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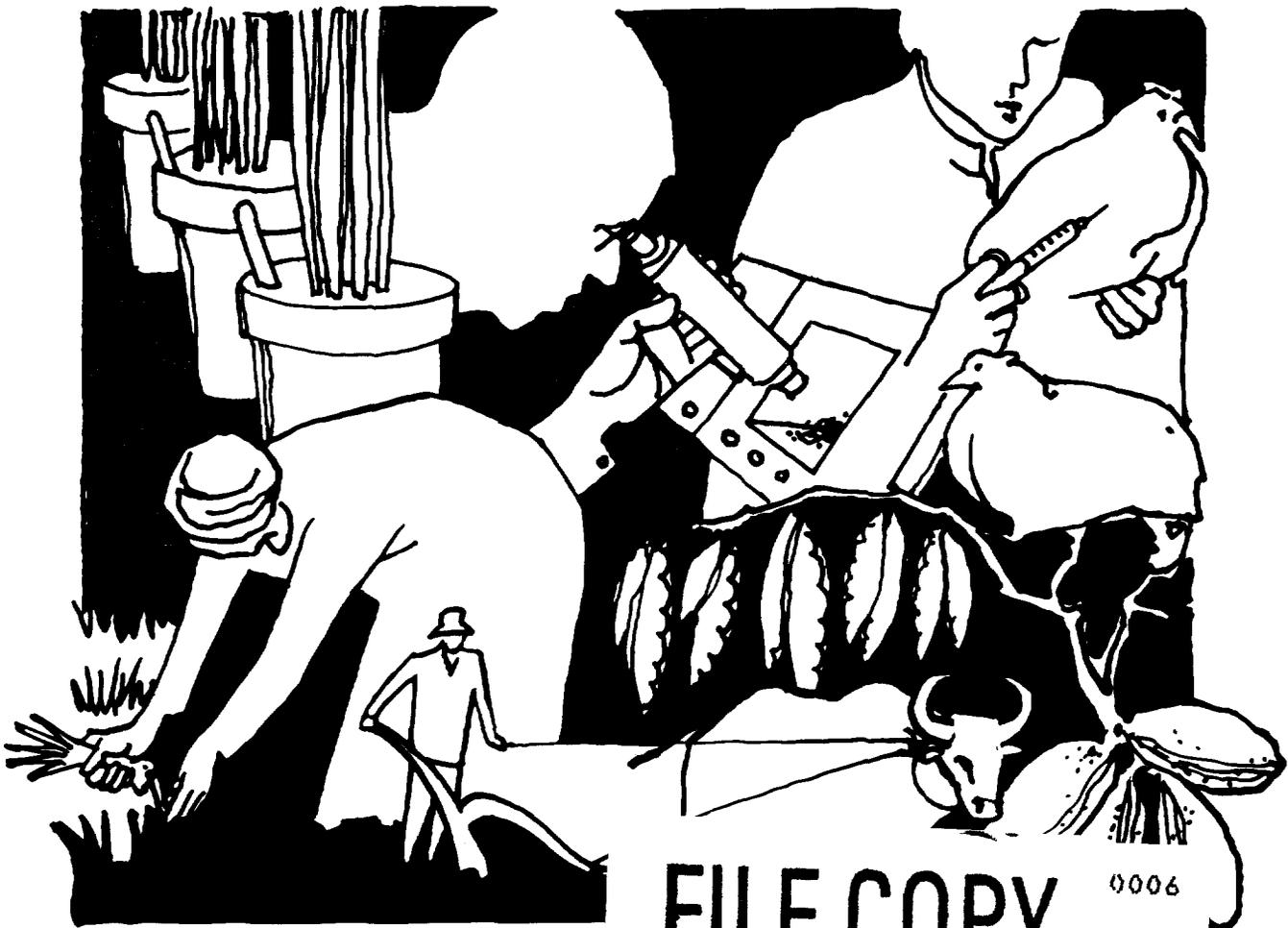
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Burkina Faso and the CGIAR Centers

A Study of Their Collaboration in Agricultural Research

Ibrahim Firmin Ouali



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Ibrahim Firmin Ouali

The World Bank
Washington, D.C.

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At its annual meeting in November 1983 the Consultative Group on International Agricultural Research (CGIAR) commissioned a wide-ranging impact study of the results of the activities of the international agricultural research organizations under its sponsorship. An Advisory Committee was appointed to oversee the study and to present the principal findings at the annual meetings of the CGIAR in October 1985. The impact study director was given responsibility for preparing the main report and commissioning a series of papers on particular research issues and on the work of the centers in selected countries. This paper is one of that series.

The judgments expressed herein are those of the author(s). They do not necessarily reflect the views of the World Bank, of affiliated organizations, including the CGIAR Secretariat, of the international agricultural research centers supported by the CGIAR, of the donors to the CGIAR, or of any individual acting on their behalf. Staff of many national and international organizations provided valued information, but neither they nor their institutions are responsible for the views expressed in this paper. Neither are the views necessarily consistent with those expressed in the main and summary reports, and they should not be attributed to the Advisory Committee or the study director.

This paper has been prepared and published informally in order to share the information with the least possible delay.

Ibrahim Firmin Ouali, formerly a senior economic adviser to the government of Burkina Faso, now works as a private consultant.

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Summary

Burkina Faso is a country with all the characteristics of underdevelopment. Agriculture is the main activity of 95 percent of the population. The country's economy is predominantly free enterprise.

A national debate is in progress over how to evolve a structure better suited to the new development process needed by Burkina society. Chapter 1 of this report outlines the principal aspects of the economy, drawing on detailed World Bank reports.

Until recently, the "national agricultural research system" (NARS) has been managed by bilateral and, to a certain extent, multilateral scientific cooperation. Chapter 2 describes the structure of research and Chapter 3 outlines the input the CGIAR centers have had on that structure. It is shown that there is no objective national program of agricultural research in Burkina Faso; those research activities which are being pursued in the country are most often associated with "development projects" supported from abroad. The results of this research have been adopted by the rural community.

Since February 1985, Burkina Faso has been evolving a national program for agricultural and zootechnical research and has become involved in bilateral and multilateral cooperation, in particular with the institutes of the CGIAR, but within a new framework reinforcing the capacities for managing the research activities of the NARS.

Acknowledgment

This study is based on interviews with those responsible for agricultural policy, rural development, agricultural research and higher education in Burkina Faso who have collaborated with the international agricultural research institutes, in particular with the CGIAR.

In view of the differing tasks of the various individuals, the interviews consisted at times of conversations lasting several hours and at times of a few succinct words exchanged at professional meetings. Whatever the nature of the interviews, the author has endeavored to communicate the speakers' impressions and often passionate assertions.

The study comes at a time when the function and tasks of agricultural research in Burkina Faso are being clarified. The question of collaboration of research institutions in bilateral and multilateral cooperation arises and must be solved within the framework of the democratic people's revolution. The author cannot therefore prejudice the debate; the proposals are as a result frank, direct, and often passionate.

In this study, encounters with the native population were deliberately favored. Our partners in bilateral and multilateral cooperation have not been closely involved with this study, which reflects above all the point of view of the population of Burkina Faso on this issue.

The author thanks Dr. Lagemann and colleagues of the GFA, who provided the opportunity for this study to express in all openness certain points of view which may appear somewhat controversial. Dr. Herdt edited the English translation of the original French version.

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Abbreviations

ADRAO	French language acronym for WARDA
AVV	Volta Valleys Planning Authority
BDPA	Bureau for the Development of Agricultural Production
CCCE	Central Economic Cooperation Fund, France
CEAO	See WAEC, West African Economic Community
CERCI	Experimental Center for Rice and Irrigated Crops
CFAF	Franc
CFDT	French Company for the Development of Textile Fibers
CGIAR	Consultative Group on International Agricultural Research
CIEH	See ICHS, Inter-African Committee for Hydraulic Studies
CILSS	See ICDCS
CIRAD	International Cooperation Center for Agricultural Development Research
CNESRS	National Council for Higher Education and Scientific Research
CNRST	National Center for Scientific and Technical Research
CRDI	See IDRC, International Development Research Center, Canada
CRST	Commission for Scientific and Technical Research
CRTA	Research Center for Animal Trypanosomoses
CSRAZ	Special Committee for Agricultural and Zootechnical Research
CTFT	Technical Center for Tropical Forests
DAC	Development Assistance Committee
DDP	Department of Documentation and Publication
DEF	Department for Financial Implementation
DGRST	General Management of Scientific and Technological Research
DSA	Administration of Agricultural Departments
DSE/IA	Department for Livestock and Animal Husbandry
FAC	Cooperation and Aid Fund, France
FAO	Food and Agriculture Organization

FDR	Rural Development Fund
FSU	Farming Systems Unit (of Purdue University)
GERDAT	Study and Research Group for Development of Tropical Agriculture
GFA	German Foundation for Agriculture
GNP	Gross National Product
GTZ	German Agency for Technical Cooperation
HYV	High Yielding Variety
IBE	Burkinabe Energy Institute
IBRAZ	Burkinabe Institute for Agronomical and Zootechnical Research
ICDCS	Inter-State Drought Control Committee for the Sahel
ICHS	Inter-African Committee for Hydraulic Studies
IDRC	International Development Research Center, Canada
IEMVT	French language acronym for Institute for Animal Husbandry and Veterinary Medicine in the Tropics
INSAH	Sahel Institute
IRA	Agronomical Research Institute
IRAT	Research Institute for Tropical Agriculture and Food Crops
IRBET	Research Institute for Biology and Tropical Ecology
IRCT	Research Institute for Cotton and Textile Fibers
IRHO	Research Institute for Oil and Oil Plants
IRSN	Research Institute for Natural Substances
IRSSH	Research Institute for Social and Human Sciences
ISP	Superior Polytechnic Institute
IVRAZ	Volta Institute for Agricultural and Zootechnical Research (now IBRAZ)
MAE	Ministry for Agriculture and Livestock Farming
MDR	See MRD, Ministry for Rural Development
ME	Ministry for Water
MESRS	Ministry for Higher Education and Scientific Research
MET	Ministry of the Environment and for Tourism
MP	Ministry of the Plan
MRD	Ministry for Rural Development
MSU/Fada	Michigan State University (project in Eastern ORD)

NARS	National Agricultural Research System
ORD	Regional Development Organization
OFNACER	National Cereals Office
ONERA	National Office for Animal Farming
ORSTOM	Overseas Office of Scientific and Technical Research
PAPEM	Pre-Extension and Multilocational Experiments
PNRA	National Agricultural Research Programs
PNUD	See UNDP, United Nations Development Programme
RPAA	Translated as (he who is or that which is) Responsible for Accelerated Agricultural Production
RSP	Research on Systems of Production
SAFGRAD	Research and Development of Food Crops in Semi-Arid Zones
SATEC	Society for Technical Aid and Cooperation
SOFITEX	Company for the Development of Textile Fibres
T and V	Training and Visit (system of extension)
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USEB	Basic socioeconomic unit
WAEC	West African Economic Community
WARDA	West Africa Rice Development Association
WB	World Bank

1 Background

1.1 The study

This study deals with the impact of collaboration between the NARS in Burkina Faso and the IARCs, in particular those of the CGIAR. The study coincides with a national debate on this question that has led to a profound transformation in the problems identified, compared to recent similar studies. The transformations have been so profound in thought and deed that it has been particularly difficult to complete this study on time.

The work for this study has been carried out at a multitude of levels: research, development, farmers' organizations, and also between these partners, to analyze, understand and explain the constraints of development, and to propose revolutionary and democratic solutions. The interviews have made an essential contribution to the work but the impressions and assertions have been difficult to quantify, in particular with reference to the impact of technical innovations.

Apart from the institutes present in Burkina Faso (ICRISAT, IITA and ISNAR), the knowledge of the IARCs is limited, especially concerning development structures, and as a result, the opinions of a limited number of persons with knowledge of this collaboration dominate. On the other hand, we have involved the partners participating in agricultural research: development, education and farmers' organizations.

In emphasizing the opinions of the population of Burkina, we have sought to answer above all, questions concerning the national plan, and in particular, concerning the heart of the national structure of agricultural research. It is easier to define cooperation with other countries, once the national element knows exactly what it wants.

1.2 Natural environment

Burkina Faso is a landlocked country with a surface area of 274,000 km², bordered on the north by Mali and Niger and on the south by Ivory Coast, Ghana, Togo and Benin. It consists of a central plain corresponding to a rocky out-crop composed of volcanic (granitic) and metamorphic rocks enclosed by two lateral plateaus of sandstone fragments of an early sedimentary covering.

The pedological structure is dominated principally by bleached ferriferous soil and raw mineral soils, but there are also ferralitic soils, brown eutrophic soils, vertisols and solonetz.

The climate is tropical with alternating dry and wet seasons. Three principal climatic zones can be determined as a function of latitude, and can be segregated by isohyets: (1) South Sudanese climate is in the zone as far north as the 1,000 mm isohyet, where precipitation persists for more than half the year; (2) North Sudanese climate in the zone between 1,000 mm and 650 mm, where the rainy season lasts 3 to 4 months; and (4) Sahel climate north of the 750 mm isohyet.

The most common vegetation formation is the savannah. We quote the main vegetation formations encountered in Burkina Faso by Père M. Terrible in 1978:

- (1) clear or herbaceous formations with arboreous stratum containing Balanites aegyptiaca and Acacia raddiana: these formations are found in particular in the North of Burkina Faso;
- (2) clear herbaceous or ligneous formations, or complexes containing Balanites aegyptiaca (and Combretum micranthum): shrubby or arboreous savannah formations are found below the mean pluviometers of 600 to 700 mm in the Central North region;
- (3) clear ligneous formations or complexes containing Butyro-spermum parkii (and Combretum micranthum): arboreous

- savannah countryside, wooded at times, with the mean pluviometers lying between 700 and 900 mm;
- (4) clear ligneous formations with Parkia biglobosa and Butyrospermum parkii: arboreous or wooded savannah formations;
 - (5) clear or dense ligneous formations with Isoberlinia doka: wooded savannah or clear forest countryside.

The surface area of arable land is estimated at approximately 89,000 km². Together with forests and pasture land, this amounts to 229,000 km², which is 84 percent of the total surface area.

The cultivated surface area is in the order of 3 million ha. This means that it is possible to extend the area of cultivated land. However, there is diversity not only in the fertility of the soils, but also in the spread of population. Certain zones are verging on the critical threshold of exploitation where the cultural intensity coefficient (ratio between cultivated and agricultural land) exceeds 50 percent (ORD Yatenga, 71 percent; ORD center-north, 56 percent; ORD center, 54 percent; ORD center-west, 51 percent).

For development activities, it is necessary to consider homogeneous zones even if the available classification does not yet obtain a national consensus. For convenience, the country is divided into the six main zones with the characteristics shown in Table 1.1.

Table 1.1 Characteristics of the "Homogeneous Zones"

Zones	Characteristics
1 - Sudanese Sahel	<ul style="list-style-type: none"> - High risk of pluviometric deficit - Low population density dominated by the Peulhs - Extensive livestock farming - Sandy soils
2 - East	<ul style="list-style-type: none"> - Sudanese zone, absence of groundwater table - Low population density dominated by the Gourmantches - Extensive agriculture and sedentary livestock farming
3 - Mossi-North Plateau	<ul style="list-style-type: none"> - Sudanese-Sahel climate - High population density, dominated by the Mossi, with a strong migratory flow - Intensive agriculture and considerable sedentary livestock farming; transitional zone between sorghum and millet crops - Saturated and degraded land
4 - Mossi-South Plateau	<ul style="list-style-type: none"> - South Sudanese climate - High population density dominated by Mossi - Sorghum is the dominant crop
5 - West-North	<ul style="list-style-type: none"> - Sudanese climate - Low population density, strong immigration - Dominance of sorghum and important industrial cultures
6 - West-South	<ul style="list-style-type: none"> - North-Guinean climate - Low population density - Dominance of food crops: cotton, groundnut and tubers are the main crops

1.3 Population

The resident population is distinguished from the emigrant population. The resident population was estimated at 6.3 million in January 1979, which is equivalent to a population density of 22.6 h/km², one of the highest in Africa. The population spread is irregular: more than 80 h/km² in certain regions of the Mossi plateau, and less than 10 h/km² in the north and east of the country. The overall growth rate of the population is in the order of 1.6 percent, with an urban population growth rate of 4 percent.

The total rural population is estimated at 90 percent. One-fifth of the population, generally the most active fifth, lives at least temporarily outside the country. The emigration is largely towards the Ivory Coast (80 percent).

Table 1.2 Characteristics of the Population
(as percentage of total population)

Characteristics	1960	1982
Working age (15 - 64 years)	54	52
Actively working in agriculture	92	82
Actively working in industry	5	13
Actively working in the service industries	3	5
Urban population	5	11

Although there has been a reduction in the economically active rural population since 1960 (92 to 82 percent), Burkina Faso remains broadly rural. The urbanization of the population, which has doubled in 20 years (5 to 11 percent), is very low compared to the total population. Among Sub-Saharan African

countries Burkina Faso has one of the lowest levels of urbanization-- 11 percent compared to an average of 22 percent in 1982.

When lack of public health and education are seen as factors which block development, the necessity of realizing a new development strategy arises. In the field of health and education, as in other sectors, the conscious population must be active in its own development. Actions "imported" from outside will not be able to surmount the difficulties when a comparison is made on the basis of the following criteria (Table 1.3) between the standards in Burkina Faso, the countries of the Southern Sahara, and the industrial countries with their free enterprise economies.

1.4 Economy

A relevant methodological tool ought to be available for a review of the economic activities of Burkina Faso. Until now, comparisons of "developed countries" with "free market economies" have characterized the search for facts and indicators capable of analyzing the economy of the country. When no relevant indicators are provided by this method, it must be accepted that the available data are only an imperfect reflection of the reality behind a society where it is difficult to separate the economy from its sociocultural yoke. Numerous sectors of economic and social activities are not conducted on a monetary basis and do not fit within the logic of classical economics.

The present debate on the national situation makes clear the need for an appropriate analysis, envisaging a review which is able to characterize the society of Burkina in its development process, and there are some studies on this basis of limited geographical range, but none yet that consider the national situation.

Table 1.3 Public Health and Educational Characteristics
of the Population

Characteristics	1960	1982
<u>Public Health</u>		
In Burkina Faso:		
Inhabitants per doctor	81,650	48,510
Inhabitants per nurse	3,980	4,950
Average for Africa, South Sahara:		
Inhabitants per doctor	53,407	21,234
Inhabitants per nurse	5,869	2,978
Average for Industrial Countries with Free Enterprise Economies:		
Inhabitants per doctor	816	554
Inhabitants per nurse	470	180
<u>Education (as percentage of relevant age group)</u>		
In Burkina Faso:		
Registered at primary school	8	20
Boys	12	26
Girls	5	15
Registered at secondary establishment	1	3
Average for Africa, South Sahara:		
Registered at primary school	36	78
Boys	47	85
Girls	24	64
Registered at secondary establishment	3	15
Average for Industrial Countries with Free Enterprise Economies:		
Registered at primary school	114	101
Boys	107	103
Girls	112	103
Registered at secondary establishments	64	90

Source: World Bank 1982b, 1983.

Within the framework of this study, we therefore use the data of classical economics, whose limits for a real analysis are obvious. Even in this situation, it must be said that the availability of economic statistics is relatively limited; accounting data have not been established at the national level for all years, and many data referring to exports (perhaps more than a third) have not been recorded. This summary of the national economic situation is therefore incomplete and speculative in parts.

1.4.1 Income

In 1982, the gross national product (GNP) was estimated at US\$210 per person, which is insufficient to ensure a minimum level of nutrition and the purchase of non-food items.

There are no valid data referring to the number of people living in total poverty, but the indicators bear witness to many with obvious malnutrition. However, it is estimated that in normal years the country is capable of near nutritional self-sufficiency, with a food deficit not exceeding 5 percent. The problem arises far more in terms of distribution of food products in the interior of the country, and in terms of storage of surpluses with the aim of satisfying demand during years when climatic conditions or other factors prevent sufficient production.

According to the estimations of the World Bank, the growth rate of the GNP during the period 1977 to 1979 was 4.7 percent of real value. However, the long-term tendencies are less favorable. In fact, between 1960 and 1982, the average annual growth of the GNP was only 1.1 percent with an inflation of 1.3 percent (1960 to 1970) and 9.7 percent (1970 to 1981).

Burkina Faso is classed by the World Bank among the low income countries of the semi-arid zone to the south of the Sahara.

1.4.2 Contribution of the individual sectors to the economy

Table 1.4 shows the contribution of the agriculture, industry and service sectors to the country's economy. The manufacturing branch of industry is singled out because of its dynamism in the industrial sector.

Table 1.4 Contribution of the Sectors:
Structure of the Production

Sector	Share of GNP (percent)		Growth Rate Annual Average 1970-1981
	1960	1981	
For Burkina Faso:			
Agriculture	55	41	1.4
Industry	16	16	2.9
Manufacturing	9	12	3.4
Services	31	43	5.4
Average for Countries South of the Sahara:			
Agriculture	47	33	2.1
Industry	17	27	3.9
Manufacturing	7	8	3.4
Services	36	40	4.9
Average for Industrial Countries with Free Enterprise Economies:			
Agriculture	6	3	1.8
Industry	40	36	2.3
Manufacturing	30	24	2.4
Services	54	61	3.2

Source: World Bank

The following tendencies can be seen in contrasting the 1982 data with those for 1960:

- (1) reduction of the contribution of agriculture from 55 to 41 percent;
- (2) stagnation of the contribution of industry at 15 percent;
- (3) in contrast, increase of the contribution of the manufacturing branch of industry from 9 to 12 percent;
- (4) appreciable increase in the contribution of the service sector from 31 to 43 percent.

This production structure is characteristic of the classical case of the so-called "developing countries." The extraverted and disjointed tendency of the economic structure prevents any development in the country from getting underway, its logic being that of a one-way economy.

It is interesting to note from the data showing growth rates, that production growth in Burkina Faso, in the countries to the south of the Sahara and in the industrial free enterprise countries, are all in a tight "bracket."

During the period 1970 to 1981, production growth was low on a global scale. The socioeconomic effects of this situation, however, have been felt differently depending on whether one is in the central or peripheral countries. This is why it is necessary to use relevant concepts which take the reality of the economic and social situation into account.

1.4.3 Employment

Satisfactory employment statistics are not available. It is relatively easy to measure jobs offered by the administration and certain production and/or distribution units which constitute the formal sector of the economy. On the other hand, the numerous informal jobs in the service sector are not adequately reflected, and so the data shown in Table 1.5 are estimates.

Table 1.5 Employment in Burkina Faso in 1982

Sector	Number	Share per Sector
Agriculture	2,771,000	82%
Industry	439,000	13%
Services	169,000	5%
Total	3,379,000	100%

1.4.4 Domestic trade

Table 1.6 shows the share of national income by consumption (public and private) and the development of investment from 1960 to 1981.

As in many "developing countries" where the public sector, i.e., the state, is the principal economic agent, in the past 20 years the consumption of the state has doubled whereas that of the private sector has decreased. This tendency is accompanied by the lack of articulation between the various branches of the economy, which easily explains the lack of inspiration in the economy and the demands made on the state to maintain artificially (by means of subsidies) an economic structure, the logical result of which is the transfer of profits out of the country.

During this period, the share of food in imports has increased from 20 to 25 percent while the share of fuel imports has quadrupled from 4 to 16 percent. As Burkina Faso is not an oil producing country, the increase in fuel imports plays an important role in satisfying the needs of the economy.

Table 1.6 Demand Structure

Share of GNP as percentage	1960	1981
In Burkina Faso:		
Public sector consumption	10	20
Private sector consumption	94	89
Gross domestic investment	9	15
Average for African Countries South of the Sahara:		
Public sector consumption	10	14
Private sector consumption	77	75
Gross domestic investment	16	19
Average for Industrial Countries with Free Enterprise Economies:		
Public sector consumption	15	18
Private sector consumption	63	62
Gross domestic investment	21	20

The structure of exported goods has slightly diversified with the share provided by primary products declining from 100 to 85 percent over the period. Industry and agroindustry sectors are in effect production units for domestic consumption and the substitution of imports, with an exported share of 15 percent.

Analysis of the destination of exported products reveals that the industrial market economies constitute the privileged customer with a marked increase in volume between 1960 and 1981 (4 to 64 percent). The developing countries, which were the privileged partners of the sixties, with 96 percent of the volume of exports, only take second place in 1981 with 36 percent. There is little diversification in foreign trade, both as regards structure (85 percent primary products) and as regards the destination of exported products.

The economic policy pursued by the government as far as the balance of payments is concerned is subjected to instructions imposed by the Monetary Union, and in particular to restrictions regarding public and private credits.

The convertibility of currencies guaranteed by the Union eliminates to a large extent the problem of a lack of foreign exchange at a national level, but this problem still continues to arise at the level of the monetary zone as a whole. Burkina's position abroad is determined less by the management of domestic demand than by the availability of foreign funds (aid and remittance of funds), which determine the import capacity of the country and thus have an effect on the net balance of payments.

The existence of a common currency complicates particularly the analysis of Burkina's commercial trade; although the common currency facilitates cash transactions between the members of the union, it scarcely facilitates the recording of information concerning the volume and nature of these transactions. For example: the estimated trade balance is characterized by a considerable disparity between registered trade and total trade. Unofficial exports represent on average 40 percent of the estimated total of exported goods; the share of unregistered imports is less, but still represents 15 percent of the total of foreign purchases.

Neither foreign aid, nor the remittance of funds from emigrant workers have followed the rhythm of growth in the deficit of resources since 1979, which is revealed in a gradual deterioration in the overall balance of accounts. On a more recent note, almost all foreign loans have been obtained under very liberal conditions. The ratio of the national debt service compared to exported goods and non-invoiced services was 8.8 percent in 1981 and is increasing rapidly (11.8 percent in 1982).

1.4.5 Distribution of the state budget

The Ministry of the Plan (MP) had not effectively evaluated investments implemented within the framework of the Third Plan beyond 1979. Although the Ministry's estimates give the impression that all planned investments had been realized (249.7 billion CFAF), it is not very likely that after the effective flow of foreign aid, more than 160.4 billion CFAF (64 percent of the planned expenditure) had actually been invested.

The Department for Financial Implementation (DEF), which was the section of the MP in control of the financial implementation of projects, did not have sufficient means at its disposal to follow-up on project implementation. The DEF recorded the operations of approximately one-third of the 35 financial backers, attaching particular importance to the operations of two French financial backers, the Cooperation and Aid Fund (FAC), and the Central Fund for Economic Cooperation (CCCE); the projects controlled by this department only represent about half of the total investments realized during the period of the Third Plan (1977 to 1981).

The Department of the National Debt at the Ministry of Finance also controlled the financial implementation of certain projects, but for the majority of these projects, it was the financial backers themselves who exercised the control functions. Neither was there any central control of counterpart expenditure being carried out in the national currency. For the majority of projects, until recently no financial governmental contribution was planned, but, even if the contrary arose, the financial contribution was not systematically included in the planning and preparation of the budget (see section 4), to a certain extent because there was in fact no central governmental department which was informed about all signed project agreements. This data on investments by sector is indicative only (Table 1.7).

Table 1.7 Realization of Investments According to the Third Plan (1977 to 1981)

Category	1977	1978	1979	1980	1981	Total
	(in millions of francs CFAF)					
Rural Sector	5,236	7,821	11,199	20,129	19,129	64,176
Agriculture	1,475	2,589	4,361	8,371	7,445	24,241
Livestock	845	1,060	2,126	2,888	1,783	8,702
Others	2,916	4,172	4,712	9,532	9,901	31,233
Industrial Sector	5,040	6,999	9,058	8,419	13,024	42,540
Services	1,149	1,211	1,146	5,831	9,149	18,486
Transport Infra- structure	5,329	5,361	11,053	17,465	17,492	56,700
Social Services	4,814	5,122	6,512	10,612	11,341	38,401
Research	864	1,503	1,843	1,832	2,117	9,159
Total	22,432	28,017	40,811	64,950	72,252	228,462
 Total Development Expenditure Effec- tively Financed	 30,000	 33,000	 46,000	 40,000	 43,000	 193,000

Source: Ministry of Economics and the Plan

1.5 The agricultural sector

1.5.1 Structure

Attempts to characterize agriculture in Burkina Faso using such notions as pluvial agriculture, irrigated agriculture, subsistence agriculture and commercial agriculture have been made. The dualist approach contrasting traditional foodstuff farming and modern commercial agriculture throws no relevant light on the problem of understanding agriculture in Burkina Faso because on

the one hand, foodstuff production is commercial as well as for subsistence and, on the other the two products often originate from the same basic socioeconomic unit.

1.5.2 Infrastructure and institutions

Ministry for Agriculture and Livestock Farming

The Ministry for Agriculture and Livestock Farming (MAE) is the main government institution responsible for the development of agriculture and the rural milieu. In the course of reorganization, the present Ministry is the result of a long development during which various ministries for agriculture, livestock farming, public works, etc., have been combined into one overall ministry that also includes public works in the rural environment, cooperatives, credit, agricultural education together with livestock farming, waterways and forests.

The MAE has retained its responsibilities in plant production, animal production, organization and education of the rural areas. Emphasis is put on this last aspect in particular, with the aim of initiating the organization of rural life and of establishing the necessary liaison between research bodies, advisory services and farmers. Once this structure has been established at all levels, it ought to enable: (1) improved identification and characterization of the restraints of development; (2) improved participation of the rural environment in the process of grassroots development; and (3) implementation of mechanisms for coordination between research bodies, advisory services and farming communities both on a national and on a provincial or community level.

Ministry for Water

The constraints to implementing a water policy for food and animal feed production has made it necessary to establish a Ministry for Water (ME). The ME is in the course of being organized on the basis of water distribution in the villages, the arrangement of water control infrastructure for animal and plant

production and the rural organization for the management of space and water.

Ministry of the Environment and for Tourism (MET)

This ministry existed in the former development structure and continues with its strategy for action. The branch of this ministry responsible for the environment intervenes in particular in rural areas in conservation and land planning with concern for the biological equilibrium of the ecosystems.

Bearing in mind the extreme fragility of the ecosystems of the Sahel and Sudanese Sahel, the priority activities undertaken by this ministry lie in making the rural community aware of these facts, and in encouraging rural communities to organize themselves and take concerted action within the framework of development at the basic level.

Ministry for Higher Education and Scientific Research

In July 1978, the Ministry for Higher Education and Scientific Research (MESRS) was created. The Research Institute for Tropical Agriculture and Food Crops (IRAT), Research Institute for Oil and Oil Plants (IRHO), Research Institute for Cotton and Textile Fibers (IRCT) and Technical Center for Tropical Forests (CTFT), agricultural research institutes which belong to it, were to form the central core of the Agricultural Research Institute (IRA), which has never been operational. However, the international institutes, ICRISAT, IITA and SAFGRAD, continue to work with the Ministry for Rural Development.

In 1979, a research unit for farming systems was established (Farming Systems Unit - FSU) as a joint project between SAFGRAD and Purdue University.

In 1981, the Volta Institute for Agricultural and Zoo-technical Research (IVRAZ, now known as IBRAZ) was created within the MESRS and the National Center for Scientific and Technical

Research (CNRST), which regrouped the French institutes (IRAT, IRCT and IRHO), the CERCI project and the network of research stations (Saria, Kamboinse, Farako-Bâ and Niangoloko). The international institutes (IITA, ICRISAT and FSU) and the regional program of SAFGRAD located at Kamboinse are associated with the IBRAZ. The Overseas Office of Scientific and Technical Research (ORSTOM), a French public law institution, is attached to the General Management of Scientific and Technological Research (DGRST) at MESRS, and the CTFT is attached to the Research Institute for Biology and Tropical Ecology (IRBET).

The following institutes and programs remain outside the MESRS and the IBRAZ:

- (1) FAO fertilization project;
- (2) National Soils Department;
- (3) Department for the Protection of Plants with supervision of the laboratory for the protection of plants at Bobo-Dioulasso, supported by the ACDI, and the Inter-State Drought Control Committee for the Sahel (ICDCS) which is supported by FAO and USAID;
- (4) Department for advisory services and experimentation with research and development projects in the farming community;
- (5) Ranches and livestock stations of the Ministry for Rural Development (MRD);
- (6) Department of Agrometeorology at the Ministry of Equipment;
- (7) Research center for animal trypanosomiasis, supported by the Institute for Animal Husbandry and Veterinary Medicine in the Tropics (IEMVT) and the German Agency for Technical Cooperation (GTZ); this research center is under the supervision of both the MRD and the MESRS.

In 1985, the MESRS was being completely modified, in particular with regard to research, to orient the research programs toward priority for better identified and characterized development aims. These developments are examined in chapter 2.

1.5.3 Price policy

The country's economy is dominated by outside forces and the notion of a one-way economy, which has been used a few times, is not exaggerated. Nevertheless, within the restrictions which become tighter from year to year as a result of the contradictions of the capitalist system, the country has still tried to implement measures to support its agricultural policy. The price policies for agricultural products and primary materials are often at the heart of this debate.

Commercialization structures

Until recently, the role played by the state in the commercialization of cereals by the intermediary of the National Cereals Office (OFNACER) has been limited to the purchase of some 15,000 ton/year, which according to estimates is approximately 10 percent of the marketed surplus. The government had more ambitions for its office, but the latter is limited by a lack of funds. Its aim is to purchase and resell 50 to 60,000 tons of cereal per year (including a safety stock of 10,000 tons), which is approximately one-third of the commercialized quantities, with the aim of stabilizing the prices in the private sector, and of intervening on the market to establish floor and ceiling prices. The cereals sold by OFNACER have been basically supplied by food aid, and the actions taken have therefore probably as a whole been of more benefit to the consumers than to the producers, although the presence of the OFNACER as marginal buyer in certain regions producing surpluses has been able to provoke a rise in prices for production.

There is insufficient data available, but it appears that private trade more or less dominates the commercialization of foodstuff production.

The commercialization of fruit and vegetables, the production of which is estimated at 23,000 tons of tomatoes, 15,000 tons of onions, and 3,500 tons of green beans, is

essentially by private trade. The national union of market gardening cooperatives has only ensured commercialization of green beans and some 500 tons of fruits for export.

The commercialization of cotton is ensured by the Company for the Development of Textile Fibers (SOFITEX) on the basis of monopolistic intervention. The prices are fixed by the state for each farming year.

The commercialization of animals is conducted essentially by the private sector. However, as in the case of cereals, the state organization, National Office for Animal Farming (ONERA), intervenes and attempts to normalize the market situation, organizing the professional dealers and producers.

The price of agricultural products and primary materials

Tables 1.8 and 1.9 summarize the data relating to the prices of agricultural products and main primary materials. The duality between agricultural products for export and products for current consumption is obvious. It has taken nearly 23 years (1960 to 1983) for the official price of cereals (often scarcely used) to reach that of cotton, and this in spite of the effects of the drought in the country. For the producer, the prices of cereals between 1973 and 1975 (crucial period of drought) dropped at the moment when a rise in prices could have ensured a rapid recovery of production, in particular in the zones of great agricultural potential. The official cotton price (the only one actually used because of the monopoly), does not reveal the fluctuations in supply and demand in the domestic and foreign markets.

Finally, the prices of agricultural products show that the producer price of foodstuffs is closely related to the level of reproduction of the work force of city-dwellers and on the other hand, the price of exports is closely related to the level of functioning of the state and of outside forces. In the absence of socioeconomic studies of production costs and the rural

Table 1.8 Prices of Agricultural Products, 1964 to 1980
(CFAF/kg)

Year	<u>Sorghum/Millet/Maize</u>		<u>Rice</u>		<u>Groundnut</u>	<u>Sesame</u>	<u>Shea Butter</u>	<u>Cotton</u>
	Producer	Consumer	Producer	Consumer	Producer	Producer	Producer	Producer
1964					26	26	7	34
1965					26	26	7	34
1966					26	26	7	34
1967					26	26	7	34
1968					26	26	7	32
1969			19		26	26	7	32
1970	12		19		25	26	7	32
1971	12		19		25	26	7	32
1972	14	26	19		26	26	7	32
1973	18	30	28		34	27	8	35
1974	22	37	35		34	34	20	40
1975	18	30	35	121	38	34	20	40
1976	23	35	35	115	44	39	20	40
1977	32	45	55	115	54	45	22	55
1978	40	57	63	125	54	63	23	55
1979	40	57	63	125	54	90	24	55
1980	40	57	63	125	54	90	24	55

Source: World Bank.

Table 1.9 Prices of Agricultural Inputs, 1964 to 1984
(CFAF)

Year	Cotton Fertilizer (NOK)	Ox-Drawn Plow	Ass-Drawn Barrow	Sprayer	Endrin 250cc	Thioral 25gr	Seed (kg)		
							Sorghum and Millet	Maize	Rice
1964					6,680				
1965	35-40	8,000		10,500	100	20			
1966	32-46			10,500	100	20			
1967	35-39			6,000	100	20			
1968	35-40		22,500	7,500	100	20			
1969	38-40		22,500	7,500	100	20			
1970	35		24,000	7,500	110	20			
1971	35		24,000		110	20			
1972	35	9,600	24,000		110	20			
1973	35	11,500							
1974	35	12,275							
1975	35						45	39	72
1976	35						45	39	72
1977	35	19,355					45	40	72
1978	35	19,355	7,500				52	52	89
1979	35	19,355	43,500	9,000	85	35	108	108	95
1980	40	19,355	43,500	9,000	100	35	108	108	95
1981	40								
1982	55								
1983	62								
1984			25,500	65,000					

Source: World Bank.

production system, price fixing for the producer is conducted in a bureaucratic manner, without involving the principal interested parties, the farmers, in the decision-making process.

The relative stability of prices for fertilizer and other primary materials between 1965 and 1980 should not create illusions. The rural world is confronted by rapid changes in the prices of merchandise which is increasingly used in satisfying needs.

1.5.4 Agricultural production

Although the data for agricultural production have been presented in numerous documents, they are still estimates because of the absence of organizations for the collection of such data. With the exception of certain crops, which are produced according to supervised and controlled lines (cotton, sugarcane, market gardening in planned areas), the following data are therefore only approximate.

Production

Table 1.10 shows production of the principal crops. The development seems irregular, especially for cereals, with the effects of the drought in 1973, then a more-or-less significant recovery from 1976. Among the food crops, the fairly rapid development of the production of cowpea from 1970 is worth noting; the production of rice on the other hand shows the greatest fluctuations.

There has also been an irregular trend in the case of the oil crops (groundnuts, sesame, shea butter), in particular for groundnuts. This phenomenon is observed throughout West Africa. Compared to the recent past, the local consumption of oil crops in various forms has undergone a rapid development, particularly in urban centers.

Table 1.10 Agricultural Production, 1970-1982^c
(thousands of tons)

Products	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Millet	378.0	397.0	400.0	253.0	370.0	350.0	406.0	350.0	404.0	431.0	330.0	-	-
Sorghum ^a	563.0	576.0	512.0	481.0	705.0	650.0	717.0	610.0	621.0	610.0	550.0	1,114.0	1,250.0
Maize	55.0	55.0	59.0	58.0	62.0	62.0	46.0	50.0	101.0	105.0	98.0	132.0	141.0
Rice	34.0	36.0	30.0	31.0	36.0	40.0	41.0	23.0	32.0	47.0	29.0	29.0	39.0
Cowpea	15.5	41.0	37.0	13.9	42.2	50.7	44.4	50.3	51.8	52.6	53.5	-	-
Groundnut													
in Shell	68.0	66.0	60.0	63.0	65.0	80.0	87.0	85.0	70.0	70.0	53.0	78.0	105.0
Shea Butter	13.4	15.8	44.5	10.4	50.2	48.6	32.4	56.7	42.4	27.3	60.0	29.0	0.0
Sesame	6.3	4.0	5.6	5.2	8.0	8.0	7.0	6.0	7.0	5.4	7.1	8.0	8.0
Cotton ^b	23.5	28.1	32.6	26.7	30.6	50.7	55.3	38.0	60.0	75.1	56.0	74.9	65.0

Source: The data for millet, sorghum, maize, rice, groundnuts and sesame for 1970-1979 are FAO estimations and are also indicated in the IBRD report entitled: "Study of Agricultural Questions," October 1982, No. 3296. The figures for cotton for 1970-79 originate from the SOFITEX. The figures for cowpea and shea nuts for 1970-1979, and for all harvests in 1980 originate from the Ministry of Economics and the Plan: "National Accounts and Economic Indicators for the Upper Volta, 1970-1979," June 1981. The data for 1981 and 1982 for all harvests originate from the Ministry for Rural Development.

Notes: ^a Production for 1981 and 1982 includes millet.
^b SOFITEX declares a total production of approximately 64,000 tons in 1980.
^c The figures for 1970 refer to the harvest 1970/71 and so on.

As far as cotton production is concerned, there has been marked growth compared to the base level of 1970, in spite of low production years 1973, 1977 and 1980.

Yields

Table 1.11 shows the growth rates of production, area and yield. Apart from cotton production, it appears prudent not to comment on the figures.

Imports of agricultural products

Table 1.12 shows the figures on food aid. It can be seen that food aid has developed from being an exceptional intervention to a permanent contribution to satisfying the food needs of the Third World countries including Burkina Faso. In 1980, food aid represented 3 percent of national production.

However, even though relatively small, the consequences of this food aid on the economy of the country and its development strategies were significant. Some of these include:

- (1) significant changes in the staple diet;
- (2) disorganization of the system of production, in particular of cereal production (agricultural prices, primary material prices, marketing systems);
- (3) decline and stabilization of wages not matched by an increase in the level of domestic production from development activities;
- (4) accentuation of the dualisms between urban and rural centers, in particular with reference to access to basic food products.

Finally, the drought and permanent food aid have helped to justify a general policy of resignation, in particular in the domain of agricultural policy.

Table 1.11 Agricultural Production Growth

	Annual Average Increase ¹		
	Production ²	Surface Area ³	Yield ³
Cotton	10.9	0.0	12.3
Millet	-	3.1	-3.0
Sorghum	(1.2)	0.5	2.0
Maize ⁴	7.5	4.2	-1.6
Paddy	-0.6	1.4	-2.7
Cowpea	10.3 ⁵	not known	not known
Groundnut	0.7	2.5	-0.1
Sesame	2.8	3.9	-1.0
Shea butter	12.0 ⁵	not known	not known

Notes:

¹Growth rates according to the least squares method.

²For NIEBE and shea butter, the growth rates have been calculated for the period 1970 to 1981, as figures for these crops are only known up to 1980.

³Figures originating from IBRD Report No. 3296-UV: "Upper Volta: Study of Agricultural Questions," December 1982. The growth rates for cotton, groundnuts and sesame have been calculated for the period 1970-79; for the other crops, the figures are only known up to 1980.

⁴The gap between the growth rate for production and the growth rates for the cultivated surface areas and yields can be explained by the fact that different time periods have been considered.

⁵It is worth noting that as a result of significant fluctuations in production, the growth rate calculated on the basis of the average production for 1970-1972 and 1979-1980 is only 2.9 percent for cowpea and 6.6 for shea butter.

Source: World Bank

Table 1.12 Imports of Food Aid
(x 1,000 tons of cereal equivalents)

	1978	1979	1980	1981	1982
Total imports	50.5	49.1	36.5	51.2	82.4
Total imports as kg/inhabitant	8.5	8.1	5.9	8.1	12.7
Average total imports as kg/inhabitant for African countries south of the Sahara	3.7	3.3	4.4	6.4	5.8

Source: World Bank

1.5.5 Agricultural policy

The evolving agricultural policy reflects the general situation of growing awareness of the real constraints to increasing productivity within the social structures of Burkina Faso, in a particularly difficult socioeconomic and political world environment.

The will to control the development process, as opposed to the tendency of former policies to "drift and navigate at sight," is evident by the recognition of the existence of antagonistic classes and strata at the heart of the Burkina social structure.

As far as agricultural policy is concerned, this growing awareness is crystallized in the form of various activities with the following aims:

- (1) to improve the awareness, education and organization of the rural economy to enable it to identify and implement appropriate projects in order to solve the restraints of development (augmentation and diversification of agricultural production, improvement of educational, sanitary and nutritional amenities in the population);

- (2) to organize production and distribution between surplus and deficit food zones;
- (3) to identify and control obstacles to the implementation of a policy of development at the basic level (agrarian reform, indexed prices for agricultural products, accessibility to agricultural primary materials); and
- (4) to define the aims and strategies of agricultural development, in particular the reorganization of agricultural and livestock research (priority programs for research, structuring and mechanisms for coordination between research and development) concerning the principal activities and constraints of the rural world.

The specific aspects of the present transformations at the level of agricultural and zootechnical research will be dealt with in the following chapters of this report.

2 The National System of Agricultural and Livestock Research

2.1 General

The national system of agricultural research, as all of the development structures, is undergoing profound transformation to orient the research program towards the concrete aims of coping with the constraints of agricultural production.

In this reorganization, emphasis has been placed in particular on functions and strategies. A clear definition of the aims and strategies of national research is a necessary condition and the most important prerequisite for developing the most appropriate structure to achieve this political aim.

It is therefore important to feature in this report the former situation (aims, institutions, operation), in order to be able to assess better the significance of these transformations. A particular study had been made of this situation by a mission of ISNAR/WB/FAO in 1983.

The present state of organization and planning in agricultural research is relatively complicated because of the diversity of administrations and institutions and of their respective programs and projects. Responsibility is shared with the MESRS, the MRD, the MET, the ME and the institutions of international cooperation.

2.1.1 Ministry for Higher Education and Scientific Research

The minister's cabinet, and the General Management for Scientific and Technological Research (DGRST) are members of the National Council for Higher Education and Scientific Research (CNESRS) and of the Commission for Scientific and Technological Research (CRST). The General Director of the National Center for Scientific and Technical Research (CNRST) is also the General

Director of DGRST and thus participates in the decision making processes at this level.

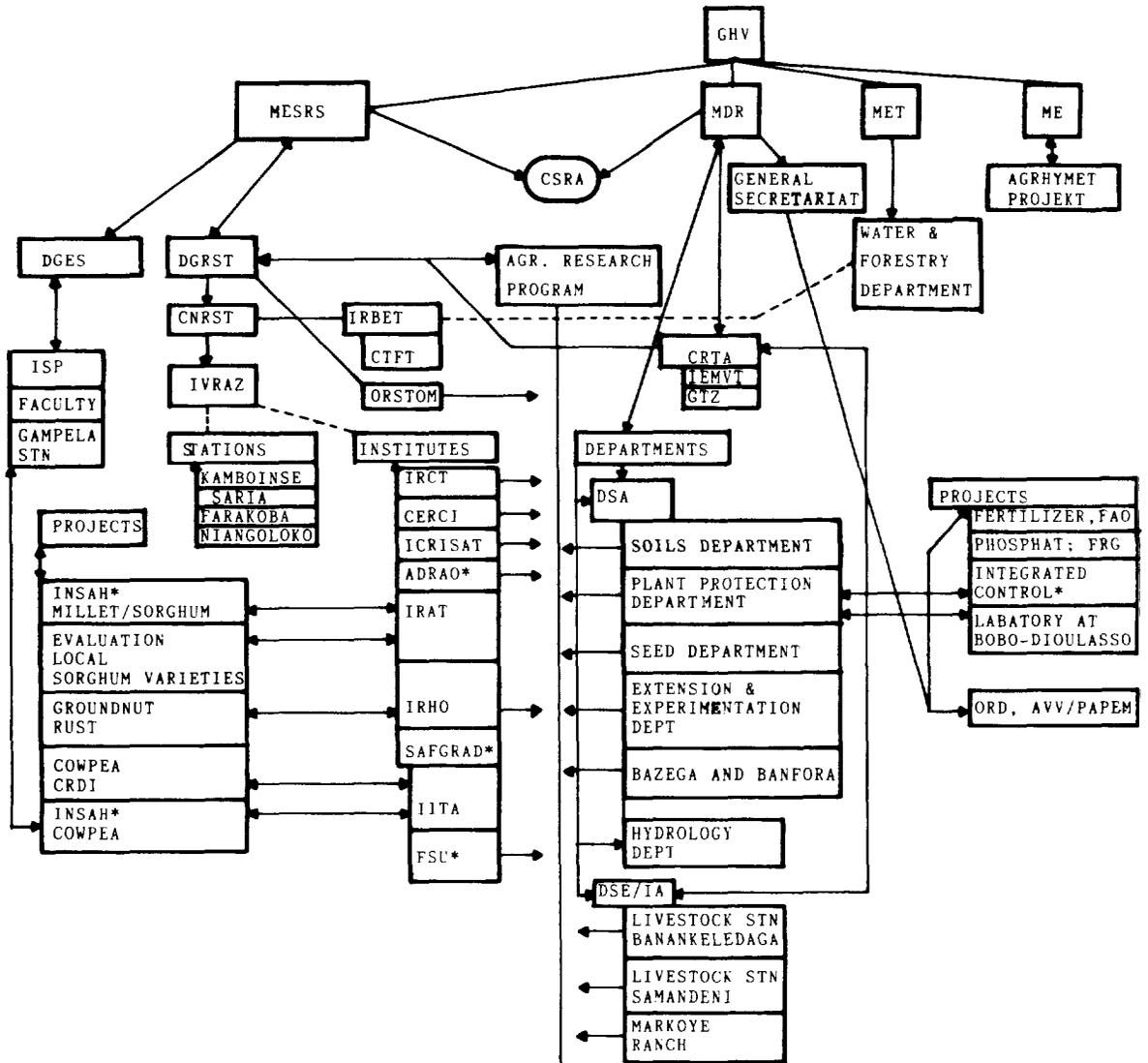
The CNRST has the supervision of five research institutes: Burkinabe Institute for Agricultural and Zootechnical Research (IBRAZ), Research Institute for Biology and Tropical Ecology (IRBET), Research Institute for Social and Human Sciences (IRSSH), Burkinabe Energy Institute (IBE), and the Research Institute for Natural Substances (IRSN) (Diagram 2.1). The center also has supervision of the Department of Documentation and Publication (DDP).

The IBRAZ manages the Experimental Center for Rice and Irrigated Crops (CERCI) and is requested to coordinate for the account of the CNRST, the execution of those programs which are allocated to the institutes of the Study and Research Group for the Development of Tropical Agriculture (GERDAT): Research Institute for Tropical Agriculture and Food Crops (IRAT), Research Institute for Oil and Oil Plants (IRHO) and the Research Institute for Cotton and Textile Fibers (IRCT). These institutes are French associations under private law. Furthermore, the IBRAZ has been allocated management of four research stations: Saria, Farako-Bâ, Kamboinse and Niangoloko.

In addition, the MESRS ensures technical management of cooperation agreements between two institutes of the CGIAR: IITA and ICRISAT. MESRS also ensures technical management of cooperation agreements for ORSTOM and FSU.

Finally, the MESRS ensures administration and technical supervision of the Technical Center for Tropical Forests (CTFT), a French association under private law. The latter is integrated in the IRBET.

Diagram 2.1 Present State of Organization and Planning of Agricultural and Zootechnical Research in Burkina Faso



* INTERNATIONAL AND/OR REGIONAL STRUCTURES
 N.B. SEE ABBREVIATION LIST

SOURCE: MISSION REPORT WORLD BANK/FAO ISNAR, 1983

IBRAZ

Diagram 2.2 shows the position of the IBRAZ in the organization of agronomic research within the MESRS in 1983. It seems that the institutional development of the IBRAZ is too limited to allow it to cope equally well with the management of research personnel as well as with the management of the programs.

The IBRAZ is housed in provisional accommodation at Ouagadougou. Three sections have been created under the supervision of the Director: administration, programs and finance. The secretariat consists of two shorthand typists. In October 1982, four scientific heads of departments were appointed (foodstuff and horticultural crops, irrigated crops, market gardening crops and industrial crops). The statutes of the IBRAZ also foresee a management board, which is not yet operational. The Burkinabe and expatriate researchers of the various structures are considered as staff of the IBRAZ; however, the responsibility for research staff management rests with the institutes, organizations and projects to which they belong. Although a special personnel statute has been passed by decree, this is not yet in application, although several applicants' files are being studied. The research stations are managed by the GERDAT institutes, with the exception of the station at Kamboinse, the director of which is nominated by the IBRAZ. However, the majority of research programs at Kamboinse are managed by the program and project directors of IITA, ICRISAT and SAFGRAD/FSU-Purdue. A Burkinabe co-director has been nominated to the CERCI program at Farako-Bâ.

As in the past, the research programs continue to be discussed and formulated according to type of production within the commissions and subcommissions created at a time when research was the responsibility of the MRD. These commissions work under the protection of the Special Committee for Agricultural and Zootechnical Research (CSRAZ), and examine each year

the current programs and activities, formulate recommendations, and propose new directions for new programs.

However, neither the subcommission, commissions nor the IBRAZ have authority to change the direction of these programs or to exercise powers of supervision, control or coordination. The research programs being conducted at present are defined by each institute (IRAT, IRHO, CERCI, ICRISAT, IRCT and Purdue) or project (CERCI and SAFGRAD).

Any possible interaction between institutions or groups of researchers are essentially the result of personal relationships and, in certain cases, these relationships ensure a better coherence between similar or complementary programs. There is no effective mechanism enabling better coordination and complementarity between programs in order to avoid duplication or even competition.

The budget of the IBRAZ for 1982 amounts to 15 million CFAF, which however does not include salaries and the social contributions for the Burkinabe personnel. From this budget, a sum of 4 million CFAF has been allocated to the financing of seed production at Kamboinse, for the account of the Ministry of Rural Development; the remaining 11 million CFAF are used to cover the administrative and operational expenses of the headquarters of the IBRAZ at Ouagadougou. The IBRAZ does not administer the operational budgets allocated to the GERDAT institutes and to the CERCI in the framework of the agreements on bilateral convention.

Research Stations

Four stations are mainly run by the GERDAT institutes and the CERCI: Saria, Farako-Bâ, Kamboinse, Niangoloko.

Saria is situated 23 km from Koudougou in the ecological zone with annual precipitation of 800-900 mm. The station was originally a cotton farm and in 1961 became a substation for

experimental agriculture belonging to Bambey (Senegal) within the network of the IBRAZ. The station has 420 ha of land, the soils of which are not representative of the Mossi Plateau. The station has serious isolation problems due to a lack of infrastructure (housing, laboratory) and equipment (not connected to main electricity).

Institutes working here are: IRAT, with programs for millet and sorghum, pedological studies and studies of crop systems; IRCT, with a subprogram of experiments with cotton; IRHO, with programs for annual oil plants (groundnuts, sesame and soja); ICRISAT, with subprograms of experiments on millet and sorghum; integrated projects of ICDCS/USAID/FAC/MRD against insects, diseases, parasites and weeds in the production systems; and FAC/Inter-African Committee for Hydraulic Studies (ICHS) project of experiments with biodigesters and their cultivation.

The infrastructure of the station is sufficient to maintain a small core of livestock (approximately 30 cows). Management of the station is by IRAT. The research staff consists of 12 researchers (including 5 expatriates) and 11 technicians/assistants. The station's operational budget amounted to 75 to 85 million CFAF, which was made up by the institutes and the Burkinabe government.

Farako-Bâ is situated in the ecological zone with an annual precipitation of 1,000 to 1,100 mm, 10 km from Bobo-Dioulasso, in the southwest of Burkina. Originally a substation belonging to Bambey (Senegal), Farako-Bâ became a station specializing in nutritional plants. In 1962, the IRCT began cotton research here. The station has 475 ha of land, cowsheds for 30 cows, water and electrical facilities, and is linked to Bobo-Dioulasso by means of a tarred road.

Since 1972, the station has developed substantially with the following programs: IRAT with programs for maize, market

gardening crops, tuber crops (yams, cassava, etc.), plant production systems and selection of trypano-tolerant cattle for draft power; IRCT with the cotton program; headquarters of the regional office of WARDA; ICRISAT with tests for adapting varieties of millet and sorghum; IITA/IDRC with tests for adapting cowpea; CERIC project with programs for rice, and other irrigated crops (maize, fodder crops, market gardening crops); and integrated ICDCS/USAID/FAC/MRD projects against insects, diseases, parasites and weeds in the production systems.

The IRAT is responsible for administration of the station; the research staff consists of 26 researchers (including 11 expatriates) and few technicians. The operational budget of the IRAT amounts to 90 million CFAF. The other budgets have not been disclosed. The CERIC is responsible for an experimental outpost in the Kou Valley located 25 km from Bobo-Dioulasso.

Kamboinse is situated in the same ecological zone as Saria, with 100 ha of heterogeneous soil, enclaved in a village 15 km from Ouagadougou. Its development is connected with the arrival of ICRISAT and IITA.

Today, Kamboinse belongs to the two main agricultural research centers in Burkina, with the following programs: ICRISAT with programs for selecting sorghum and millet, crop techniques emphasizing water economy; ICRISAT also has a research cell for production systems; IITA with programs for selecting maize and cowpea, crop techniques emphasizing water economy and studies of storage techniques for cowpea; integrated ICDCS/USAID/FAO/MRD project for controlling insects, diseases, parasites and weeds in the production systems.

The IBRAZ is responsible for administration of the station. It is the headquarters of the Purdue FSU program, and the base of the RPAA-SAFGRAD, which is working on a scheme for liaison between research and development in Burkina. The station also

produces seed for irrigated rice and market gardening crops for the Ministry for Rural Development. Twenty-one researchers (including 16 expatriates) work at Kamboinse. The IBRAZ makes a symbolic contribution of 4 million CFAF to the operation of the station (seed production) and covers the salaries of the Burkinabe researchers, whereas the international institutes and projects operate with outside finances.

Niangoloko is situated 130 km to the south of Bobo-Dioulasso in the ecological zone with 1,200 mm annual precipitation, in the extreme southwest of Burkina. It was created in 1949 for research into shea butter, and then became a Saria substation for research into groundnuts, and this remains its main activity. Today the station also conducts tests on soya, sesame and sunflower. The station has only 35-40 ha of land, with possibilities for extension. However, the farm buildings and equipment are in very poor condition. The station is administered by IRHO, with two expatriate researchers and two technicians.

Gampela station belongs to the Superior Polytechnic Institute (ISP) located 17 km east of Ouagadougou. The station has 400 ha of land, farm buildings and a hotel for 50 trainees. Various projects already in progress include: IDRC/IITA project for storing cowpea; Sahel Institute (INSAH)/IITA project for improving cowpea; INSAH/IRAT project for assessing local varieties of sorghum and millet; IRHO project for storing seed of rust resistant groundnut varieties; and village laboratories. ICRISAT and FSU have selected villages where they carry out tests in the rural environment with the farming population, either to study and complete production techniques and systems which can be extended, or to gather socioeconomic statistics and information on the principal factors which are restraints to rural development.

Without using the expression "village laboratories," IRAT is also active in approximately 50 villages, either gathering socio-

economic statistics, or studying traditional agricultural systems.

2.1.2 Ministry for Agriculture and Livestock Farming

Several research programs remain with the MAE, under supervision of the Administration of Agricultural Departments (DSA), or of the Administration of the Departments for Livestock and Animal Industry (DSE/IA).

Administration of Agricultural Departments

The Soils Department supervises the National Soils Institute (project UNDP/FAO). The latter is equipped with analytical laboratories (soil, water, plant life) and assumes responsibility for research in related areas: water and soil conservation, studies of the mineral deficiencies and fertilization of soil, control of soil erosion, etc.

The Department for the Protection of Plants is responsible for the control of migratory insects and for phytosanitary protection in general. It supervises two research projects. The integrated project (ICDCS/USAID/FAO/MRD) has operated since 1981, with the aim of updating systems integrating cultivating methods and biological control methods in order to reduce the need to resort to pesticides. The stations at Saria, Kamboinse and Farako-Bâ participate in this experiment. A laboratory for the protection of plants at Bobo-Dioulasso (UNDP project for controlling the cotton weevil, extended to include all phytosanitary problems by the Canadian Agency for International Development [CIDA]) concludes an initial program phase with three researchers (including one expatriate).

The Department for Advisory Services and Experiments provides technical support for the regional development organizations (ORD). The department is in the process of being established, and its role as far as experiments are concerned is not yet properly defined.

The Fruit Stations at Bazega and Banfora, entrusted to the Research Institute for Fruits and Citrus Fruits (of GERDAT), carry out tests and keep collections of fruit species, the best of which are multiplied and distributed for commercial production.

The support points for pre-extension and multilocation experiments (PAPEM) are supervised by the Ministry for Rural Development. They are also used by the IRAT and IRCT for updating extension production techniques and systems. Seven PAPEM have been created since 1966.

Finally, the MRD supervises the Fertilizing Project of the FAO, the Phosphate Project of West Germany, and the ICHS Project for exploiting biogas as a source of energy.

Administration of Livestock Departments

The veterinary laboratory takes samples and analyses the various parasitic diseases with the aim of establishing epidemiological maps. The microbiological and serological departments intend to make investigations in order to establish epidemiological maps for infectious diseases.

The Animal Production Department conducts tests in several stations, in particular in the livestock stations at Banankeledaga, Samandeni and Markoye. These activities have been interrupted through lack of financial means, and their results have not been utilized. Elsewhere, the IEMVT has conducted and then abandoned cattle fattening tests, in particular at the Saria station. This department intends to recommence research activities at a number of small stations, including ones at Samandeni, Banankeledaga and Markoye. Each has facilities for livestock maintenance and observation.

Research Center for Animal Trypanosomoses (CRTA)

Administrative supervision of the CRTA at Bobo-Dioulasso is

in the hands of the MRD and the MESRS jointly. The center was created in 1975 following a 1972 agreement between the French and Burkinabe governments which were joined by the West German government in 1973. The station consists of several buildings for rearing glossina and laboratory animals; the station also has an irradiator capable of 12,400 curies, various laboratories (entomology, cell cultures, immunology, biochemistry, serology), and all the scientific equipment required for high quality work. The center has 220 cattle which are needed for rearing animals for experimental purposes at Banankeledaga.

The center's staff consists of 18 expatriate researchers (GTZ-IEMVT) and 6 Burkinabe specialists (one entomologist, one veterinary surgeon, one biochemist from IBRAZ, two livestock engineers and one specialized nurse).

2.2 Financial resources and research

The collection and processing of data relating to the resources allocated to agricultural research are particularly difficult given the diversity of research institutions. Agricultural research is characterized by unplanned and uncoordinated activities of national institutions and bilateral and multilateral scientific cooperation.

Under these conditions, it is difficult to exactly define the domain of agricultural research. From the research stage through to application, a series of activities can be observed under willfully evasive terminology; experimental development, pilot action zone, accompanying research, research-development liaison, production systems research and others.

This confusing phraseology, which has been introduced from outside, was not developed from a sufficiently clear understanding emerging from an analysis of the national situation. As a result, no clear set of aims and strategies of the national

policy on agricultural and zootechnical research has been adopted. The analysis of the financial resources of agricultural research therefore only presents a partial picture of the true situation.

2.2.1 Financial resources allocated to research

During the period of 1977 to 1981, research has received an average allocation of 4 percent of development investments, according to a study by the World Bank (see also Table 1.7).

On the basis of the overall data, it is not possible to pinpoint the allocation made for agricultural research (agriculture, livestock, forestry). However, it is believed that agricultural research receives more resources than the other types of research, especially that at universities. Research receives 12 percent of the investment made in the rural sector (agriculture, livestock, others).

These data would appear to indicate that the effort made for agricultural research is significant compared to the multitude of needs in the country. However, this must be put in perspective by emphasizing that the greater part of the resources allocated to research in fact provide various logistical and monetary support for the expatriate and national researchers (more for the former, less for the latter).

This situation is not peculiar to research or to agricultural research. It reveals the logic of development projects prompted from the outside, whereby the expertise (external and internal) absorbs in various ways almost 80 percent of the resources allocated, to the detriment of the equipment and implementation of the research programs. For the national staff (researchers and technicians), new regulations have just reduced the operational tasks to objective proportions related to the necessity of development at a basic level.

2.2.2 Financial resources allocated to agricultural research

The state basically controls agricultural research, which until recently was organized within the Ministry for Rural Development. The national budget funds allocated to agricultural research are a reflection of the significance attributed to rural development activities. The following two features emerge from the budget data in Table 2.1.

There has been very limited allocation of funds to activities of rural development (2 to 6 percent) in a social structure in which the rural world represents at least 85 percent of the population, and contributes 75 percent of gross national product. There was a noticeable reduction (2.33 to 0.51 percent) in the budget for the Administration of Agricultural Departments, to which agricultural research belonged until 1979.

At this stage in the state budget contributions, it is not possible to define specifically the financial resources allocated to agricultural research.

Table 2.2 shows the resources allocated to agricultural research by various organizations in 1980. The IARCs (ICRISAT, SAFGRAD, WARDA, CRTA) provide resources which cannot be considered solely directed toward Burkinabe agricultural research. In addition, certain other research programs (FAO fertilizer experiment, livestock station, livestock laboratory, MSU Fada, ICDCS/FAO, Soils Department) control resources allocated to agricultural research on a general basis, but the final destination of which, in terms of aims and strategies, is not controlled by the national structure with a mandate to pursue the country's agricultural research needs.

This table puts in perspective the complexity of interconnections which characterize agricultural research in Burkina, confronted with bilateral and multilateral scientific cooperation.

Table 2.1 National Budget Contribution to the Financing of the Agricultural Departments for Years 1959, 1969, 1979, 1980, 1981. Subject to Additional Budgets (often decided in Council) and Expenditures

Year	State Budget	Budget Ministry Rural Development	Percent MRD/State	Budget Department of Agriculture	Percent DSA/State
1959	4,964,874,000	143,072,000	2.88	115,521,000	2.33
1969	9,030,587,000	535,668,000	5.93	239,486,000	2.65
1979	35,703,531,000	2,025,785,000	5.67	183,699,000	0.51
1980	40,223,035,000	2,234,179,000	5.55	223,310,000	0.58
1981	46,779,254,771	3,187,446,410	6.81	240,105,000	0.51

Source: Summary Report of the Second Executive Conference, Ministry for Rural Development, June 1981.

Table 2.2 Human and Financial Resources for Agricultural Research, 1980

Organization	<u>Researchers</u>		Technicians	Others	<u>Annual Budget from Outside</u>	
	Expatriate	Burkinabe			(million CFAF)	(percent)
DSA	0	1	0	0	1.3	0
IRA	0	3	0	2	9.7	0
IRAT	5	4	11	85	170.7	64
IRCT	1	4	1	n/a	52.0	54
IRHO	2	1	6	n/a	54.8	51
CTFT	2	0	7	20	54.3	62
AVV	5	0	0	5	--	100
Station and Livestock	0	0	4	30	5.0	0
Laboratory	1	3	5	5	3.0	0
CERCI	6	4	14	n/a	190.7	68
FAO-Fertilizing Experiment	4	0	0	0	32.2	n/a
ICRISAT	12	5	22	55	210.0	88
SAFGRAD/Purdue	4	1	4	8	105.0	100
SAFGRAD/IITA	5	3	10	11	262.5	100
SAFGRAD/RPAA Production	1	0	0	0	17.5	100
MSU/Fada	3	1	5	20	64.1	100
WARDA	n/a	n/a	n/a	n/a	n/1	n/a
CRTA (IEMVT)	10	0	n/a	n/a	205.0	100
CILSS/FAO Project	1	0	2	0	1.3	100
Soils Department	2	3	12	n/a	145.0	64
Total	64	33	103	241	1,584.0	

Source: World Bank

Beginning in 1983, this situation led to the implementation of a procedure for programming agricultural research activities in Burkina Faso. It should thus be possible for the IBRAZ to elaborate, execute and evaluate a national agricultural and animal husbandry research program with priority for concrete development aims.

During the process of taking stock of past and present programs in Burkina, we have collected data on financial resources allocated to agricultural research. The organized agricultural research has been ensured essentially by financial participation from the state and from France as shown in Table 2.3. The data for the 1960s are, however, only partial and have not been included here. The direct participation of the FAO (CERCI project) and other international research institutions are more recent (1978). Comparing Table 2.2 with 2.3 shows that in 1980 the financial resources "controlled" by IBRAZ represented less than 20 percent of the human and financial resources allocated to agricultural research.

However, as we have emphasized previously, these data do not portray the real effort made on increasing production of these crops, bearing in mind the resources allocated in terms of expatriate and national personnel, and the lack of correspondence between the research programs and priority aims of development strategy.

Financial support to research by Burkina and France was equally shared prior to 1973, but beginning in 1973 for food crops and 1974 for oil seed and cotton, the Burkinabe participation dropped below 50 percent. However, this Burkinabe contribution does not account for the burden of the salaries for the national researchers, which are ensured directly by the Ministry for Financial Resources.

Table 2.3 Financial Resources of Agricultural Research 1970-85 (in thousands of CFAF)

Year	Food Crops				Oil Crops				Cotton Crops				Total
	Burkina	France	Total	%	Burkina	France	Total	%	Burkina	France	Total	%	
1970	26,050	26,050	52,100	53	11,534	11,534	23,068	23	10,986	10,986	21,972	22	91.1
1971	27,250	27,250	54,500	53	11,995	11,995	23,990	2	11,535	11,535	23,070	22	101.5
1972	29,685	29,685	59,370	54	12,430	12,430	24,860	22	12,588	12,588	25,176	23	109.4
1973	28,375	31,215	59,590	53	13,225	13,225	26,450	23	12,789	12,789	25,578	22	111.6
1974	29,800	37,250	67,050	54	13,445	16,500	29,945	24	12,219	14,635	26,854	21	123.8
1975	32,433	48,100	80,533	54	16,403	19,526	35,928	24	12,574	17,725	30,290	20	146.7
1976	35,670	55,675	91,345	54	19,550	20,150	39,700	23	15,427	20,957	36,384	21	167.4
1977	44,650	78,100	122,750	60	20,100	20,900	41,000	20	22,450	17,000	39,450	19	203.2
1978	49,100	85,000	134,800	60	22,100	23,000	45,100	20	16,000	27,950	43,950	19	223.8
1979	54,000	94,000	148,300	60	24,300	25,500	49,800	20	17,200	30,550	47,750	19	245.8
1980	60,200	112,300	172,500	61	26,800	28,000	54,800	19	27,335	28,000	55,335	19	282.6
1981	77,400	134,750	212,050	62	30,100	31,700	61,800	18	33,550	34,500	68,050	19	341.9
1982	95,350	158,500	253,850	61	35,650	36,150	71,800	17	37,400	47,000	84,400	20	410.0
1983	98,760	184,100	282,860						37,300	58,850	96,246		
1984	88,242	199,250	287,492	63	30,714	40,420	71,134	15	33,390	63,250	96,640	21	455.2
1985	88,240				30,714				33,391				
Average				57				20				21	

For the period 1970-84, the average participation of Burkina amounts to 44 percent. Compared to the entirety of financial resources allocated to agricultural research being undertaken in Burkina, the participation of the state is particularly limited (less than 20 percent).

Under these conditions, and in the absence of a definition of the aims, priorities and strategies of a national policy for agricultural and zootechnical research, the orientation of research programs will not be able to respond to the real needs of grassroot development.

Agricultural research is certainly not the only factor contributing to the present state of underdevelopment but it has made an active contribution to recognizing that certain hypotheses of development are not compatible with the reality of the social structure.

The necessity for understanding the development problem, for defining the development aims, and for defining the new research programs as well as understanding why research has accomplished little has clearly emerged.

Research, and in particular agricultural and animal research, cannot fulfill its observations and analysis functions outside the production system. Research must observe and analyze on the basis of and within the system, thus on the basis of and within the social structure.

In the following sections, we go into more detail on the problem of using resources within research programs to achieve development aims and will examine aspects of the impact of international research on solving the real constraints of development.

2.3 Human resources

The data relating to human resources in research are shown by scientific discipline, level of education and training, and professional experience in Tables 2.4, 2.5 and 2.6.

2.3.1 Human resources as a function of scientific discipline

The national researchers represent 58 percent of the total scientific staff in February 1985, but this is a recent development. From 1960 to 1977 there were only three national researchers in agricultural research (one researcher per crop type: foodstuff crops, oil plant crops, cotton crops). During that period agricultural research in Burkina Faso was managed by GERDAT within the framework of scientific cooperation with France.

Table 2.4 Human Resources in Agricultural Research
by Discipline, February 1985

Scientific Discipline	National	Expatriate		Total
		Bilateral	Multilateral	
Plant improvement/ phytotechnics	11	4	6	21
Animal improvement/ zoototechnics	1	-	-	1
Agricultural biology	10	6	1	17
Agricultural construction and technology	2	-	-	2
Rural sociology, geography, economics	3	-	2	5
Agricultural biometrics/ statistics	-	-	-	-
Pedology-climatology	9	-	7	16
Total	36	10	16	62

Since 1978, there has been a concentrated effort to recruit and train national researchers, closely related to the political will to gain control of agricultural research in order to orient it towards concrete development aims. The need to create a national program for agricultural research became particularly clear with the creation of MESRS in 1978, followed by the creation of IRA.

There is an imbalance between the disciplines currently represented by national staff. Those disciplines capable of analyzing the constraints imposed by pedological and climatic conditions (water, soil, fertilizer) which form the principal constraints on agriculture and livestock farming, represent 52 percent of the scientific staff. When the plant improvement area is added, the two disciplines together represent 84 percent of the scientific staff. Animal research has few staff as does agricultural economics, rural sociology or other areas that could analyze the development situation using the contribution of behavioral disciplines.

The imbalance between the biological and behavioral sciences is an essential characteristic of the scientific potential of the IBRAZ. If the origins of that imbalance are in the current approach to the development problem, where the rural world is forced above all to be a user of technical innovations which have been developed outside of its milieu (economic, sociocultural and political), then there is an urgent need to reestablish a just balance of disciplinary competences.

Disciplines responsible for collecting, processing and distributing scientific information (biometry, agricultural statistics, planning) necessary for development and educational activities and for national and regional planning, have no scientific staff or structure. Finally, the other domains of the IBRAZ attend with more or less relevance to the essential aspect

of liaison between research and development, education and the organs of political decision-making.

Bilateral scientific collaboration concentrated on plant improvement and agricultural biology and multilateral scientific collaboration on similar disciplines serve to reinforce this unbalanced situation.

Because scientific cooperation represents a considerable part (42 percent) of the scientific resources of the country, questions arise with regard to the definition of aims and strategies of the control of resources, and the impact of agricultural research in Burkina Faso. We will treat these questions in greater detail, as this forms the main aim of this report: the impact of foreign scientific cooperation on the national structures for research and development.

2.3.2 Human resources according to level of education

Before analyzing the academic training of the present research staff, it should be said that the classification of the national personnel assumes that candidates with bachelors and doctors degrees which are not awarded until the end of the university year will be successful. In fact, in the month of February 1985, there were only 5 bachelor graduates and 10 doctorates.

The spread of the national scientific potential is fairly balanced, but this is a recent development. In 1977, the three national researchers were candidates and bachelor graduates. Since 1978, the concerted effort to train researchers and encourage a balance among disciplines has started. The general educational system has increasingly influenced research as the candidates are better able to grasp problems in the scientific domains that relate to the development situation of the country.

Table 2.5 Human Resources in Agricultural Research
by Academic Level, February 1985

Level	National Researchers	<u>Expatriate Researchers</u>		Total	Percent
		Bilateral	Multilateral		
Technicians	12	6	0	18	30
Bachelors	6	3	0	9	14
Masters	3	0	0	3	4
Doctors	15	1	16	32	52
Total	36	10	16	62	100

When compared to the overall situation, the bilateral scientific cooperation efforts are characterized by a rather high proportion of general technicians (60 percent). By contrast, the international scientific staff are all at the doctoral level.

Linguistic communication is one difficulty with the international scientific cooperation in particular whose staff have a better command of English than of French. This communication problem is compounded with the difficulty of understanding an agricultural system in transition and an economy functioning in a dominantly capitalist production mode with the active survival of pre-capitalist modes.

2.3.3 Human resources as a function of professional experience

National researchers with less than 5 years of professional experience represent 64 percent of the total, those with between 5 and 10 years make up 30 percent, and only 5 percent have more than 10 years of experience. This extreme youthfulness results in the need for "senior" researchers to provide the appropriate leadership for their fellow researchers in the disciplinary

and/or multidisciplinary teams. Clearly, one of the challenges is for bilateral and multilateral scientific cooperation to provide such leadership by professional training and experience. Do the mechanisms of collaboration in the elaboration, execution and evaluation of the research programs carried out in Burkina provide this solution? Answers to these questions are explored below.

Table 2.6 Human Resources in Agricultural Research
by Professional Experience

Years of Experience	National	<u>Expatriate Researchers</u>	
		Bilateral	Multilateral
unknown	0	4	6
0 to 1 year	3	-	-
2 to 4 years	20	-	1
5 to 9 years	11	-	2
10 to 13 years	2	-	1
14 and more years	0	6	-
Total	36	10	10

2.4 Efficacy and constraints

2.4.1 Efficacy of IBRAZ

The planning process which has been initiated by IBRAZ has made it possible to take stock of the research programs conducted in Burkina Faso, and to analyze the extent to which they are adequate to solve the problems of agricultural development. But an evaluation of the programs against that goal is not feasible because it is not exaggerated to say that there was no national research program, but individual pieces of agricultural research

work, being pursued in Burkina Faso. The lack of political will about agricultural policy and agricultural research policy prevented coordination and planning of bilateral and multilateral scientific cooperation. It appears to us that it is not the scientific content of this research, but rather the extent to which it can cope with the constraints confronting development at the grassroots level, which should be used to assess the efficacy of agricultural research.

Liaison between research and development

Liaison between research and development in the present situation is a euphemism in the sense that the products of research are not aimed at development when this is understood to mean a profound transformation in the socio-economic-political conditions.

In this situation the product of research aims above all at a quantitative and qualitative increase in production. Historically, this is the corollary of a productivity based agricultural policy, with its reality being the increase of products (cotton, groundnuts, sesame). The aim of such research is to provide technical innovation (seeds, fertilizer, cultivation techniques) to be integrated in a production process which is under control (for example, cultivation of cotton).

In general, these production systems are effectively functioning so that the mechanisms for transferring technical innovations are approached from the inside of the productivity problems. In a sense, this research has the logic of what is called accompanying research, but accompanying research for a productivity project.

The thematic research program is conceived on the basis of the following implicit considerations: the technical innovations are to be researched outside the USEB; the innovations proposed by research must be accepted and adopted by the farmer; and, the

constraints confronting the farmer's efforts to increase production and improve the standard of living are essentially of a technical nature.

This conception is reinforced by agricultural research programs connected to the execution of development projects, so that they constitute what is called accompanying research. In fact, work carried out in Burkina Faso has resulted in technical and economic knowledge on animal-harnessed cultivation, fertilization, improved seeds, crop rotation, and other aspects which have no apparent relations to traditional systems of cultivation and production.

The adoption of technical innovations by producers confronted as they are by their socioeconomic environment, is the major constraint for which up to now there has been no successful solution, either from research or from the advisory services. In Burkina Faso and in the countries of the lower region, research has been carried out with certain positive results, but on the whole it has not resolved the need for increased food and an increase in incomes which is necessary for satisfying other needs.

The thinking in this domain is advancing, as can be seen in the improvements at the level of conception of research and advice by extension programs. But even here, one must ask how opportune such improvements in the tools of observation and analysis are, when the debate must be brought back to the level of concepts. It is surprising that a quarter of a century after these theories had been systematized, and in view of the subsequent criticisms, research programs are still being initiated on the basis of these same theories. The policy of the "green revolution" on the basis of high yield varieties (HYV) and imported inputs is one of the assumptions of the agricultural research being pursued in Burkina Faso.

For example, the approach to farming, or the methods of the advisory services, have been significantly improved. But will this improvement have a radical effect on solving the constraints facing the farming community? And, at a more general level, of the social structure?

We are thus indicating that as far as a coherent and adequate policy is concerned, it was rather a case of measures taken under the pressure of circumstances, and decisions generated by the "implementation of development operations" prompted from abroad.

With reference to measures of support for agricultural policy (price policy for agricultural products, loans, subsidies for fertilizers, etc.) these measures have been taken on the basis of the same strategy, favoring the transformation of transitional agriculture, in the person of the farmer who has already reached a certain primitive level. The most deprived (and these form the large majority) are implicitly excluded from this strategy.

However, it should be stressed that this tendency goes back to the 1960s. It must also be recognized that basic studies in the rural milieu, with the implicit intention of observing, analyzing, understanding, even explaining the specific constraints of development, date essentially from 1979. It should therefore be recognized that special efforts must be made to improve knowledge of the systems of production of the basic socioeconomic units (USEB), and of the rural zones.

Contribution of Research on Systems of Production (RSP) to research and development

RSP has been created to find answers to three principal problems: the constraints facing farmers, the resources available to farmers, and how to link research to farmers. Disciplinary research is very specialized, so it does not have

the same overall vision of farming as the farmer does. The researcher often assesses technology according to the yield performance and is not sufficiently informed about the consequences of adopting the technology for farming as a whole. On the other hand, the farmer assesses the technology according to its overall impact on the farm. As a result, certain constraints facing the adoption of a new technology may be obvious to the farmer, and escape the researcher completely.

RSP works as an interdisciplinary team, favors the overall vision of farming, and increases the chances of identifying constraints which otherwise would have passed by unnoticed and which would have acted as brakes on the technological transfer. It also makes it possible for research to be inspired by the real situation -- the possibilities, technical capacities and resources at the disposal of the farmer-- and not by some rarely encountered hypothetical situation.

Disciplinary research has often tended to work on the technologies it has introduced, at times ignoring the wealth of local resources. It has therefore not had sufficient opportunity to study and improve local technologies in order to alleviate or remove the constraints existing on the farms.

RSP works in the actual milieu with the effective, dynamic participation of the farmers and is thus able to exploit the technical possibilities found there.

One of the difficulties encountered in the transfer of technology from research to development is the lack of a concerted framework between researchers, farmers and advisors. This lack of coordination does not help to identify the problems in the transfer of technology and results in the continued development of technologies which are insufficiently adapted to the needs of the rural world.

The RSP program is intended to be a framework of coordination between the advisory services, thematic research, and the farmer. It is aware of the socioeconomic circumstances of the farmer, identifies the main constraints, uses the expertise of thematic research and the assistance of the advisory services to experiment with those technological packages which are most likely to raise or alleviate these constraints. It gives the thematic researchers the opportunity to better adapt their programs to the real conditions facing the farmer, the advisors the opportunity to become acquainted with and master the scientific methods, and the farmers the opportunity to contribute to the development of those technologies which are destined to help them.

Emergence of national agricultural research

In September 1983, MESRS gave instructions to IBRAZ to become involved in the national effort to reach self-sufficiency in food. At that time, IBRAZ was hindered in its functioning by numerous constraints of an organizational and administrative nature. National agricultural research had been widely sub-contracted out to foreign agencies in the framework of scientific cooperation.

The IBRAZ decided to mobilize all its human resources (national researchers and expatriates) in an elaboration of a national program of agricultural research. Three substages have been completed: stocktaking of the current research; organization of a national working party on policies and strategies; and identification and description of eight research programs.

While these programs were being developed other activities have been in progress including: organization of a seminar in January 1985 on liaison between research and advisory services with assistance from FAO; consultation with Burkina's traditional partners in agricultural research; and definition of the main

guidelines for the organization of the national system of agricultural research.

The national seminar on agricultural research in the service of the farmer was the culminating point of this process. It was a crucial meeting between the principal partners of research, agricultural production, and national economic development. In fact, beyond analyzing and adopting the national research program, the seminar set itself the task of examining the constraints of the administrative and financial management of the IBRAZ and of making appropriate recommendations to the government with the aim of making the national research system effective.

The results of the seminar go far beyond the recommendations which have been adopted. In fact, many other less noticeable results mark an important step in the progressive reorganization of the agricultural research system.

- (1) Examination of the programs: contrary to the past, especially in the National Working Party on the "Policies and Strategies for Reinforcing Agricultural Research" in April 1984, there was no systematic opposition during the debates between researchers and developers. Indeed, an agreement of opinions on all important questions could be ascertained. This result implies that the liaison between research and development has functioned adequately at the level of the researchers and developers.
- (2) Synthesis and order of priority of the research programs: the seminar has adopted the eight proposals for national agricultural research programs (PNRA) made by the IBRAZ.

This result is of capital importance, in view of the fact that up to now, the research programs were elaborated by foreign institutes, who came into the country to implement them. The PNRA is of particular importance because in times

such as these, it equates completely the needs of national development. Furthermore, the various components of the PNRA have been classified according to national priorities by the ministerial departments responsible for defining the country's agricultural policy.

The order of priority for the eight PNRA programs has been drawn up as follows:

two basic programs for:

- production systems
- water, soil, fertilization, irrigation, agricultural machinery

vegetable and animal productions: priorities to be established according to the potentials of regional development. However, for vegetable productions, the order of priority is as follows: sorghum/millet/maize; annual oil plants and seeded pulses; market gardening crops, fruit plants, tuber plants; rice and rice crops; cotton.

- (3) Examination of the proposals for restructuring and reinforcing the national system of agricultural research. The implementation of the retained research programs is ensured by the IBRAZ. In the following chapter, we will analyze the problems of bilateral and multilateral scientific cooperation in the context of reinforcing the capacities of the NARS. In the meantime, we will consider the influence of this scientific cooperation, in order to characterize it in terms of its mandate, and its human and financial resources.

2.5 Influence of foreign scientific cooperation

2.5.1 Bilateral scientific cooperation

Bilateral scientific cooperation is dominated by the agreements which have historically linked Burkina Faso to France. In

1960 when the country became independent, France was given the mandate to define, implement and evaluate the agricultural research programs being carried out in Burkina Faso. This agreement was not challenged until 1983, when the IBRAZ clearly expressed its desire to take charge of the planning, implementation and evaluation of the national agricultural research program, oriented toward meeting the country's development aims.

Bilateral scientific cooperation functioned through the institutes of the GERDAT (IRAT, IRCT, IRHO) which has recently become the CIRAD. In addition to French scientific cooperation, bilateral cooperation on a lesser scale was carried out with West Germany via the GTZ and the Dutch in cooperation with the Royal Tropical Institute.

The dominance of French agricultural scientific cooperation has led the other cooperative research work to be implemented in the rural areas directly with the producers. But these research activities are not identified as research, but as experimental development activities, supporting development projects. This type of work is difficult to include in the evaluation of the national structure of research.

2.5.2 Multilateral cooperation

Multilateral scientific cooperation in Burkina Faso often has a regional aspect which hinders the analysis of its contribution in terms of human and material resources. However, its impact can be identified more easily through its reinforcement of the national research system and improvement of production conditions in the rural milieu. This is covered in chapter 3.

3 Impact of the IARCs

The IARCs of the CGIAR are recent institutions when one considers that agricultural research in Burkina Faso goes back to the colonial period. The SAFGRAD program corresponds to the drought since 1973, which introduced a new dimension to the problems of food supply and overall development in the Sahel region, and in Burkina Faso in particular.

This brutal revelation of the phenomena and mechanisms accentuating the fundamental characteristics of under-development, resulted in a surge of international solidarity.

At this stage, one can ask what would have been the national structures of research and advice services without the introduction of the institutes of the CGIAR? What are the main contributions of these institutes? These questions were put to about thirty people working at regional and national institutions in development, higher education and agricultural research. The answers emerging from these interviews allow an appreciation of the problems of multilateral scientific cooperation, especially of the CGIAR.

3.1 Biological material

It was the opinion of the people interviewed, that the main contribution of the IARCs was in the domain of biological material: WARDA, IITA and ICRISAT are the NARS' main suppliers of biological material for rice, sorghum, maize and cowpeas.

3.1.1 Rice

On the basis of collaboration of WARDA, IRRI and the FAO/CERCI project in Burkina Faso, it has been possible to introduce, test and extend rice varieties for rainfed and irrigated rice.

In a CERIC report from 1983, the researchers show that of 17 varieties of rice tested between 1978 and 1983, 6 varieties originated from IRRI or were introduced to Burkina as a result of tests coordinated by WARDA. After the test phase, these varieties were retained for extension purposes on account of their potential (cycle, resistance to disease, yield, seed quality). Table 3.1 shows the characteristics of the varieties which have been adopted for agricultural extension.

Table 3.1 Rice Varieties Introduced by IRRI/WARDA

Variety	Origin	Potential
VIJAYA	IRRI introduced from India	5.7 T/ha
IR20	IRRI	4.5 T/ha
IR 1529.680.3	IRRI	5.6 T/ha
IET 1996	Introduced from India/WARDA	4.6 T/ha
IET 2885	Introduced from India/WARDA	4.6 T/ha
BR 51.319.9	Introduced from Bangladesh/WARDA	5.6 T/ha

Source: CERIC: Liaison Research-Development Technical Report 1981-1983.

3.1.2 Sorghum

More than 5,000 varieties of sorghum have been tested by ICRISAT over a period of 10 years. Most were unsuitable. However, three varieties seemed promising after tests in the farming milieu and have even started to be featured in extension programs, especially in the central zone of the country.

Table 3.2 ICRISAT Sorghum Varieties: Test in Farming Milieu

Variety	Origin	Potential
E35-1 (ICSV1HV)	India	3-4 T/ha
Framida (ICSV1001HV)	India	3-4 T/ha
82-S-50 (ICSV1002)	India	3-4 T/ha

3.1.3 Millet

More than 2,000 varieties of millet have been tested by ICRISAT over a period of 10 years. Just as in the case of sorghum, they were unsuitable. However, varieties issuing from crossbreeding with local crops have shown certain promise and are available for advance extension. There is therefore no widespread distribution in the farming milieu of varieties of sorghum and millet originating from the ICRISAT program.

3.1.4 Cowpea

The IITA program tested several thousand varieties, most of which proved unsuitable. Two of the introduced varieties have been appreciated in tests in the farming milieu (KN1, TVX 32.36). Variety KN1 has been accepted in extension programs but there are still only limited areas cultivated with this crop. The improved local variety, Gorom, on the other hand is cultivated more widely, especially in its original area.

Table 3.3 IITA Cowpea Varieties: Test in Farming Milieu

Variety	Origin	Potential
KN1	Nigeria	1-1.5 T/ha
TVX 32.36		1-1.5 T/ha
Local Gorom	Burkina Faso	1-1.5 T/ha

3.1.5 Maize

The IITA program tested 400 varieties which have largely proved unsuitable. Two varieties have been tested in farming areas. None is yet in advanced extension.

Table 3.4 IITA Maize Varieties: Test in Farming Milieu

Variety	Potential
SAFITA 104.2	3-4 T/ha
Pool 16, 27	3-4 T/ha

All these improved cereal varieties (sorghum, millet, maize) require deep, fertile soil and improved cultivation techniques, conditions which do not characterize agriculture in Burkina Faso, particularly in the zone of food deficiency (north-center).

3.2 Ideas, techniques and methods of research

The IARCs of the CGIAR, and in particular those present in Burkina Faso, have introduced ideas, techniques and methods of research both at the level of researchers, development workers, and farm production. Some of these are positive, while others are inadequate for development at the grassroots level. Except for WARDA, IARCs present in Burkina Faso (ICRISAT, IITA) were introduced in specific circumstances relating to drought. In this respect, the SAFGRAD project had given rise to great hopes, whether founded or not, especially in those sections of the public ignorant of objective knowledge of agricultural research and development.

3.2.1 The ideas

The researchers of the IARCs maintain direct contact through scientific and technical information with their partners in Burkina Faso, and have thus induced a way of thinking and

reacting with respect to the varieties and to the various components of production.

The idea existed in Burkina Faso that the selectively bred variety is the factor which will revolutionize the problems of production. The introduction of ICRISAT and IITA strengthened this idea in particular. Outside a fairly marginal section of the public which is aware of the problems, everyone is still expecting the miracle variety. This situation is all the more preoccupying because a number of political personalities and others from development institutions share this view.

In the social sciences, in particular the analysis of the process of development, the overwhelming tendency reflects classical and neoclassical concepts of anthropology and economics.

3.2.2 Research techniques and methods

As far as the techniques and methods of research are concerned, the IARCs have made a considerable contribution in the domain of the biological sciences. The training of researchers and the logistic support at their disposal within the country and in research centers abroad, allow them to implement the latest technological procedures. On the other hand, their attitudes toward collaboration with the national researchers does not always result in the best use of this capacity.

In fact, the introduction of the IARCs is surrounded by ambiguity, despite the existence of an explicit mandate. There is a lack of fluency (which is not synonymous with anarchy) in the IARC/NARS reports, preventing the NARS from increasing its ability to intervene. The agreement for establishing SAFGRAD headquarters in Burkina Faso resulted in improvement of the research station at Kamboinse. Real or sustained ambiguities prevent this opportunity being better exploited by the national structure.

In the social sciences, the conceptual and methodological contributions are particularly limited, apart from researchers and development workers who promote the neo-classical concepts of anthropology and economics.

In the approach to transitional agriculture and to the function of a participative agricultural research which is committed to observing, analyzing and understanding the problem of production in the USEBs and the social structures, a clear cleavage has emerged in this debate. This cleavage must be emphasized all the more, as it is finally the understanding of the committed social structure in the pernicious process of underdevelopment, which would have allowed the elaboration of appropriate technologies for coping with this situation.

The restricted impact of the innovations of the IARCs' research on the country's production can be easily explained in an equation with the national system, on the understanding that an innovation is never neutral. On the other hand, collaboration with ISNAR has rapidly assisted the thinking about programming the activities of national agricultural research. The most significant fact is that this process has started an unprecedented contradictory debate on research and the development process.

This is an example where ideas, techniques and methods of work coincide harmoniously with the social, economical and political situation of the social structure. The proposals made by the ISNAR/WB/FAO mission had little chance of being implemented only three years ago. These proposals reflected exactly the conflicting hopes of the partners: politicians, researchers, development workers and farmers. We have synthesized the work accomplished in this sense in the preceding chapters.

It must be acknowledged that the IARCs and their researchers have persevered with determination, tenacity and persistence in carrying out their tasks, often in difficult situations. However, after nearly a decade, the ideas and philosophy of the IARCs' interventions do not seem adequate to cope with the country's development situation.

The idea of the reinforcement of national research structures, the advice and extension services, the organization of farming life, as the medium- and long-term solution to allow the social structures to define and implement their own development, the idea that foreign scientific cooperation may not substitute the national structures, scarcely emerged at all, either in direct contact, or in writing. The narrow-mindedness of the IARC researchers, confronted with the great debate on how to approach the Third World societies, is stupifying. The sense of independence bestowed by the use of vast, autonomous resources compared to the national structures, leads to the isolation characterizing the SAFGRAD research. This has led to the impression that these institutes carry out "their research." The national researchers have no means of influencing these concepts and orientations, and have simply grown accustomed to coexisting with this idea.

On the other hand, the development workers, who in the end have less contact with the research of the IARCs, expect a lot from its innovations. The agricultural producers who have direct contact with the IARCs, in particular in the "village laboratories" during the tests conducted by the researchers and farmers, are subjugated both by the proposed innovations and by the means at the disposal of the IARC researchers. In this way, the development workers and farmers pursue their activities under artificial conditions.

The implementation of similar works by the national structure thus encounters certain reticence, which cannot be obviously explained without challenging the approach of the IARCs.

During the ISNAR seminar on national agricultural research and issues for the future in November 1984, the majority of participants acknowledged that ISNAR performs studies at the request of the countries concerned. These diagnoses advocate above all the reinforcement of the NARS. The countries and their national structures are finally confronted with their responsibilities, which ISNAR does not intend to take over were it capable of doing so.

This role as cautious, diligent advisory bureau is the saving aspect in the ISNAR approach. In the same way, in the domain of rice development, WARDA with its network of coordinated tests, allows the national structure, with the CERCI working within it, to test varieties with the farming organizations in the low-lying area and in the cultivated planes. The substantiated varieties are accepted by the farmers.

On the other hand, one cannot see how the philosophy of SAFGRAD/ICRISAT and IITA can reasonably find a solution to the country's food problems in the short term. The drought, the undernourishment and the slump in production are all consequences of underdevelopment. Taken as such, these problems require global actions issuing from an adequate agricultural policy with a general policy of social education. Even the intervention of efficacious research with sophisticated means cannot solve the problems in the short term, without transforming all the farmers into salaried agricultural workers, engaged in a vertically integrated, controlled production process.

It is obvious that these concepts of development ought to be revised and, as a corollary, the philosophy of the SAFGRAD/

ICRISAT/IITA project ought to be reoriented. The Third World is full of this type of project, which in spite of the resources employed, only serve to reproduce the existing conditions of their origin.

3.3 Organization of research

The research undertaken by the SAFGRAD/IITA/ICRISAT project coexists with that undertaken by the national structure. It participates in joint action at the request of the NARS (seminar, "think-tank" group, tests in the rural milieu). It also invites the NARS to participate in its own activities (seminar, review).

The two systems coexist, in particular with the common partners - development workers, rural world. The conflicts which emerge from this type of relationship in the research stations are resolved each time, but prevent a better definition of a comprehensive strategy for the intervention of research in Burkina Faso.

The current programming process is going to exacerbate the conflicting state of this collaboration. The implementation and evaluation of a national research program over a period of five years is fundamentally different from the previous situation. Research will no longer be evaluated by research, but by the effects on development and the rural world.

In the face of this debate, the NARS is obliged to take up its responsibilities with regard to autonomous research and/or substitution of the IARCs.

This behavior is identical with respect to bilateral and multilateral scientific cooperation, whether aimed at one country or at a group of countries. The only way to assure consistent, active participation, is to support the reinforcement of the national structures.

3.4 Information and training

The methodological rigor which characterizes the interventions of the IARCs appears in the collection, treatment and distribution of the IST. The IARCs also participate in the training of national staff.

3.4.1 Information

The collection, treatment and distribution of the information is fairly systematic as far as work carried out in Burkina Faso is concerned. It is also regular for work carried out in similar conditions. But two major phenomena have been observed which must be emphasized. The IARCs are engaged in self-promotion: they only distribute information concerning work performed within the same scientific circle - the IARCs of the CGIAR. The distribution of the IST is generally in English, in an area where few speak the language. The IST is therefore scarcely exploited.

If, as has already been indicated, the contribution in biological sciences is considerable, one witnesses a lack of interest for the tools of communication of the social sciences. The problems of income distribution are disconcerting for researchers of the social sciences whether in Africa, Asia or the Middle East and the approaches for analyzing it all proceed from the same neo-classical concepts.

In Burkina Faso, the IARCs do not assist in reinforcing the capacities of the NARS in collecting, treating, distributing and storing information. An efficient documentation service is a prerequisite for a broadly capable research system. The IARCs are content to dispatch their information and research findings without worrying about the real conditions under which it is exploited.

The ILCA microfiches are distributed in Burkina Faso but here again the documentation centers are not equipped to exploit them, so that the researchers at stations in the country's interior do not have the opportunity to use these microfiches.

3.4.2 Training

Seminars, short training courses and academic training courses all contribute to improving national capacities. In these areas, the IARCs make a considerable contribution which, however, must be put into perspective with respect to the growing need to train national staff in this period of setting up the structure of the NARS.

Those institutes present in Burkina Faso (ICRISAT, IITA, WARDA) organize seminars and working parties on a regular basis in the various areas of current work. These seminars provide the opportunity for fruitful exchanges between the researchers of Burkina and those of the invited countries. These institutes also promote study trips by national technicians and researchers in the IARCs, particularly to India, Nigeria, Sierra Leone and the Philippines.

The researchers of these institutes are also responsible for the training of their fellow national technicians and researchers who are sometimes assigned to the SAFGRAD research programs.

National researchers have also benefitted from grants for academic training courses in preparation for MS and PhD qualifications.

It must therefore be emphasized that the contribution of the IARCs in the domain of training national technicians and researchers is positive. The encounters facilitate on the one hand the sustenance and even improvement of the standard of

knowledge and, on the other hand, the creation of informal or formal networks for regional researchers to exchange experiences.

However, it must be noted that the seminars encourage participation from researchers from the same scientific circles. A sort of repetition can be increasingly observed. Participation at the seminars is less aware and prevents the fundamental problems of transitional agriculture from being discussed.

In the field of production system research programs, the emerging lines of thought had given rise to anticipation of an answer to these questions. The choice of concepts which implicitly support certain development strategies without allowing any tentative overtures or alternatives, stifles the debate with the researchers who do not share this option.

It appears that a clarifying debate is urgently needed in this area, which to a large extent sets the conditions for the elaboration of appropriate technologies.

3.5 Relations between the IARCs and the NARS

The analysis of the management of agricultural research activities in Burkina Faso has shown that: the recently created NARS is in the process of restructuring and elaborating the programs with priority; national research activities were managed by the structures of bilateral scientific cooperation; and the research activities of the IARCs are carried out in Burkina Faso in the framework of the multilateral cooperation agreements.

The relations between the IARCs and the NARS necessarily take into account the relations of bilateral cooperation. These relations can be analyzed via the communication networks which have been established with respect to the management of research activities and the application of resources, especially human resources.

3.5.1 Management of research activities

In the countries of the underdeveloped region, the prior aims in terms of research activities are closely linked to achieving food self-sufficiency. Priority is therefore necessarily given to those programs capable of identifying and characterizing the constraints on increasing food production, with a view to proposing solutions.

There is therefore agreement between the IARCs and the NARS on the level of the prior aims for the research programs, and the major axes of research activities take the form of improving production conditions for sorghum, millet, maize, cowpea and rice.

But at the level of the NARS, the aims and strategies of elaborating, implementing and evaluating the activities had not been formulated with precision in order to propose a coherent framework of management for national research activities. On the other hand, at the level of the IARCs, the programs are defined, elaborated, implemented and evaluated by organisms which create a coherent framework for research activities.

The commitment of the management of national research activities to bilateral cooperation is also the element which enables agricultural research in Burkina Faso to be portrayed as a cauldron of conflicting situations. There can therefore be no objective integration, but superimposition of various interests, aims and strategies. The current programming at IBRAZ is intended to clarify this highly confused situation, so that national research can acquire the means to implement a national program oriented with priority to solving the constraints of development in the rural milieu.

In the domain of relations between the IARCs and the NARS, the opinion of the people interviewed were unanimous: research management could no longer be conducted in this way. The

impression which emerged was one of a sort of pact formed between bilateral and multilateral cooperation, sharing together the fields of influence to the detriment of the NARS.

On the whole, the integration and complementarity of programs, with a view to taking into account the complexity of constraints in the rural milieu, has made way for a tendency to substitute the functions and activities of the NARS.

3.5.2 Exploitation of resources

As far as the exploitation of human resources is concerned, there is no competition, as the employment market is saturated at present.

The NARS is not in a position to offer employment to the technicians and researchers graduating from the various training centers in the country and from abroad. In this respect, the IARCs offer an unexpected outlet for candidates seeking their first employment.

However, the contracts are of limited duration so that the NARS often finds itself called upon to ensure permanent employment for the researchers and technicians hired and dismissed by the IARCs. This is often a source of conflict, in spite of the existence of laws governing employment. On the other hand, a trend to competition emerges in the domain of mobilizing financial resources from abroad to reinforce the management capacity for research activities of the NARS.

The IARCs and the bilateral cooperation institutes appear to be more efficient than the NARS in planning and implementing research programs for the rural populations of the country and region. The instances of bilateral and multilateral financial cooperation tend on the one hand to reinforce this conception, and on the other hand, to insist in reinforcing the IARCs and the bilateral cooperation institutes.

If this approach is continued (as in certain other Third World countries), one will witness a Balkanization of the "national program" between various international and bilateral programs of scientific and financial cooperation. Flag and banner politics will thus become a reality, once more delaying the emergence and reinforcement of the NARS.

4 Impact of Research on Production

The examination of the efficiency and constraints on agricultural research has enabled us to take up certain aspects of the problems of transferring innovations to the rural milieu. In interviews, those responsible for agricultural policy evaluated the contribution of agricultural research in improving production. However, a quantitative evaluation of this contribution is a problem, in particular with respect to food and animal production.

The mechanisms of innovation transfer will be dealt with to analyze the final destination, as the rural milieu does not present a homogeneous mass when approaching the productive forces. It is difficult to measure the changes induced by innovations in terms of increased yield, production, monetary income, etc., in the absence of reliable data.

4.1 The main innovations

During the last 20 years, innovations have been adopted by producers. To facilitate this analysis, we consider first plant production, then animal production. The people interviewed mainly discussed plant production, estimating that the field of livestock farming is still at the stage of natural exploitation of animal resources.

4.1.1 Plant production

As far as improving the conditions of plant production is concerned, the following innovations have been adopted with an impact ranging from major to slight: animal-harnessed cultivation (ploughing, weeding, earthing up); mineral fertilization; organic fertilization; improved seeds; and phytosanitary products (for treating harvested crops, seeds, growing plants).

Animal powered cultivation and crop techniques

In Burkina Faso, the use of animal labor is a recent innovation which was introduced with colonization. The use of the ass, horse and ox for drawing agricultural equipment (plough, barrow) is certainly the most significant innovation in the rural milieu. In spite of the numerical increases in mechanization, the most recent studies on the transformations induced by harnessed cultivation show results which invalidate generally acknowledged ideas. The scale of transformation is marginal both regarding manpower and the agronomic and economic impact on production.

However, significant results have been achieved in the zones of high agricultural potential, with easy access to land, with vertically integrated production of cotton. These are also the specific conditions of production of a few USEBs which illustrate the success of mechanization.

In the research station, mechanization studies easily show the advantages of this innovation. The basic constraints must therefore be sought at the level of the mechanisms for transferring the innovations and at the level of defining agricultural policy in Burkina Faso.

In a recent study on the mechanization of the countries of the CILSS, the situation in Burkina Faso is classified as under-equipped agriculture. In fact in 1981, only 40,020 USEBs equipped for harnessed cultivation (15,470 ass-drawn, 14,500 ox-drawn) were counted, which is 9 percent of all the USEBs in the country.

In view of the fact that the agricultural advisory services have mobilized the majority of its resources for this theme, an examination of the studies on agricultural policy is indispensable. In the new orientation of agricultural policy, emphasis is put on agrarian reform, democratization of agri-

cultural credit, price fixing for profitable agricultural products and, above all, the organization of the rural milieu so that it can become a promoter of its own development.

Mineral fertilization

This is also a technical innovation which was introduced with colonization by the French bias of agricultural research, initially for revenue crops (cotton, groundnut), and more recently for food crops.

The most widely used fertilizer at present is cotton fertilizer. It is used both for cotton and for cereal crops. The spectacular progression in the consumption of fertilizer recorded since 1977 has decelerated in the last few years, partly as a result of unfavorable precipitation, and partly as a result of price increases (40 F/kg in 1980, 62 F/kg in 1982 and 78 F/kg in 1983).

In 1983, fertilizer imports amounted to 25,000 tons, but when referred to the cultivated surface of the country, this quantity indicates the limited use of fertilizer (13 kg/ha). As for harnessed cultivation, fertilizers are used most in the cotton zone, for the same reasons.

Organic fertilization

Organic fertilization is traditionally used in the rural milieu. However, the increasing deterioration of the cultivated soils has made it necessary to formalize research work in this area. The institutes of the International Cooperation Center for Agricultural Development Research (CIRAD) are the pioneers in making rational proposals for the fabrication and application of organic fertilization in the rural milieu.

A corollary can be drawn between the mobilization of resources for the application of organic fertilizers and the level of deterioration of the fertility of the soil. In the

zones of high agricultural potential, where natural fallowing is possible, organic fertilization poses no acute problems.

In the Mossi plateau zones with high demographic density, where the organic contributions are indispensable, current technical methods only allow a minimum spread of some 200 kg/ha instead of the recommended dose of 5 t/ha.

Research work in this area is currently being reinforced to find more adequate, global solutions for the management of the agrarian systems. IITA and ICRISAT are participating in this new generation of programs (water, soil, fertilization, irrigation, agricultural machinery).

Improved seeds

As has already been indicated, improved seeds are often the first innovation to be advanced when discussing the contribution of research to the increase in production. To improve understanding of this problem, the situation of dualism introduced by the "development strategies" prompted from abroad must be taken into consideration.

Improved seeds for the revenue crops -- cotton, groundnut and, to a lesser extent, sesame - have been adopted in the rural milieu in the zones where these productions are particularly well structured. The spectacular success in the progression of cotton production is often quoted, due to a great extent to the introduction of the Allen varieties by the BJA.

In the area of food crops, agricultural research has performed more or less significant work depending on the period concerned, in three channels: improvement of the local populations; introduction of varieties; and composition of relevant characteristics from the first two instances. In this

way, numerous varieties have been tested in research stations and in the rural areas.

In the end, few of the improved varieties have been adopted in a significant manner by producers. But in the case of the rice crops in the low-lying areas and cultivated plains, the high-performing varieties have been adopted by a significant number of farmers.

Improved varieties and other innovations are also adopted in the case of rice crops with partial or total water control and those with partially commercialized farms.

Finally, significant improvements of the system of production, and of the social, economic and political environment of the production process, induce a marked tendency to adopt innovations, including improved varieties. However, these observations do not reflect the reproduction tendencies of those USEBs which practice these systems of production.

The CIRAD institutes are the pioneers in this field in Burkina Faso. More recently WARDA, followed by ICRISAT and IITA, also participates in implementing new programs in the food area.

Phytosanitary products

The fight against insects and diseases is an important aspect in the improvement of production conditions. Interventions affect harvested crops, growing plants and seeds. As far as food crops are concerned, the treatment of seeds and harvested crops is an innovation adopted by producers following an important agricultural advisory campaign during the 1970s. The constraints are the level of supplies and the recommended doses, in view of the price increase of the distributed products.

Treatment of growing plants with phytosanitary products is used mainly in the case of cotton crops, and has become a major

factor in good production. Production follow-up specifically emphasizes supplies, observing the doses and periods of treatment.

4.1.2 Animal production

Up until now, there has been no noticeable progress in livestock farming, apart from certain animal health aspects (vaccination). Research has been carried out almost exclusively by regional and international organizations (IEMVT; ORSTOM, CERCI, CIRAD, GTZ).

The national units, in particular the livestock departments, have made efforts to initiate research on trypanosomiasis, animal selection, restoring pasture land and others, but all these efforts have not been started because of a lack of human and material resources.

However, the concentration of the population in the urban centers, and the creation of a market, thanks to regularly paid wages from industry and the state, have generated a type of peri-urban livestock farming (poultry, rabbits, pasturing of cattle and small ruminants), using technical innovations in feeding, sanitary cover, improvement of infrastructure and herd management. This adoption of innovation is marginal compared to the total animal production. The one innovation with a significant impact on the livestock sector is the fairly regular vaccination of cattle herds.

4.2 Mechanisms for the transfer of innovations

In July 1984, an interministerial commission authorized to evaluate past and current advisory service programs in Burkina Faso was created following a recommendation of the January 1984 workshop. This commission consisted of the following partners: Ministry for Rural Development (SNVA, AVV, ORD, FDR); Ministry for Higher Education (IBRAZ); Ministry for Social Affairs

(department for women's participation in development); Ministry for the Environment (forestry, fishing and fish breeding department); Ministry for National Education (National Institute for Functional Adult Literacy); Ministry of Information (rural radio); Ministry for Health (department of health education); and Ministry of Planning (planning department).

The commission established a fairly exhaustive diagnosis of the agricultural advisory services, and formulated its recommendations. The analysis of the mechanisms for transferring innovations in the rural milieu is borrowed from this report.

4.2.1 History of advisory services in Burkina Faso

It is only possible to increase plant and animal production when a certain number of factors are used conjointly by the farmers: agricultural equipment, high yield crops which are resistant to drought, phytosanitary products, animal care, and by land usage aiming to conserve and restore exploited soils -- anti-erosive sites, cultivation of low-lying ground, and reforestation.

Since the 1950s, the agricultural world in Burkina Faso has been the melting pot for several internationally organized structures (CER, SATEC, BDPA, IRHO, IRAT, CRDI, CFDT), and for national structures for more than a decade (ORD, AVV, UP, DAC). Using different methods (demonstration fields, accessible follow-up, literacy campaigns, community development), these structures have attempted to extend the themes available to the farmers.

Despite huge resources available especially to the above mentioned international organizations, it must be said that their interventions only affected small sections of the village community, which were created artificially for "the needs of the cause": mutualist farms, 1956-61; and cooperatives, pilot farms and state soil zones, 1962-68. During this period, the agricultural advisory services have centered their attention

mainly on the following themes: animal-harness cultivation (use of ass- and ox-drawn equipment); use of inputs (fertilizer, pesticides, disinfection of seeds, varieties) for the cash crops of groundnut and cotton; and cultivation of low-lying land.

The extension of these subjects by the staff from foreign institutions has encountered a certain number of problems resulting from: lack of receptiveness among farmers; lack of executive staff; lack of understanding of the subjects; lack of follow-up; and a total lack of structure.

However, certain innovations such as row seeding, seed treatment, and varieties of rice, groundnut and cotton, are now well known by a number of farmers.

It was not until the ORD was created in 1966 that a large mass of the farming population, gathered throughout the village communities, could be reached. As a result of joint intervention of the executing organizations ORD, SATEC, ADC, BDPA and CFDT, a better approach to extension was found, and many farmers were introduced to the above innovations.

The village groupings were only created after 1975, after the departure of the SATEC, the BDPA and the organizations recognized by the ORD. The village groupings are the privileged dialogue partners of the ORD, AVV, UP, DAC and other organizations, for all field work. The "Training and Visit" (T and V) extension system implemented in the ORD in the upper basins, Bougouriba and North Volta, has been tested in certain other ORDs. Although this system does not encounter too many difficulties in being implemented in the ORD in the West, it could suffer from a lack of financial means in the other ORDs. Notwithstanding the efforts made by the development organizations in agricultural advice and extension services, the acknowledged lack of personnel and follow-up are the most significant constraints.

4.2.2 Methods adopted

The extension methods are also diversified: T and V in the Upper Basins, North Volta, Bougouriba and part of the Yatenga and the Center-West; mass extension by the intermediary of those responsible for the village groupings in Center-East; and group extension on demonstration parcels in the Sahel, East. In certain ORDs (Comoe, Center-North) there is no extension system in the proper sense of the word.

The T and V system is not really integrated in the ORD structure. The section heads, and to a lesser extent the subsection heads, are not directly involved in the implementation of the system. The advisor's program of work, based on visiting three groups of farmers each day, seems poorly adapted to the rhythm of daily work of the farmers. In practice, the advisor cannot really visit more than two groups per day. The farmer groups or "follow-up units" are often formed on the fringe of the village groups (VG). Although the VG have an essentially economic purpose (buying, selling, credits, etc.) they offer an important potential for diffusing technical subjects.

The "mass" or "group" extension systems are not clearly defined, and the advisors do not have a properly structured program of work. In the Sahel, group extension is based on organized demonstrations on parcels of land cultivated by the farmers (two parcels per advisor). There are two constraints to this system: (1) it is difficult to get all the producers to meet out in the countryside, and as a result it is also difficult to plan individual follow-up subsequent to these demonstration days; and (2) the advisors have to take charge of matters relating to credit for equipment.

The mass extension model in the Center-East exists only in the principle of the diffusion of technical subjects by the intermediary of the village groups; the structure and follow-up responsibility for these groups is not defined.

4.2.3 Constraints and difficulties

Outside of the main cotton growing regions, the ORDs' advisory and extension services have not in general achieved noticeable results. The main problems and constraints facing the advisory and extension services include substantive, organizational and administrative ones.

There is an almost total lack of basic structure and training in the advisory service. There is an absence of "messages" to be extended to the farmers, even when appropriate technologies exist, perhaps because of the lack of formal liaison with the research institutes -- the only contacts are on a personal level.

The organization of ORD activities lacks a well-defined program of work for the advisors and system of coordinating and controlling their work. There is inadequate definition of the role of head of section in the advisory and extension program, and poor coordination between the section heads and the heads of the various departments.

The advisors are hindered by a number of tasks alien to their main function (collection of credit, supply of fertilizers and other inputs and gathering statistics). There is a lack of financial flexibility at the ORD level, resulting in delays and uncertainties in the payment of salaries and lack of funds to cover traveling expenses. This demoralizes the advisors and limits their activities. The problem is further aggravated by the conditions of employment not being the same for permanent and contract staff and for ORD staff benefiting from exterior financing. The absence of administrative structures to unify the various advisory and extension departments is also a problem. The various sections of the ORD are not linked to a central organization in the administrative and technical plan. Each section has its own principles and its own methods of agricultural extension. There is rapid changeover of staff in

certain ORDs, the absence of a good follow-up and evaluation system, and lack of qualified staff at the level of head of department and head of section.

4.2.4 Synthesis of the results of the study

The new conception of development in Burkina Faso has set itself two aims: first and foremost, research should be oriented towards satisfying the fundamental needs of the rural communities (food, water, health, education); second, the country's own energies and resources should be exploited first, especially on the initiative of the organized masses within the ORDs.

It is therefore necessary for this framework to be taken into account in the strategies proposed for the agricultural advisory and extension services. But the agricultural extension services in Burkina Faso have evolved into a compartmentalized system. The farmers and rural communities are faced with technical governmental and non-governmental institutions whose intervention strategies are neither coordinated nor planned. Agriculture, livestock, waterways, forests, health and education agencies conduct activities that are not coordinated. For example agriculture carries out programs of animal-harness cultivation, agricultural credit, rural youth, plant protection, experimentation, agricultural extension and others.

However, at certain times, the compartmentalized system which characterizes advisory services in Burkina Faso, takes on unified or hybrid forms, but the activities are rarely coordinated. When it takes this form, the compartmentalized agricultural advisory service acts by substitution. Thus the T and V extension system has an essentially compartmentalized structure, and if there is any unification, this then leads to substitution by specialized competences. Where there is proof of efficiency, this results from the fact that a limited number of producers in the rural community are privileged by the system's

approach to a crop or activity and the privileged producers are the innovator farmers.

Production by sector necessarily tends to create an optimum environment for increasing target production, particularly in controlling the production-distribution process. The adequacy of this system, with the strategies of grassroot development, with its own self-centered dynamic, is a major question which ought to be the subject of research work.

4.3 Effects of innovations on production

The effects of the innovations on production are known with precision at the level of the research stations. In the rural areas, follow-up and evaluation of the transfer of innovation is fragmentary and irregular in the absence of a coherent structure of the agricultural extension services. In numerous cases, it is the researchers who conduct studies on the impact of technical innovations. This tendency has appeared fairly recently in the framework of the programs for research into the production systems.

However, the oldest experience in this field dates back to 1968 with "the model farm" of the Saria research station (1968 to 1978), conducted by IRAT. At the stage of tests in the farming areas, it is possible to isolate (for evaluation purposes) the action of one or two factors on yields.

On the other hand, with the adoption of innovations under real conditions, it is the farmers yield which is the relevant indicator of the evaluation by the farmer.

Therefore, no reference will be made to the numerous farmers' field tests carried out by agricultural researchers, the results of which are published in the annual reports. Instead, attention will be given to the results of the micro-economic

studies carried out with the farmers (to determine the transformations caused by the innovations), and to the contributions of the people interviewed.

The analysis is not exhaustive; three zones will be considered: the north (ORD Yatenga); the center (ORD Koudougou); and southwest (ORD of the Upper Basin). This will make it possible to consider the effects of the innovations with respect to income, wellbeing, nutrition, structural changes, and social relationships between the sexes.

4.3.1 The northern zone

The northern zone has benefited from numerous pieces of research work from ORSTOM and other research, education and development institutions that are participating in the ORD Yatenga.

In the prevailing conditions of this zone, a considerable degree of deterioration of the soils has led to a reduction in soil fertility but the adoption of technical innovations has tripled the yields of sorghum and doubled those of millet, the principal crops of the zone.

However, in view of the present scale on which animal-harness cultivation is being adopted at the ORD level (300 pieces of equipment per year), in proportion to actual needs (60,000 USEBs), the question arises as to the impact of the innovations on overall production.

The level of acceptance of other technical innovations is quite low relative to estimated needs: erosion control of 300 ha/year compared to needs of 10,000 ha; reforestation of 70 ha/year compared to needs of 720,000 ha; and cultivation of low-lying ground for rice and market gardening products of 70 ha/year compared to needs of 12,000 ha. These low levels of

implementation lead one to question the transformation of development through projects prompted from abroad.

However, the USEBs in this zone are adopting the technical innovations with more or less significant results and the effects are appearing at the level of crops and livestock production systems.

Effects on yield

The average yield with improved cultivation methods on sorghum are 546 kg/ha compared to 300 with traditional methods while millet is 415 kg/ha compared to 200. But the notion of an average yield has little relevance, as it covers a range (sorghum 990-280 kg/ha; millet 870-130 kg/ha) in the USEBs which have adopted the innovations.

The families often own plots of land situation in several different sites corresponding to different types of soils, and pursue a no-risk strategy. All the plots have been cultivated for at least 10 years, and often 20 to 30 years without lying fallow. The yield is therefore variable and it is rare for a yield in excess of 500 kg to be observed for the larger plots (1 ha and more).

Effect on the diversification of crops

In this area, 80 to 90 percent of the cultivated land is occupied by two cereals: millet and sorghum, pure or mixed (mixed for 60 percent of the land). Pulse crops (groundnut, cowpea, earth pea), maize and cotton are found on a much smaller scale. There has therefore been little influence on the diversification of crops.

Effect on intensifying the cultivation system

The farmers are well acquainted with the benefits of using organic and mineral fertilizers, but the application levels are

low because farmers have neither the technical mastery for their use nor the funds with which to purchase them.

As far as the application of animal-harness cultivation is concerned, the work is slow (the undernourished animals tire rapidly), the plots are rarely ploughed completely (real working time available as a function of the agricultural year), and the quality of work is mediocre (shallow, little ploughing under of fertilizers, little husbandry). And animal-harness cultivation is used on a modest proportion of land.

Innovations (animal-harness cultivation, organic and mineral fertilization, improved seed) are seldom concentrated on one and the same plot. Instead, the innovations are spread over the plots of the USEB, always on the basis of a no-risk strategy.

Effect on the transformation of the livestock system

Cattle rearing is the occupation of the Peulh population, present particularly in the northern zone, spread out in camps distinctly separated from the Mossi villages. The cattle are owned partly by the Peulh, partly by the Mossi, but managed by the Peulh. Small ruminants (sheep and goats) and poultry are raised by both communities.

The introduction of animal-harness cultivation has introduced the management of cattle rearing to the Mossi community. The livestock system presents a complex picture, and there has been little detailed study in this field, in spite of the introduction of animal cultivation at ORD Yatenga.

Effect on food supplies

On the basis of the average annual yield of 400 kg/ha, a cultivated area per active resident of 0.5 ha and a ratio of active/inactive residents of 1/1, the production per resident (active and inactive) amounts to 100 kg. This is half the yearly needs per person. There is therefore a chronic food supply

deficit which, depending on the year, can be reduced to zero if the yield approaches 500 kg/ha and on the other hand may be very high if for example the yield drops to 200 kg/ha.

This fluctuation indicates the extent to which the technical innovations are mastered by the USEB. A transformation of the agricultural production system is essential in order to locate the constraints, and to initiate a process which will enable an overall improvement in the production systems of the USEBs.

Effect on incomes and general well-being

Agricultural production serves essentially to ensure part of the food supply requirements. Agricultural production, in particular market gardening and seasonal crops, also provide part of the monetary income. The system of rearing livestock, in particular small ruminants, makes a considerable contribution (35 to 40 percent) to the overall income of the USEBs.

In the end it is the non-agricultural incomes (commerce, manual trades, migratory incomes) which play a decisive role at the various levels of production.

The impact of newly adopted technical innovations on the income and general well-being of the USEBs is generally marginal, but in a limited number of USEBs the contribution to a balanced food supply and to satisfying other needs is considerable.

Effects on the functioning of USEBs

In the northern zone, the overall results of innovations are mediocre, partly because of the inability to master the technical methods, but above all because of the major constraints of the ecosystem, which cannot be overcome at the level of the USEB.

Apart from a few USEBs with a considerable level of capital, where the adoption of innovations influences the functioning of the USEBs, there is an overall process which accentuates the

situation of underdevelopment, and amplifies the contradictions within the USEBs. The migration of the population in this area is one of the highest in the country (15 percent of the active population). A relation exists between this migratory phenomenon and the diminution, even elimination of the collectively farmed fields; production therefore has an individual tendency.

4.3.2 The central zone

The effects of technical innovations adopted by the farmers of the country's central zone were obtained from a study which was carried out between 1978 and 1984, in 76 USEBs in five villages within the ORD at Koudougou. All these USEBs have adopted animal-harness cultivation and other innovations (cultivation techniques, organic and mineral fertilization, improved seeds, phytosanitary products). The qualitative assertions and appraisals emerging from the interviews are further quantified using data gathered during this study, as shown in Table 4.1.

Table 4.1 Effect of the Innovations on Yield, Central Zone

Crop	Average Yield of the USEBs	Yield for Saria Station	Yield as per Traditional Agriculture
Sorghum	1,000	2,034	650
Millet	749	1,145	450
Maize	1,893	2,300	750
Rice	738	1,555	750
Cowpea	225	1,500	300
Cotton	1,022	1,283	650
Groundnut	595	1,356	450

There is no spectacular effect on the yields. The average lies between traditional agriculture and the results obtained in the stations. The analysis of the real application of mechanization reveals an under usage of the equipment with an average of 40 days of tractor power per crop year with 80 percent of these traction-power days devoted to preparing the soil. Husbandry work, which is important for increasing yield, is carried out by hand. Other innovations are used, but rarely at the level required, in particular fertilization and phytosanitary treatment. The potential offered by the adoption of innovations, which has involved the mobilization of considerable monetary resources, is markedly under used.

Effect on the diversification of crops

The area is divided with 87 percent in cereal crops, and 13 percent in revenue crops. Animal-harness cultivation and the adoption of other innovations has not introduced a diversification of crops. In this territory, where there is maximum occupation of agrarian land, the dominant aim is to satisfy food needs.

Effect on the intensification of the cultivation system

An analysis of the data indicates that the cultivation system is heterogeneous in terms of cultivated/active surface area. But those USEBs which have adopted animal powered cultivation have a more extensive cultivation system, which could result from the easier conditions created by the use of equipment (soil preparation). But the saturation of the agrarian land available prevents any further increase of the cultivated surface area by land clearing.

This extensive tendency of the cultivation system appears to contradict the adoption of animal-harness cultivation, the other innovations, and the scarcity of land. Future developments will therefore probably see an intensification of the cultivation and production system.

Mechanization and transformation of the livestock system

An improvement in the livestock rearing systems can be ascertained, in particular for cattle, but the extent of investments is still limited in relation to the capital represented by these animals. There are no noticeable transformations in the rearing of small animals (sheep, goats and pigs) apart from poultry where vaccination and improvement of feed and the races (crossing local and European races) are observed.

The improvement in the flow of money between the cultivation and livestock systems should be emphasized even more than the technical transformations. There is reciprocal transfer of money between these two systems. The livestock system brings a considerable income which is used to purchase equipment. The income from plant production (market gardening) is invested in the purchase of small ruminants and in improving livestock conditions.

Effect on food supply

The consumption levels of the workforce have been examined on the basis of raw products (cereals, pulses) and on the basis of calories. Eighty percent of the USEBs studied showed a food deficit from one crop year to the next over three successive crop years. All the USEBs which had adopted animal-harness cultivation showed a deficit. Although attempts could be made to put this result into perspective, it depicts a tendency observed in our studies in this area since 1978.

In the face of this general food supply deficit, needs are satisfied by purchasing cereals. There is therefore a different situation among the USEBs regarding the availability of money. The contribution of non-agricultural activities (commerce, manual trades, product processing, wage earning) is of major importance.

Effect on income and general well-being

Half the USEBs without any mechanization are characterized by falling economic viability in which incomes do not cover fundamental needs. In the expanding USEBs, non-agricultural incomes are significant. On average the mechanized USEBs are expanding with resources covering needs. However, this overall result conceals the differences among them. Three groups can be differentiated: the first group without salaried income (the work force is mainly agricultural workers) appears to be representative of most of the USEBs in the Central zone; the second intermediary group, where salaried incomes play a major role; and the third group, where salaried incomes and non-agricultural activities play a significant role in covering the needs.

The two latter groups have reached a stage of expansion in which accumulation is greater than depreciation. Even certain aspects of social consumption which are in principle ostentatious expenditures, provide a monetary contribution.

Access to mechanization and innovations has been particularly selective. The USEBs with a primitive accumulation adopt the innovations more easily. The present situation thus represents the cumulative effect of the contributions resulting from the adoption of the innovations.

Effect on the functioning of the USEBs

In the USEBs where mechanization has been adopted for over 20 years, and in those which have adopted it recently, other inputs and innovations are rarely used. There is therefore a technical and economic barrier to rational application of these innovations which prevent them from having a greater impact on the crop and livestock production systems. This technical-economic barrier may remain, in particular in those USEBs with considerable monetary income and in which crop and animal production has become a part-time activity.

The system is not optimized in terms of productivity of work, but seeks the production requiring minimum labor and expense. The food production thus obtained is complemented by purchases made possible by non-agricultural incomes.

Technical innovations are used to a fairly limited extent and have not introduced any great transformations in the functional relations of the USEBs. However, some changes have emerged, in particular in the relations between the older and younger generations with regard to the control of productive resources and increases in the work imposed on women and children in livestock rearing and management and in carrying out mechanized work.

Women and children form the most dynamic group involved in animal-harness cultivation, from breaking the animals to performing the various cultivation tasks. The same observation has been made in Senegal, where the introduction of mechanization is older and more widespread. The improvement of herd management (feeding and tending the animals), is a daily activity of the women and children. This is a significant transformation in the particular case of cattle, as the Mossi are not traditionally a cattle-rearing people.

The adoption of mechanization introduces an exacerbating element into the conflicting situations within the USEB, with consequences which can go as far as disrupting the cohesion of the group.

4.3.3 The southwest zone

The southwest zone has high agricultural potential. It has been the subject of numerous studies each of which have been focused on one agricultural product. We have tried to keep to a general study, but the data have been obtained from various sources.

Effect on yield

Average yields are not an indication of the agricultural potential in the southwest. The natural fertility of the soils, and the possibility of periodic fallow make yields superior to those of the north and center possible (Table 4.2).

Table 4.2 Effect of the Innovations on Yield, Southwest Zone

Crops	Average Yield of USEBs Having Adopted Innovations	Yields for Farako-Ba Station	Yields from Traditional Agriculture
Sorghum	945	1,670	600
Millet	770		550
Maize	860	2,100	800
Rice		1,200	800
Groundnut	800	1,740	650
Cotton	1,020	1,380	800

A fairly differentiated situation is apparent with regard to the USEBs which have adopted animal-harness cultivation and 30 hp tractor. Yields of 2,000 kg/ha for sorghum, 3,500 kg/ha for maize and 2,500 kg/ha for cotton are often achieved.

Effect on the diversification of crops

The adoption of technical innovations has not fundamentally changed the traditional cultivation system. The introduction of cotton dates back to the colonial period. The dynamic element is the changing proportion in various crops. The area of cotton and maize each approach 30 percent in some USEBs. In the southwest zone, cereals take up more than half of the area, and cotton a quarter (in the cotton growing zones). Pulse areas (groundnuts, cowpea, soya bean) range from small to considerable.

Soya bean cultivation is a possibility which is still inhibited by a lack of marketing and processing.

Effect on intensifying the cultivation system

At the level of the cultivation system there are three intensification situations: cotton and to a certain extent maize which are the focus of efforts at innovation; the other cereal crops, in particular sorghum and millet, which benefit from the results of the intensification of cotton and maize, as well as receiving some of the inputs intended for these crops; and those crops which take up a low proportion of the cultivated area and which have had little innovation attention.

The studies have observed a relationship between cultivated area per agricultural worker and method of cultivation with manual cultivation at 1.45 ha, animal-harness cultivation at 2.08 ha and motorized cultivation of 2.96 ha. This compares to the data for the northern and central zones of 0.40 to 0.80 ha. This relationship is particularly noticeable for cotton and maize, which is also accompanied by an increase in productive inputs (mineral fertilizer, phytosanitary products).

Mechanization and transformation of the livestock system

Livestock farming is important in the southwest zone, using local breeds resistant to the tsetse fly, and increasingly with crossbred bulls and zebu cattle. These zebu cattle came from the north during the drought period of the 1970s. Small ruminants, pigs and poultry also constitute an appreciable stock in the economy of the USEBs.

The contribution of livestock farming, although an important factor in the production systems of the USEBs, is not as dominant as in the north and center of the country. It is better integrated, taking into account the relative abundance of productive forces. However, it appears necessary for the productivity of current systems to be safeguarded.

Cattle rearing, which was traditionally left to the Peulh herdsmen, is becoming integrated in the USEBs as a result of the expansion of animal-harness cultivation adopted in this zone. This results in innovations associated with less limited food and regular tending of the animals. However, the rest of the livestock have not benefited from the same attention.

Effect on food supplies

The southwest zone appears to be self-sufficient in food, but the mechanized USEBs do not play a major role. The diversity in the crop production (cereals, tubers, fruit and vegetables) and livestock farming ensure a relatively abundant food supply for the zone.

The balance between resources and needs must, however, be subjected to rational management because the population migration from the north and center may lead to an over-exploitation of the zone's potential.

The new development perspective will try to achieve an optimum use of resources within a national framework for satisfying needs. In particular the cotton crops must be better integrated in the cultivation and production systems of the USEBs.

Effect on income and general well-being

The situations analyzed above contribute to the income and well-being of the USEBs and the zone, but budget management must become an important element in the USEBs.

There is no correlation between the higher production by the zone and the general well-being here compared to the northern and central zones. It seems that other ways of using the resources would have a greater impact on the productivity of the zone and of the rest of the country.

The relative abundance of productive resources also does not eliminate the discrimination in access to these resources, or the conflicting situations which characterize the individuals and social groups within one and the same community.

4.4 Innovations with a potential impact

In the discussion about potential innovations, few suggestions were made by those interviewed about how to increase the contribution of such innovations to transforming production conditions, increasing production, or improving the living conditions of the population, in particular the rural population.

Emphasis was given above all to the need to transform the social, economic and political environment of the USEBs, in particular the need for a better agricultural policy for promoting the adoption of new technologies.

In certain domains, it could be said that agricultural research has at its disposal, innovations which are capable of fundamentally changing the present situation of agriculture. But these potential innovations can only be adopted if accompanied by appropriate changes in the country's agricultural policy.

This analysis has not evaded the new political leadership of Burkina Faso. Certain arrangements have been made to increase the role of agriculture in the economic and social development of the country, and these are being implemented in a new context in which the rural population is participating as an actor and beneficiary of its own development. Agrarian reform and production intensification strategies are presently being planned and executed.

Agrarian reform is being designed with the aim of increasing the productivity of work, improving the organization of the rural areas, introducing modern agricultural techniques and developing

a diversified agriculture. The traditional socioeconomic structures which oppress the farming population are being abolished, with the aim of making agriculture the main support of the country's industrial development.

An intensification of agricultural production is being undertaken with an emphasis on purchase of local factors of production whenever possible, increased marketing of agricultural products, organization of the production of local products, installation of capacity structures for the agroindustrial transformation, and the liberation of the agricultural regions from their isolation to facilitate the distribution of inputs and the collection of raw materials.

These innovations are the products of research programs initiated in the 1980s which will be coordinated and implemented by IBRAZ in the framework of the national agricultural and zoo-technical research program adopted in 1985.

Research is no longer a collection of commodity operations and activities. By adopting a global approach to the constraints hindering the improvement of agricultural production and in association with agricultural policy changes and farming organizations, research organizations have proposed a coherent group of technical innovations which will be tested in the rural areas. The preconditions for the adoption of these innovations are analyzed at the same time, in order to make relevant decisions.

4.5 The impact of the IARCs

The interventions of and collaboration with the IARCs, in particular the CGIAR, are recent: 1973 for WARDA, and 1978 for ICRISAT and IITA. The IARCs therefore had no impact on earlier research in Burkina Faso, which was done along lines which must be reorganized in the new context discussed above. On the other

hand, as far as the operations and programs of the new generation of research are concerned, the IARCs are a vital component in the thinking processes and in the actions to be taken.

In this chapter we analyze the contribution and the collaboration between the IARCs and the NARS. We also give details of the conditions and prerequisites which will enable the IARCs to make a more active contribution to the planning, execution and evaluation of the national program of agricultural research.

As Burkina Faso has a national research program, collaboration and participation must take place within the context of this program, which is consistent with the mandate of the IARCs. Any substitution of the functions and activities of the NARS contradicts the mandate of the IARCs.

The practical modalities of the contribution of the IARCs must objectively aim at its own eventual withdrawal (aid must help to manage without aid). Of course, the contribution of the IARCs belongs to a regional framework which extends beyond the specific situation in Burkina Faso. Conditions must therefore be created which favor more concerted action of the different countries, a common will to direct the contribution of the IARCs within the mandate to reinforce the NARS, and a more active and critical participation of the political authorities in the countries who in the end solicited this aid and must assume full responsibility for it. In fact, scientific cooperation is not only a technical matter; it also has an objective political aspect which must be assumed even if this leads to the hypothesis of the dissociation of political and technical powers.

5 Conclusions

Agriculture in Burkina Faso has not been adequately characterized by previous and current studies or by "development projects" sponsored from abroad. Few recognize that the country is experiencing a transitional form of agriculture, which has borrowed certain apparently contradictory features from several different systems. Agriculture is working for home consumption as well as for the market. It retains its traditional elements without rejecting all innovations and as a result forms a complex system compared to all the common terms of reference of rural economists.

It is rarely admitted that agriculture cannot be isolated from its political context and from the economic and social structures. In Burkina Faso today, agriculture functions according to the dominant capitalist mode of production, while remnants of the pre-capitalist mode still remain. For some people, this issue does not exist. For others, the situation is evident but they do not learn its lessons in terms of the logical approach and analysis.

In this sense, agricultural research is an element of the country's agricultural policy. It is this agricultural policy which determines the role, function and activities of agricultural research and which will direct it towards concrete development aims. On this basis, it must be possible, on the one hand, to observe, analyze and understand the various development situations and their agricultural constraints and on the other to present to the policymakers proposals for agricultural policy which lead to decisions to overcome the constraints.

Agricultural research in the past was managed by the colonial powers and, after independence, by bilateral cooperation agreements which were to the disadvantage of the newly independent country. There was no national agricultural research

program as such. Instead one might say that research activities in this domain were being pursued in the country.

Since 1983, a new situation has been created which has provoked a radical transformation of the country's politics and thus necessarily of agricultural research. The IBRAZ has been engaged in a programming process, an important stage of which has just been completed, resulting in the adoption of the national agricultural and livestock research program in February 1985.

The next main stages are execution and evaluation. However, the research which has been pursued has had certain gains which have been adopted within the framework of development projects sponsored from abroad. CIRAD has played a pioneer role in this research.

More recently, and in particular after the catastrophic drought of the 1973 period, research programs in Burkina Faso have been operating in new directions. CGIAR centers participate directly (IITA, WARDA, ICRISAT) and indirectly (IRRI, CIMMYT) in executing the research programs being carried out in Burkina Faso.

Although from a historical point of view CGIAR centers have not actively participated in the planning, execution and evaluation of research in Burkina Faso, the new conditions offered by the IBRAZ form an adequate framework for such concerted participation. The centers have proven competences in producing potential innovations which are the future of agriculture in Burkina Faso and they can assist in reinforcement of capacities for NARS research.

However, insofar as cooperation with the CGIAR centers has a regional content, the mode will have to be refined to guarantee the participation of the greatest number of regional researchers. The researchers of the NARS may no longer be the distributors of

the IST, results of research carried out in the community by the IARCs.

At the subregional level, institutions such as the WAEC and CILSS have mechanisms for communication and coordination on research and technology. This framework must be used for the implementation of projects with a regional orientation. In this way, it will be possible to place agricultural and livestock research in its social, economic and political context. The products of research must facilitate the success of projects that will help control variability in the production process (agricultural inputs, processing of products, distribution of agricultural products). The CGIAR could be a partner in this collaboration which combines bilateral and multilateral intervention.

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Appendix

People Visited

Dr. Sedogo, Director, IBRAZ, Pedologist
Dr. Bosso N'Guetta, IBRAZ, Management Technical Advisor, Maize
Selector
Dr. Isai Konate, IBRAZ Management Phytopathologist
Dr. Albert Djigma, Soya Selector
Dr. Clementine Dabire, Kamboinse Station, Cowpea Entomologist
Dr. Chantal Zoungrana, Livestock Department, Nutrition Expert
Dr. Marcel Bicaba, University Ouagadougou, Nutrition Expert
Dr. Didier Zongo, University Ouagadougou, Physiologist
Dr. Philippe Sankara, University Ouagadougou, Phytopathologist
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Places Visited

Farako-Bâ Station

Cultivated Plain of the Valley of Lou

Saria Station

Kamboinse Station

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