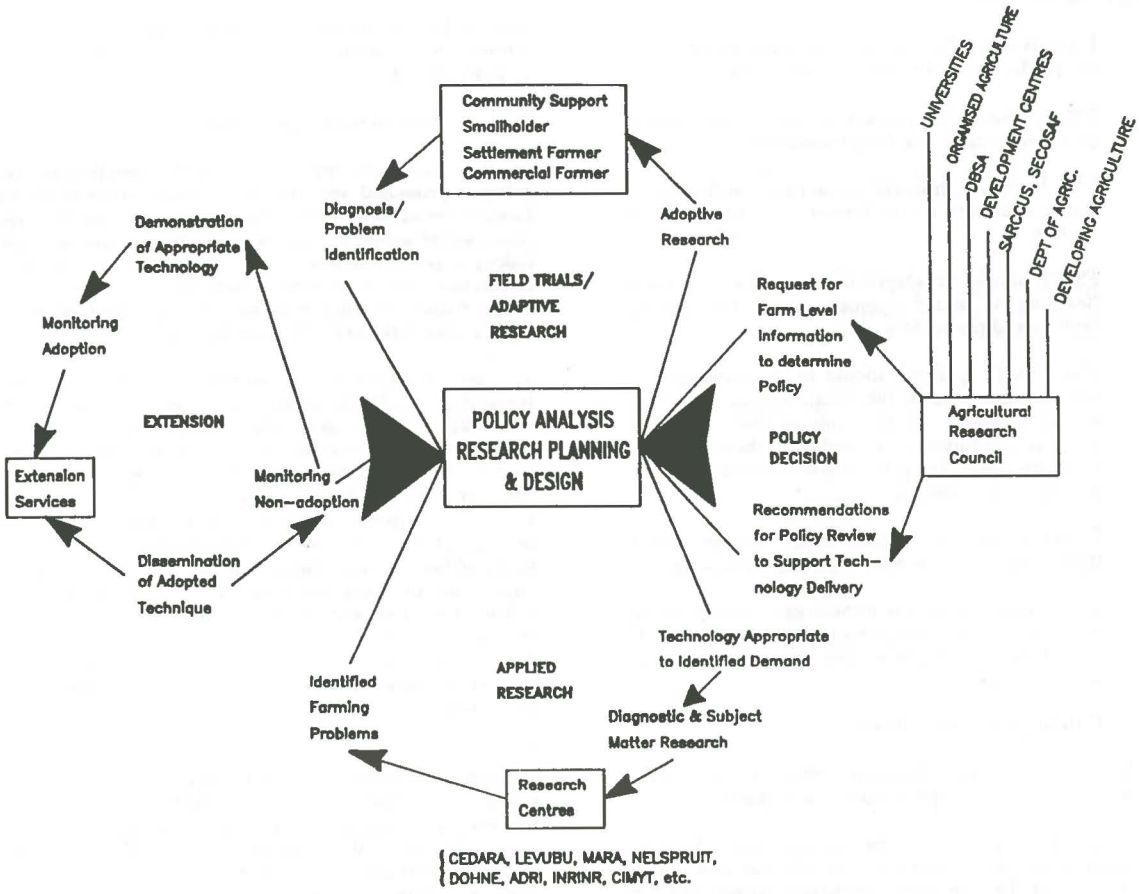



Figure 2: Policy/Decision making/Research station - and on-farm research and extension in an institutional framework

In this context, a phased approach with clear milestones should be followed, ultimately leading to large scale comprehensive Farmer and Community Support Programmes aimed at ameliorating the economic deprivation of less developed areas and enabling these areas to make a positive contribution to the national economy.

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