Le Programme nigérian de mise en valeur des terres agricoles: effets sur les revenus agricoles dans les États d'Oyo et Osun

Cette étude analyse les effets du Programme national de mise en valeur des terres agricoles sur les revenus agricoles dans les États d'Oyo et Osun, au Nigéria. Dans chaque État, 60 agriculteurs, également répartis entre le groupe participant et celui qui ne participait pas, ont été choisis de façon aléatoire. L'étude a montré que le programme réalisé dans ces deux États a atteint moins de 2 pour cent des objectifs fixés pour la mise en valeur des terres et le placement des participants au cours des sept ans qu'a duré le projet (1992-1999) et le taux de rotation des participants a été de 76 et 79 pour cent respectivement pour les États d'Oyo et Osun. De même, les revenus agricoles nets des agriculteurs (allant de 164 à 267 dollars EU) étaient nettement insuffisants pour satisfaire leurs besoins et ceux de leur famille. L'article présente certaines recommandations visant à améliorer les résultats de projets analogues pour l'avenir, qui prévoient notamment des financements adéquats, ainsi que la fourniture d'infrastructures rurales et de crédits aux participants.

El Programa nacional de fomento de tierras agrícolas de Nigeria: repercusiones en los ingresos agrícolas de los Estados de Oyo y Osun

Este estudio evalúa el impacto del Programa nacional de fomento de tierras agrícolas de Nigeria en los ingresos agrícolas de los Estados nigerianos de Oyo y Osun. En cada uno de ellos se seleccionaron al azar 60 agricultores, con una distribución equitativa entre los que participaron y no participaron en el Programa. El estudio demostró que en estos dos Estados el Programa había alcanzado menos del 2 por ciento de los objetivos establecidos por lo que respecta al fomento de tierras y asentamiento de los participantes durante los siete años de duración del proyecto (de 1992 a 1999), y mostró que la rotación de los participantes había sido del 76 por ciento en Oyo y del 79 por ciento en Osun. Al mismo tiempo, los ingresos agrícolas netos de los campesinos (que oscilaban entre 164 y 267 dólares EE.UU.) eran decididamente insuficientes para satisfacer sus necesidades y las de sus familias. El artículo contiene algunas recomendaciones para mejorar los resultados de proyectos similares en el futuro, entre ella las de proporcionar financiación adecuada así como infraestructura rural y crédito a los participantes.

The National Agricultural Land Development Programme in Nigeria: impact on farm incomes in Oyo and Osun states

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The study assesses the impact of the National Agricultural Land Development Programme on farm incomes in the Oyo and Osun states of Nigeria. In each state, 60 farmers, equally distributed between the participating and non-participating, were randomly selected. The study showed that the programme in these two states achieved less than 2 percent of the targets set for land development and placement of participants during the project life of seven years (i.e. 1992–99), and showed a participant turnover of 76 and 79 percent for Oyo and Osun states, respectively. Similarly, net farm incomes by the farmers (ranging from US$164 to US$267) were grossly inadequate to satisfy the needs of the farmers and their families. The article makes some recommendations to improve the performance of similar projects in the future. These include adequate funding, as well as the provision of rural infrastructure and credit to participants.

INTRODUCTION

The Nigerian economy is basically agricultural. The sector contributed up to 60 percent of gross national product (GNP) and employed over 70 percent of the total labour force by 1981. However, by 1998, the sector's contribution to GNP had declined to only 40 percent as a result of the increased contributions of petroleum and the neglect of agriculture. This relative decline in the importance of agriculture to the Nigerian economy is worth noting. Self-sufficiency in food production has been impaired, while the plan to create a robust and diversified export structure has not been achieved.

The last 40 years of Nigeria's existence as a sovereign nation have witnessed the introduction and implementation of a number of agricultural development programmes. The list includes Farm Settlement Schemes, Operation Feed the Nation (OFN), the Green Revolution Programme, Agricultural Development Programmes (ADP), River Basin Development Authorities (RBDAs), the School-to-Land Programme and the Land Use Act. They were all designed to bring about the development of the agriculture sector. Another in the growing list of such programmes was the National Agricultural Land Development Programme (NALDA). Established in 1991, its major objective was to utilize the nation's land and human resources optimally to raise the quality of life of rural people. This included the provision of strategic public support for agricultural land development and economically viable farmholdings to consolidate scattered, fragmented farms. The programme also aimed at the evolution of economically viable village settlements that would reap economies of scale in the provision of social services (water, health, primary schools, etc.) and agricultural technologies.

The land and the people are the strategic resources for rural development in Nigeria. If there is to be national development, therefore, policies must be operationally relevant to both the improved use of land and the energetic participation of the people. Every system of local economy of agriculture (all over the world) was at once both a

system of local organization and a system of land use. Such local systems of economy were generally based upon three general principles: (1) group control of access to opportunities to use land; (2) allocation of land-use opportunities to members of the group by an authority; and (3) individual family responsibility for survival through the exploitation of opportunities to use the land (Parsons, 1970). Within each stage of development there are systems of rules for the use of land, which mature under the stress of scarcity and conflict into systems of rules for land tenure regulating the use, occupancy and transmission of land (Fabiyi and Idowu, 1991).

STATEMENT OF THE PROBLEM

Land is obviously the most important of all the resources for agricultural production. In Nigeria, with shortages of land occasioned by the pattern of land ownership under the customary tenure systems and localized population densities, few farmers can afford to grow crops for the market. The average Nigerian farmer operates patches of small-scale holdings barely adequate to meet family subsistence needs. The meagre farm income generated is generally inadequate to guarantee a decent standard of living (Adegeye and Dittoh, 1985). In addition to the land constraint, available family labour is rarely fully utilized, leading to underemployment as well as unemployment in the rural areas.

JUSTIFICATION

The study was conducted on the performance of NALDA, one of Nigeria's numerous projects aimed at revitalizing the agriculture sector. NALDA was established by the Government of Nigeria in 1991 to facilitate the optimal use of the country's land and human resources. The programme was the first ever community-based agricultural and rural development programme in Nigeria. Under the programme, local community participation was incorporated into the planning stage as a way of ensuring the success of the programme. Although the project has been discontinued this study remains relevant insofar as it will, among other things, highlight the problems that led to the demise of NALDA and similar programmes – a subject that has not been given due consideration in the country, with the result that mistakes in programme design and implementation are often repeated.

OBJECTIVES OF THE STUDY

The broad purpose of the study was to evaluate the effectiveness of NALDA in the light of its objectives. Specifically, the study was intended to:

(i) assess the impact of NALDA on farm incomes in Oyo and Osun states;
(ii) compare the costs and returns of farm enterprises by participating and non-participating farmers;
(iii) identify the problems militating against the achievement of the goals of participants in the two states.

REVIEW OF PAST AGRICULTURAL DEVELOPMENT PROGRAMMES IN NIGERIA

Many studies have been carried out on past agricultural development programmes in Nigeria. These include: the Farm Settlement Schemes (Olatunbosun, 1967; Roider, 1971; Idachaba, 1986); Farm Institute Programmes, the National Accelerated Food Production Programme and Operation Feed the Nation (Adegbola and Akinbode, 1986); the River Basin Development Authorities (Bamidele, 1991); the Green Revolution Programme (Aribisala, 1983; Oyatoye, 1986) and the Agricultural Development Programmes (Sanda, 1991).

The main objective of modern agricultural development is the modernization of the smallholder production system that dominates Nigerian agriculture. This system is mainly characterized by the application of low levels of technology to the methods of production and by the small-scale nature of most of the farmholdings (Helleiner, 1966). Attempts have been made to transform this type of agriculture and increase its productivity. The main approaches have included mechanization to make possible larger-scale operations, the cultivation of

introduced and sometimes improved crops, the use of paid labour recruited outside family sources, the modification of systems of land allocation for farming activities, the use of modern mechanical methods for the processing of agricultural products and the orientation of production towards the world market. These efforts were made in the belief that the modernization of agriculture held the key to economic transformation in developing countries (Lewis, 1970; Agboola, 1979).

There was considerable public support for the Farm Settlement Scheme right from the start. The scheme was fashioned after the Israeli Moshav agricultural project. The projects were capital intensive in nature with central services such as schools, medical stations, churches or mosques, market stalls or shops, post offices, staff houses, processing equipment and machinery pools located in the centre of the settlement. The fact that only 23.7 percent and 37.3 percent of the 15 203 hectares projected for development had materialized by 1966 and 1970, respectively, was mainly a result of the capital-intensive nature of the scheme (Roider, 1971).This prevented the government from putting in place the necessary facilities to expand and maintain existing farm settlements.

Among other reasons cited for the demise of most of these programmes were: the recruitment of the wrong group of participants, who were not interested in the programme (Idachaba, 1986); lack of incentives to enable the participants to adopt improved farming practices; inadequate funding and undue concentration on technically grandiose projects at the expense of simple but cheap designs (Adegbola and Akinbode, 1986). Others include land-tenure problems, paucity of data prior to land development, inadequate infrastructure, bureaucratic delays and inadequacy of executive capacities in project implementation (Aribisala, 1983; Oyatoye, 1986; Sanda, 1991).

BACKGROUND INFORMATION ON THE PROGRAMME

The National Agricultural Land Development Programme was established by the federal government on 7 May 1991. According to the programme document (NALDA, 1991), among its objectives were:

(i) to provide strategic public support for land development that currently constitutes the most severe infrastructure development bottleneck hindering the development of viable economic farmholdings;
(ii) to promote and support optimum utilization of the nation's rural and land resources for the accelerated production of food and fibre;
(iii) to consolidate present fragmented and scattered agricultural landholdings to narrow rural–urban income inequalities;
(iv) to encourage the evolution of economic-size village settlements that will reap the economies of scale in the provision of social services (water, health, primary school, etc.) and agricultural technologies;
(v) to provide gainful income and employment opportunities for rural people, raise rural incomes and the general living standard in rural Nigeria;
(vi) to provide incentives for programme participants.

In pursuit of the objectives outlined above, the main content and targets of the programme included, among others:

(i) development of 30 000–50 000 hectares of land in each state, beginning with the 1992–94 rolling plan period, divided into 4-ha farm lots;
(ii) placement of at least 7 500–12 500 programme participants such that no farmer need travel more than 3–5 km to get to his or her farm;
(iii) settlement of 250 farmers per Local Government Area per annum;
(iv) network of physical and social infrastructures;
(v) subsidized land development and management;
(vi) supervised agricultural credit and cooperative schemes of produce marketing and utilization;
(vii) zonal seedling production facilities to feed satellite villages of settlers or participants (NALDA, 1991).

GUIDELINESS FOR PARTICIPANTS

The programme was designed to operate according to the following guidelines:

(i) Participants/settlers must be carefully selected such that successful applicants are truly dedicated to agriculture, have the necessary agricultural background, have a stable family life and other desirable characteristics, not those simply seeking temporary refuge from unemployment.

(ii) Communities that wish to participate must voluntarily offer land for which no compensation will be paid. Forgone compensation represents the substantial contribution and irrevocable commitment of participating communities.

INCENTIVES

Programming for NALDA was to ensure that there were adequate incentives to attract and retain participants. Incentives to attract participants included:

- subsidized land development costs in the initial period;
- supervised credit;
- supervised processing and marketing of produce;
- integrated extension services;
- robust extension services;
- loan recovery period of 15–20 years, after an initial grace period of 2–7 years.

FUNDING ARRANGEMENT

NALDA was jointly funded by local communities and local, state and federal governments. The bulk of the financial contributions of local communities was the foregone land compensation payments for land used for the project. The funding formula for the programme was federal government, 85 percent; state governments, 10 percent; and local governments, 5 percent (NALDA, 1991).

METHODOLOGY

Sampling method and data collection

The study was conducted in Oyo and Osun states in the southwestern part of Nigeria. The NALDA project in Oyo State was located at Ilero, within the Guinea savannah zone, and the project in Osun State was located at Iwara, within the forest zone. In each project site, 60 farmers (i.e. 30 project participants and 30 non-project participants) were randomly selected for study.

Primary data were collected through the use of structured questionnaires, while secondary data were obtained from the records at the headquarters and field offices of the NALDA projects in the two states. Descriptive statistics, t-test (showing the significance of variations between project participants and non-participants) and budgetary techniques were used to analyse the data collected.

RESULTS AND DISCUSSIONS

Socio-economic characteristics of respondents

Sex. Field survey revealed that all the National Agricultural Land Development Programme participants interviewed in both Oyo and Osun States were male (Table 1). Some female non-participants (about 13 percent in Oyo and 17 percent in Osun) were, however, interviewed. Further discussion with the programme officials showed that no female was admitted to participate in the programme in the two states despite the existence of women farmers within the programme catchment areas. Male crop stereotyping for tree crops generally (cashew and oil-palm for Oyo and Osun States, respectively) might have accounted for this non-inclusion of women in the programme.

Age. The mean ages for respondents in the two states showed that farmers in Oyo State (about 49 years) were slightly older than those in Osun State (about 43 years). The result, however, indicated that the majority of farmers (both project participants and non-project participants) in the two states are still within the productive age range for agricultural production. Consequently, age differences are not likely to cause any difference in the performance indicators (such as income) between the two categories of farmers.

Table 1

Summary of socio-economic characteristics of respondents

	OYO STATE		OSUN STATE	
	Project farmer	Non-project	Project farmer	Non-project
Sex (percentage):				
Male	100.0	86.7	100.0	83.3
Female	-	13.3	-	16.7
Age (years):				
Minimum	31	30	26	32
Maximum	58	60	55	66
Mean	49.1	48.9	43.0	43.1
Formal education (percentage):				
None	60.0	66.6	53.3	63.3
Primary	26.7	16.7	30.0	26.7
Vocational	-	-	-	-
Secondary and above	13.3	16.7	16.7	10.0
Migration pattern (percentage):				
Natives	63.3	100.0	73.3	60.0
Non-natives	36.7	-	26.7	40.0
Family size:				
Minimum	4	5	0	2
Maximum	16	14	15	16
Mean	9.0	10	7	8
Occupation (percentage):				
Farming as primary occupation	13.3	20.0	60.0	70.0
Farming as secondary occupation	86.7	80.0	40.0	30.0
Distance of farm from homestead (km):				
Minimum	3.0	n.a.	0.1	n.a.
Maximum	9.5	n.a.	5.0	n.a.
Mean	5.1	n.a.	4.1	n.a.

Source: Field survey, 1999/2000.

Formal education. The study found that a slightly higher percentage of project participants had formal education than non-project participants. In Oyo State, 40 percent of project participants had some form of formal education, compared with about 33 percent for non-participants. Similarly, in Osun State, about 47 percent of the project participants (and about 37 percent of non-project participants) had formal education. The selection process for the project participants seemed to favour educated farmers in the two states.

Migration pattern. The migration patterns for project participants were found to be different for both states. Non-natives represented 36.7 percent of the Oyo sample and 26.7 percent for Osun. However, no non-native was among the non-project respondents for Oyo State, whereas non-natives constituted 40 percent of those for Osun State. These results reflect differences in the farming systems in the two states. The project in Oyo State is located within the savannah zone where the cultivation of arable crops dominates, and which has not attracted resident migrant farmers. On the other hand, most of Osun State (including the project site) lies within the forest zone, where tree-crop production is common. Over the years, migrant farmers had been involved in tree-crop production (especially cocoa and oil-palm) in the forest zone of southern parts of Nigeria (Helleiner, 1966; Agboola, 1979; Idowu, 1989). Hence the higher presence of non-native respondents in that area.

Family size. The family size distributions of all participants in the two states (1–16) are similar and tend to be representative of large families. These family sizes are better considered as consumption units rather than production units because only very few family members help on project farms. This means that high incomes are needed by the farmers to meet the feeding, educational, health and other social needs of their families.

Occupation. The majority of respondents in Oyo State regarded farming as a secondary occupation, while the reverse was the case

in Osun State. Within Osun State, the availability of rainfall for most periods of the year encourages farming activities and cultivation of crops all year round, unlike in Oyo State, where the project location experiences rainfall for only a part of the year. Hence, most farmers within the project catchment area in Oyo State usually have other occupations to engage in during the off-season periods when crop cultivation is not feasible due to lack of rainfall.

Distance of farm from homesteads. The distances covered by project farmers to get to project farms ranged from 3 to 9.5 km (mean: 5.1 km) for Oyo State and from 0.1 to 5.0 km (mean: 4.1 km) for Osun State. This result is close to the programme objective that no farmer should travel more than 3 to 5 km to get to his or her farm (compared to longer distances typically travelled before the introduction of the programme).

SIZE OF FARMS CULTIVATED BY RESPONDENTS

Table 2 shows the size distribution of farms cultivated by both participants and non-participants in the two states. In Oyo State, most of the participants (67 percent) cultivated 1 hectare or less, whereas in Osun State only about 23 percent cultivated similar-size farms. The mean farm sizes cultivated by the participants were 1.6 ha and 2.6 ha for Oyo and Osun States, respectively. For non-participants the mean farm sizes were 2.3 ha and 1.7 ha for the two respective states.

The implication is that most of the participants cultivated less than 4.0 ha of the land allocated to them. Some of the reasons cited by the participants for their inability to cultivate the total farmland allocated included: difficulty in obtaining tractors, and lack of farm inputs and credit facilities.

CROPS GROWN

The NALDA project crop for Oyo State was cashew, and oil-palm for Osun State. Intercropping, which is a general farm practice in the southern parts of Nigeria, is observed among participants and non-participants alike. Among the project participants, the common food crops grown include: maize, cassava and to some extent yams (Table 3). These crops are useful as sources of food and income to the families before the tree crops (cashew and oil-palm) start to bear fruit. A number of farmers in Osun State also grow other tree crops such as cocoa, kola nut and plantain in addition to oil-palm (the project crop).

USE OF FARM INPUTS

Results obtained from the field indicated that farm inputs (machinery, planting materials and credit) were not readily available to both groups of farmers in the two states covered by the study. As opposed to the claims by the programme officials that inputs were available, the participating farmers did not readily get them to use on their farms. This compelled many of them to patronize local markets or use part of the previous year's harvest as planting materials.

As shown in Table 4, non-project participants in Oyo State benefited more from cooperatives as sources of credit, probably owing to the short maturation

Table 2
Percentage distribution of farm sizes cultivated by respondents

HECTARES	OYO STATE		OSUN STATE	
	Project participants	Non-project participants	Project participants	Non-project participants
≤ 1. 0	66.6	-	23.3	6.7
1.1–2.0	16.7	46.7	16.7	90.0
2.1–3.0	-	50.0	26.7	3.3
3.1–4.0	16.7	3.3	33.3	-
> 4.0	-	-	-	-
Total	**100.0**	**100.0**	**100.0**	**100.0**
Mean farm size	1.6	2.3	2.6	1.7

Source: Field survey, 1999/2000.

Table 3
Crops grown by respondents

CROPS	OYO STATE		OSUN STATE	
	Project participants (percentage)	Non-project participants (percentage)	Project participants (percentage)	Non-project participants (percentage)
Maize	96.7	100.0	76.7	70.0
Cassava	86.7	96.7	83.3	100.0
Yam	40.0	66.7	10.0	3.3
Melon	23.3	6.7	-	-
Groundnut	-	3.3	-	-
Plantain	-	-	-	3.3
Cajanus cajan	3.3	-	-	-
Cocoa and kola nut	-	-	-	26.7
Cashew (project crop)	100.0	-	-	-
Oil-palm (project crop)	-	-	100.0	26.7

Source: Field survey, 1999/2000.

Table 4
Sources and uses of farm inputs and machinery by respondents

		OYO STATE		OSUN STATE	
		Project participants (percentage)	Non-project participants (percentage)	Project participants (percentage)	Non-project participants (percentage)
Availability of machinery:					
Readily available		53.3	26.7	33.3	30.0
Difficult but available		46.7	70.0	23.3	-
Not available		-	3.3	43.4	70.0
Sources of planting materials:					
From previous year's stock		30.0	23.3	30.0	33.3
Bought from local market		60.0	50.0	70.0	66.7
Government agencies (NALDA)		10.0	-	-	-
Cooperative societies		-	26.7	-	-
Sources of credit:					
Friends and relatives		-	3.3	-	-
Cooperative societies		10.0	66.7	-	30.0
Agricultural bank (NACB)		70.0	10.0	-	-
Other government agencies		-	-	50.0	-
None at all			20.0	50.0	70.0
Access to agricultural	Yes	70.0	-	-	-
insurance programme:	No	30.0	100.0	100.0	100.0
Access to extension sources:	Yes	100.0	100.0	100.0	100.0
	No	-	-	-	-

Source: Field survey, 1999/2000.

period of annual crops grown by them. It was only in Oyo State that programme participants benefited from the services of the government-owned agricultural bank and insurance scheme.

COSTS AND RETURNS

Tables 5 and 6 show the costs and returns per farmer and per hectare by respondents in Oyo and Osun States, respectively. In Oyo State significant differences (t-ratio at 5 percent level) were observed in the total revenue, total cost and returns to management per farmer between project participants and non-project participants. Non-project participants consistently recorded higher values for each of these parameters. However, on a per hectare basis, none of the variables was found to be significant.

This observation can be explained in terms of the larger farm sizes cultivated by the non-project participants rather than high productivity as a result of more efficient farm operation (see Table 2). Large- and medium-scale arable crop production is common among non-project participants within the project area as opposed to cashew crop production (a tree crop with a longer maturation period) by the project participants. While the project participants recorded returns to management of only N18 732.00 (about US$170), the non-project participants recorded N27 719.66

Table 5

Costs and returns of project participants and non-project participants in Oyo State

ITEMS	PER FARMER			PER HECTARE		
	Project participant N	Non-project participant N	T-ratio	Project participant N	Non-project participant N	T-ratio
Total revenue	31 158.33	45 743.33	2.07*	19 596.43	19 888.40	0.07
Cost of hired labour	6 871.67	9 116.00	1.74	4 .321.81	3.963.48	0.38
Cost of hired machinery	2 741.66	4 116.67	2.61*	1 724.31	1 811.60	0.22
Cost of planting materials	742.66	1 066.67	0.97	466.54	463.77	0.01
Cost of fertilizer	966.67	1 933.33	1.30	607.95	840.58	0.45
Cost of agrochemicals	56.67	93.33	0.79	35.64	40.58	0.15
Interest on loan(s)	1 048.00	1 706.67	2.33*	659.12	742.03	0.44
Total cost	12 426.33	18 032.67	2.36*	7 815.30	7 840.29	0.01
Return to management	18 732.00	27 719.66	3.14*	11 781.13	12 048.11	0.06

Source: Computed from survey data, 1999/2000. Values in naira (N).

* Significant at 5 percent level.

Table 6

Costs and returns of project participants and non-project participants in Osun State

ITEMS	PER FARMER			PER HECTARE		
	Project participant (N)	Non-project participant (N)	T-ratio	Project participant (N)	Non-project participant (N)	T-ratio
Total revenue	45 544.53	28 476.66	4.17*	17 517.13	16 653.02	0.33
Cost of hired labour	10 309.33	6 473.67	3.66*	3 965.13	3 785.77	0.27
Cost of hired machinery	1 237.50	257.50	4.21*	475.96	150.58	2.19*
Cost of planting materials	640	360	2.27*	246.75	210.53	0.45
Cost of fertilizer	-	600	2.23*	-	350.88	1.63
Cost of agrochemicals	3 496.67	2 596.67	1.21	1 344.87	1 518.52	0.37
Interest on loan(s)	505.75	195	1.85	194.52	114.04	0.75
Total cost	16 189.50	10 482.84	2.90*	6.226.63	6 130.32	0.05
Return to management	29 355.28	17 993.82	4.16*	11 290.49	10 522.00	0.27

Source: Computed from survey data, 1999/2000. Values in naira (N).

* Significant at 5 percent level .

(about US$252) per farmer during the 1999/2000 crop season.

Osun State, however, presented a different picture. The project participants recorded higher amounts for total revenue, total cost and return to management (i.e. revenue minus costs), which were found to be significant at 5 percent level on a per farmer basis, but not on a per hectare basis. The existence of a vibrant tree crop economy probably assisted project participants in Osun State to catch up quickly with the modern innovations of oil-palm production and input supplies under the programme, and they thereby recorded higher total revenue and return to management than the non-project participants. But in general, the net farm incomes earned by the farmers (participants and non-participants alike), which ranged from N17 993.82 or US$164 to N29 355.28 or US$267, were grossly inadequate to supply the needs of the farmers and their families.

PERFORMANCE OF THE PROGRAMME IN THE TWO STATES

The study showed that the programme had failed to make significant impacts in the areas of operation in the two states. Since its inception in 1991 until its end in 1999 (a period of about seven years), the programme developed only 545 hectares of land in Oyo State and placed 75 participants (representing 1.81 percent and 1.0 percent, respectively, of the targets), with a participant turnover of 79 percent due to abandonment of project farms as a result of fire outbreaks and farm destruction by nomadic herds. In Osun State, the programme developed only 535 hectares of land with 120 participants (representing 1.78 percent and 1.60 percent, respectively, of the targets). Of these numbers of participants, 112 had deserted the project farms as a result of inexperience in farming, financial constraints and absence of rural infrastructure.

The programme was unable to achieve the target of 30 000–50 000 hectares of land development and 7 500–12 500 participants in each of the states. Underfunding by both the federal and state governments coupled with untimely release of the limited funds constituted the major problems that accounted for the projects' failure.

CONCLUSIONS AND POLICY RECOMMENDATIONS

The failure of the National Agricultural Land Development Programme in Oyo and Osun States in particular (and Nigeria in general) was not due to faulty planning. It was the first community-based rural development programme incorporating active participation of local communities and the three tiers of government (local, state and federal). The problem was defective implementation, mainly in the form of a shortage of funds to execute properly what was at bottom a good programme. Rational utilization of available land resources can only be achieved through the establishment of an institutional framework that gives participating farmers protection and incentives with respect to the human–land relationship, with its attendant social and political order. Provision of credit facilities is a complementary and indispensable measure without which land redistribution or consolidation programmes such as NALDA will not have a lasting effect, but will remain half-hearted measures which can only prolong the economic agonies of the smallholder cultivators. Lessons learned from the failure of NALDA in Nigeria should assist in future planning in other countries where similar projects are operating or contemplated.

The following recommendations are therefore made to improve the performance of similar projects in the future:

(i) To reduce high participant turnover in similar programmes, efforts should be made to recruit only genuine and experienced farmers who are particularly interested in the project and reside within the project catchment areas. Similarly, there should be improvement in the farm input delivery systems to the participating farmers as well as provision of rural infrastructural facilities such as potable water, health care and adequate roads within the project areas and localities.

(ii) Adequate funding should be provided by the government at appropriate times to execute projects and maintain facilities in functional condition. In addition to production credit, consumption credit (in cash or in kind) should be given to the participating farmers, especially in the early stages of project life, to prevent high participant turnover. Private sector participation should be encouraged.

(iii) Finally, there is a need for political goodwill for land development programmes to succeed and be sustainable. This may require legislative enactments that will reduce policy instability. This is an issue in developing countries where political parties' manifestoes emphasize short-term projects that bring quick results to the electorate rather than long-term projects with enduring results.

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FAO/19480/G. Bizzarri

Certaines conséquences socioéconomiques de la révolution verte

Depuis les années 60, la révolution verte a suscité des débats animés parmi la communauté scientifique internationale non seulement en ce qui concerne ses aspects techniques, mais surtout pour ses effets socioéconomiques. L'article analyse d'abord les théories du développement du secteur rural des années 50 et 60 afin de décrire la base théorique sur laquelle repose la révolution verte lancée dans les pays en développement, à savoir le modèle des intrants à rendement élevé. L'article décrit ensuite les effets socioéconomiques fondamentaux que les ouvrages spécialisés ont relevés en Asie, où 60 pour cent de la population vit avec moins de deux dollars par jour. Le rôle du secteur agricole doit être réexaminé non seulement en fonction de l'évolution de la structure économique, mais aussi à partir d'une évaluation adéquate d'autres éléments (capital social, politique et institutionnel et environnement) afin de mettre en place des processus de développement durable.

Consecuencias socioeconómicas de la revolución verde

Desde los años sesenta la revolución verde ha sido objeto de animados debates en la comunidad científica internacional, no solo en relación con sus aspectos técnicos sino también, y por sobre todo, con sus repercusiones socioeconómicas. En este artículo se analizan en primer lugar las teorías sobre el desarrollo del sector rural imperantes en los decenios de 1950 y 1960, con objeto de describir el camino teórico que dio inicio a la revolución verde en los países en desarrollo: el modelo de insumos de alto rendimiento. Se ofrece luego una descripción de los elementos socioeconómicos que se desprenden del análisis de la literatura pertinente sobre Asia, donde el 60 por ciento de la población vive con menos de dos dólares EE.UU. por día. Para impulsar procesos de desarrollo sostenible se hace indispensable reconsiderar la función del sector agrícola no solamente a la luz de los cambios en la estructura económica, sino también de una evaluación adecuada de otros componentes (como el capital social, político e institucional o los factores ambientales).

Some socio-economic consequences of the Green Revolution

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Since the 1960s the Green Revolution has been the subject of lively debate among the international scientific community, not only with regard to its technical aspects but, and above all, for its socio-economic impacts. The article first analyses the development theories of the rural sector in the 1950s and 1960s in order to describe the theoretical path that started the Green Revolution in the developing countries, i.e. the high pay-off input model. The article then describes the critical socio-economic elements that the literature analysis highlights for Asia, where 60 percent of the population live on less than US$2 per day. The role of the agriculture sector has to be reconsidered not just in terms of a changed economic structure, but also with an adequate evaluation of other components (e.g. social, political and institutional capital, as well as the environment) in order to initiate sustainable development processes.

ECONOMIC THEORIES ON THE ROLE PLAYED BY AGRICULTURE IN THE 1950s AND 1960s

At its inception, development economics paid limited attention to the role of the primary sector in starting economic growth. According to the modernist view, development was understood as the process of transformation of the economic structure, which was ascribed to the reduction of the contribution of the primary sector to the gross domestic product (GDP), as well as the reduction of population actually employed in agricultural activities.

The role of agriculture in development economics was undervalued as a result of considerations such as those presented below:

- Engel's law highlights how the demand for basic consumer goods increases less than proportionally to the increase in income (inelastic demand). As a consequence, as time goes by, the value of the primary sector production increases less than the increase of GDP, and thus the primary sector cannot in theory determine, in the short term, a rapid growth of the economy.
- The agricultural transformation has been considered uniform and constant in all economies. As documented by Clark (1940), Kuznets (1966) and Chenery and Syrquin (1975) from the analysis of the time series, both in the capitalist and in the socialist countries, the percentage of the primary sector relative to the active population and to the domestic product tends to diminish progressively. This finding has supported those development economists who refused the hypothesis of investing in the primary sector in order to jump start a rapid economic development, given the inevitable decline of agriculture compared to other productive sectors.
- In 1949, two important economists, Raul Prebisch (Prebisch, 1950) and Hans Singer (Singer, 1984), enunciated the thesis that in those countries that export primary goods and import manufactured articles, the tendency is towards worsening terms of trade. It follows that the hypothesis of initiating economic growth through the development of agriculture for export is a vision of economic policy open to criticism.

- In 1958, Albert Hirshmann introduced the concept of linkages effects to explain how the investment in certain compartments of the economy determines further developments in other sectors (through related production lines, and input-output connections). Hirshmann suggested that, in order to obtain efficient economic planning, it is necessary to stimulate public investment in those sectors where the linkage effects might be stronger; this would amplify even more the effect of endogenous investments. Hirshmann judged that agriculture has little capacity to create new activities through linkage investments, to which industry is more suited. It follows that investments in industrial activities would certainly create more economic growth than those in agriculture (Hirshmann, 1958).

Therefore, development economics had to find ways to accelerate the progressive marginalization of the primary sector by transferring resources (especially human resources) from the traditional sector to the industrial one, as the latter guaranteed labour productivity and was considered the real engine of the development.

This reallocation vision was repeated in an article published in 1954 by Sir Arthur Lewis, "Economic development with unlimited supplies of labour" (Lewis, 1954). This essay presents a model of economic expansion with two sectors: a modern capitalistic one opposed to a traditional one that was lagging behind. The main characteristics of the capitalistic sector are the use of capital with the aim of investing it and the sale of the production in order to obtain a profit. Such aspects are missing in the traditional sector, where the priority is self-sufficiency, and also because the primary sector lacked the perception of profit as a magnet for economic growth and therefore investment. Lewis' reallocation of human resources from the traditional sector (where marginal productivity of labourers reaches almost zero) to the modern sector generated capital development thanks to the profits produced by the greater productivity of the labourers. The maximum expansion of the model is reached when the salaries in the two sectors are equivalent, and therefore the two-sector model becomes a neoclassical one-sector one.

The success of Lewis' theory with regard to the development of the industrial sector stimulated a whole series of innovative studies on the role of the industrial sector in development processes. In one study by Jorgenson (1961), comparing Lewis' model with a neoclassical model, the economist arrived at the conclusion that the development of the capitalistic and modern sector depends on the growth rate of the agricultural surplus. Other researchers in the 1960s arrived at the same conclusion (Ranis and Fei, 1961), stating that in order to avoid the trap of a low-level equilibrium in the initial development phases it was essential to realize some investment in the agriculture sector in order to accelerate its growth and the consequent surplus augmentation.

This research was also elaborated by other authors: Johnston and Mellor (1961) highlighted that agriculture had an essential role in activating growth processes of an economy through five main contributions:

a) procuring human resources;
b) creating capital to invest in different sectors of the economy;
c) acquiring foreign currency through the sale of export products;
d) producing consumer goods for the active population employed in diverse economic sectors;
e) providing an outlet market for local industrial products.

The role of the primary sector was anything but passive for jump-starting a process of economic growth. This consideration led to empirical research on the transfer of resources between different economic sectors in the various development phases.

The new theoretical approach to the role of agriculture in jump-starting development heavily criticized the assumptions underlying the diffusion model of innovative

techniques for agricultural development that was applied in the 1950s and 1960s, and implemented instead the principle of "agricultural extension", which had been successfully developed in North America. The new model assumed as its principle that the distribution of resources in the developing countries would not happen in an efficient economic way, under the assumption that poor farmers would not have the capability to take decisions and that it would be necessary for them to obtain external help in order to overcome such an impasse, a thoroughly negative judgement.

Theodore Schultz, in his book *Transforming traditional agriculture* (1964), heavily criticized this assumption, declaring that such a vision was rather the expression of the economists' and development planners' limited analytical ability in evaluating the farmers from the developing countries as efficient economic agents: "The Third World farmers and herders far from being irrational and fatalistic, were calculating economic agents who carefully weighted the marginal costs and benefits associated with different agricultural techniques" (Staatz and Eicher, 1984).

Schultz considered traditional agriculture as an efficient system of allocating the available production factors. He held that the low levels of production, and thus of income, were due to production factors that were inherently low-yielding because of their low technological level. The provision of new technological input, combined with information on its use, was therefore the solution to the widespread agricultural poverty in the developing countries; the governments of the developing countries therefore had to invest in scientific research, as applied to the agriculture sector, and in training.

The Schultzian assumption reinforced the role of scientific research, already thriving at an international level, of the International Rice Research Institute (IRRI) in the Philippines and of the International Maize and Wheat Improvement Center (CIMMYT), for the adoption of dwarf high-yielding varieties of rice and grain in poor countries.

The strategic concept of the Green Revolution economy (the high pay-off input economic model) for this reason has been unanimously attributed to Schultz. He was convinced that the traditional agricultural societies could not create, in the short term, a radical change in their organization, because he considered the levels of saving and investing of these societies insufficient to start a growth process. The only thing that would probably increase production was the adoption of external productive factors (hybrid seeds, fertilizers and pesticides) that would develop farming production, in order to satisfy the increasing food demand, and thus augment the capital necessary to the development of the whole economy. The Green Revolution would therefore initiate the transformation of the rural pre-capitalistic society (given that most exchanges were based on bartering, this was characterized by a low coinage level) into a capitalistic society where the agriculture sector propelled economic development.

THE GREEN REVOLUTION IN THE 1960s AND 1970s

The Green Revolution is a critical juncture in the traditional methods of farming. In 1966 the Rockefeller Foundation and the Mexican Government established, at the CIMMYT in El Batan, Mexico, a research activity to select a high-yielding hybrid of wheat. The new plant had to have particular physiological characteristics, such as a shorter stem that could benefit from fertilizers and an increased resistance to typical wheat diseases. After extensive experimentation a hybrid was selected, Norin-10. Likewise, in the Philippines at the IRRI, the IR-8-288-3 variety was selected, which was the product of crossing Indonesian and Taiwanese seeds; now called IR-8, it guaranteed far higher production than traditional varieties.

It is nevertheless a common opinion that the Green Revolution does not simply consist of a process of replacing traditional seeds with high-yielding ones. The traditional farming system underwent a complete transformation, with the

Table 1

Area of cereals harvested (ha) by region and category

Year	Latin America and Caribbean	Developing Asia	Developing Africa	Developing countries	Developed countries	World
2005	50 737 259	298 487 576	95 188 555	444 427 201	237 270 942	681 698 143
2000	48 355 463	301 477 620	84 298 239	434 143 541	240 043 549	674 187 090
1990	47 414 545	308 019 648	73 236 467	428 687 511	279 772 111	708 459 622
1980	49 128 982	301 922 554	57 820 349	408 890 152	308 603 517	717 493 669
1970	46 549 063	289 475 428	60 007 067	396 046 788	279 644 323	675 691 111
1961	37 265 137	266 827 243	51 166 106	396 046 788	292 855 436	648 129 670

Source: FAOSTAT.

Table 2

Cereal production (tonnes) by region and category

Year	Latin America and Caribbean	Developing Asia	Developing Africa	Developing countries	Developed countries	World
2005	158 610 805	1 016 785 390	113 377 871	1 288 811 140	930 546 367	2 219 357 500
2000	138 034 466	961 742 360	97 518 416	1 197 331 040	862 425 580	2 059 756 620
1990	99 083 566	857 771 742	81 342 397	1 038 232 410	913 365 140	1 951 597 550
1980	88 443 342	618 506 118	59 230 017	766 220 291	783 952 607	1 550 172 900
1970	71 364 892	463 159 814	52 372 797	586 925 797	605 740 344	1 192 666 140
1961	47 399 044	309 050 290	39 589 144	586 925 797	480 961 311	877 026 930

Source: Data processed from FAOSTAT (available at http://faostat.fao.org) updated to January 2006.

Table 3

Cereal yields (kg/ha) by region and category

Year	Latin America and Caribbean	Developing Asia	Developing Africa	Developing countries	Developed countries	World
2005	3 126.1	3 406 5	1 191.1	2 809.9	3 921.9	3 255.6
2000	2 854.6	3 190.1	1 156.8	2 757.9	3 592.8	3 055.2
1990	2 089.7	2 784.8	1 110.7	2 421.9	3 264.7	2 754.7
1980	1 800.2	2 048.6	1 024.4	1 873.9	2 540.3	2 160.5
1970	1 533.1	1 600.0	872.8	1 482.0	2 166.1	1 765.1
1961	1 271.9	1 158.2	773.7	1 114.8	1 642.3	1 353.2

Source: FAOSTAT.

Table 4

Population (thousands) by region and category

Year	Latin America and Caribbean	Developing Asia	Developing Africa	Developing countries	Developed countries	World
2005	558 280	3 707 430	842 642	5 117 471	1 336 155	6 453 626
2000	520 231	3 473 926	751 672	4 754 077	1 316 509	6 070 586
1990	441 526	2 972 866	585 592	4 006 557	1 257 029	5 263 586
1980	361 401	2 456 120	440 476	3 263 267	1 171 408	4 434 675
1970	284 858	1 990 315	334 627	2 613 995	1 078 504	3 692 499
1961	224 405	1 604 635	266 324	2 098 764	981 366	3 080 130

Source: FAOSTAT.

introduction of modern agricultural techniques such as corrective fertilization, transplanting and correct spacing between seedlings. All these new methods somehow had to be combined with the climatic conditions of the location where they were introduced, and this required in-depth studies of the different rural environments by the research institutes in joint ventures with the local agricultural universities.

Tables 1, 2 and 3 report on cereals, show the increase of the farmed area and the production and yields per hectare of different geographical areas in different years.

The trend in world population for different geographical areas has been reported in Table 4, in which it emerges that the world population doubled in the time frame considered. This was essentially due to an

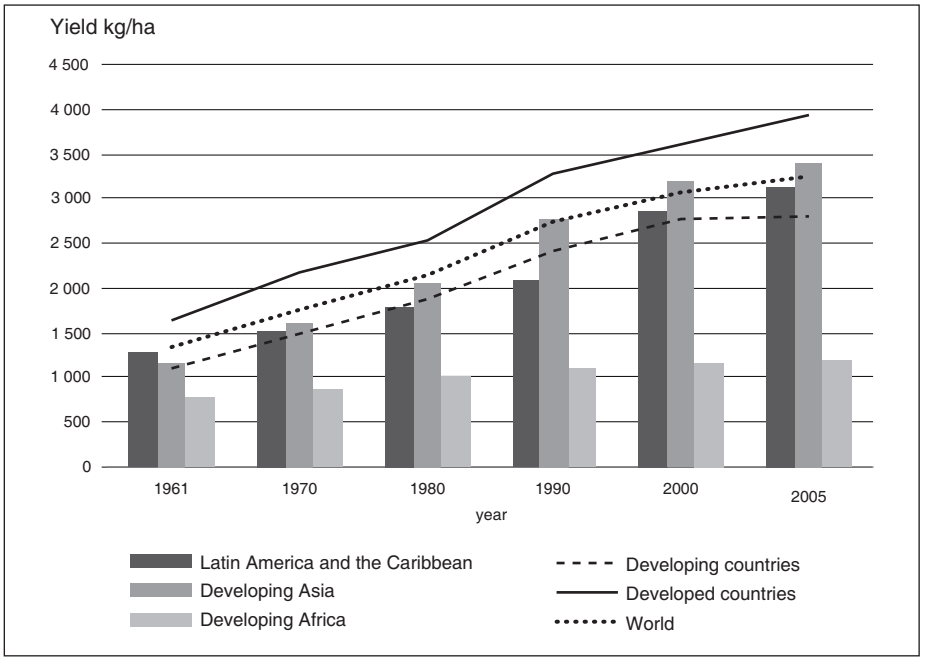

FIGURE 1
Productivity of cereals by region and category

Source: FAOSTAT.

increase of the population in developing countries.

The demographic growth was accompanied, in the developing countries, by a noticeable increased production of cereals, to which the Green Revolution partially contributed. Even so there are variations among cases, depending on whether Asia or Africa or Latin America are considered (Figure 1).

From the analysis of the data (between 1961 and 2005), it appears that cereal yield:

- almost tripled between 1961 and 2005 for the developing countries in Asia;
- more than doubled in Latin America, taken as a whole;
- only slowly increased in the developing African countries. This highlights the difficulties African countries face in feeding their populations.

These aspects are further underlined in Table 5, where cereal productivity is compared with the population increase from 1961 to 2005. The results of Table 5 are depicted in Figure 2, which shows the extremely insecure situation of Africa, where the population by 2005 had more than tripled while the cereal production increased by only one-and-a-half times compared with the 1961 value. These results are also supported by the literature, which presents the substantial failure of the Green Revolution in the African context (Reardon, 1998).

Asia, where the Green Revolution has been most successful, maintains a rate of growth of cereal production that is higher compared to the demographic increase. Latin America's situation is of substantial equilibrium in this respect.

Finally, the developed countries display the best situation, with a cereal production that more then doubled when compared with 1961 and with a population that is only 1.4 times that of the base year.

These data, even if meaningful, do not give us any indications concerning the cereal production distribution between the populations, which should be the subject of further study.

SOME CRITICAL ASPECTS OF THE GREEN REVOLUTION IN THE ASIAN CONTEXT

There are differences of opinion in the literature about the impact of the Green Revolution on rural poverty in Asia. It should be pointed out that there is a limited availability of quantitative studies on the hypothetical correlation between the Green Revolution and rural poverty, considering that this last variable could be influenced by economic and non-economic components that cannot be necessarily attributed to the introduction of the Green Revolution.

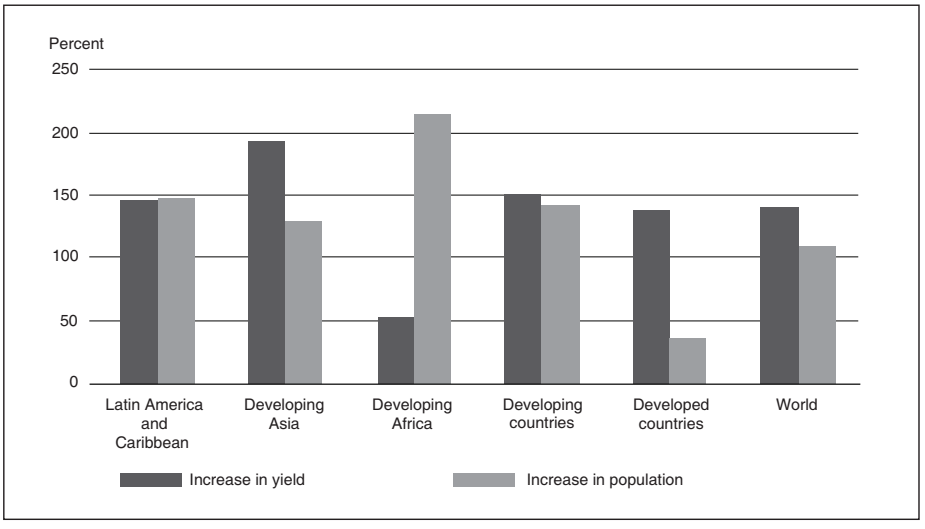

FIGURE 2
Increase in cereals yield and in population growth for regions and categories, 1961–2005

Source: FAOSTAT.

Table 5
Cereal yields compared with population increase by region and category (1961–2005)

		Latin America and Caribbean	Developing Asia	Developing Africa	Developing countries	Developed countries	World
Cereal yields *(kg/ha)*	2005 (a)	3 126	3 406	1 191	2 809	3 921	3 255
	1961 (b)	1 271	1 158	773	1 114	1 642	1 353
	(a)/(b)	2.46	2.94	1.54	2.52	2.39	2.41
Population *(thousands)*	2005 (c)	558 280	3 707 430	842 642	5 117 471	1 336 155	6 453 626
	1961(d)	224 405	1 604 635	266 324	2 098 764	981 366	3 080 130
	(c)/(d)	2.49	2.31	3.16	2.44	1.36	2.10

Source: FAOSTAT.

In order to clarify a complex matter, the following critical aspects need to be considered:

- the technological package;
- the scale dimensions of farms and productivity;
- the effect on occupation.

The technological package

The spreading of the Green Revolution in rural areas of the developing countries, and in the Asian context, happened through the adoption of the technological package which provided a series of materials, instruments and practical information on the use of hybrid seeds. Implementing the package caused many problems for a considerable section of rural society. For example:

- farmers who were illiterate found it impossible to read the instructions and the dosages of fertilizers and pesticides;
- farmers had difficulties in activating contacts with the public and private institutions that were necessary to obtain the materials, and to develop or to reinforce the marketing channels for the increased production they had realized.

In order to solve these problems, in the mid-1970s the training and visiting system (T&V) was founded. Basically, technical staff of the World Bank would establish themselves *in situ* or in experimental farms and would teach the application of the "green technology", including by diffusing the use of fertilizers and pesticides. The new method accelerated the spread of the technical knowledge, not only improving agricultural practices but also allowing a considerable increase in productivity.

The T&V system and the use of the experimental farms did not fully take into account many issues related to subsistence agriculture. In Table 6 the disparity of features in the two different situations is shown.

The results of T&Vs did not achieve their potential optimum, especially because they did not carefully consider economic aspects. For example, there was the important problem of selling the product. The new

Table 6

Main differences concerning experimental farm and subsistence agriculture in developing countries

Main features of experimental farms	Main features of subsistence agriculture
• Fertile land	• Remote and impoverished land
• Operative infrastructure	• Antiquated or inefficient structures
• High-quality irrigation systems	• Lack of irrigation systems
• Detailed and informative documentation	• Family-based labour
• Poor attention by agronomists to the economic consequences of new technology	• Low education

Source: Hogendorn, 1995.

technology could only be adopted if selling the product would generate enough money to justify the increased expenditure of the technological package. Furthermore, the remuneration of the farmer was strictly linked to a deep knowledge of the pricing and market systems, and this kind of information was not immediately available.

The Green Revolution was not only an exercise in optimizing the agronomy (so as to obtain the maximum production) but also in optimizing the economy (so as to obtain the maximum profit).

The scale dimensions of farms and their productivity

The topic invested particular emphasis for the scale dimension of farms. For the middle and large landowners, implementing the new technology did not cause undue problems, but for the poor farmer who operated on the fringes of the market the choice between the old and the new could be particularly difficult given the initial adverse economic conditions.

Contrasting opinions emerge from the economic research focusing on whether the Green Revolution was efficient considering the scale dimensions of single farms. Some believe it was a success, while others think it failed. The question involves tackling the issue of the distribution of wealth between small, medium and large agricultural producers, as well as whether the economic theory underlying the Green Revolution was actually able to alleviate poverty in many developing countries.

The result of this analysis could lead us to refuse or accept the development theory that aims at transforming pre-capitalistic economies (typical of the traditional agricultural structure) into modern market-driven economies through the adoption of external inputs for high productivity. It is often questioned whether the increased income and the replacement of a subsistence economy with the modern market economy is actually a suitable instrument for reducing poverty in many developing countries. International research shows that different situations arise depending on different sociopolitical contexts.

Considering the scale dimensions of the farm, it is possible to analyse the elements that directly influence the hectare productivity under hybrid introduction. These have been classified by Pearse (1980) into two categories:

- whether water utilization is adequate and immediate, i.e. whether the irrigation system is effective;
- the use of fertilizers.

Regarding the former, Pearse states that the advantages that could be obtained from an adequate irrigation system were on the whole more favourable to large farms, as these could well afford the cost of installing tubewells for lifting up water from underground or for capturing water from the surface. But these measures were very unlikely for small farmowners, unless there existed a sufficient public investment to provide irrigation to the smaller farms.

Where irrigation was successfully realized, however, farms became more and more concentrated. With the spreading of irrigation systems the price of the land began increasing, and large landowners started accumulating more and more land, whereas smaller owners, even though they had obtained an impressive increase in production, could not readily invest the profit in the purchase of new land or in improving the land they already owned.

Table 7

Gross income and farm business income per acre for various farm size groups, 1967/68 and 1971/72 in three villages in the Indian Punjab (values in rupees)

	Small	Medium	Large
		Medium gross income	
1967/68	2 320.75	1 762.46	1 911.93
1971/72	2 574.79	2 419.87	3 925.40
		Medium cost per acre	
1967/68	1 481.09	1 010.55	922.17
1971/72	1 439.33	1 342.33	1 637.39
		Medium farm business	
1967/68	839.66	751.91	989.76
1971/72	1 135.17	1 077.54	1 658.01

Source: Dasgupta,1977.

This phenomenon is remarked on in studies from the northeast of India (Punjab, Haryana and Uttar Pradesh) and Pakistan (Pearse, 1980; Shiva, 1993).

Research on the use of fertilizers has yielded different results. In Asia, it was observed that small farms favoured the increase of hectare or acre production, as this was in part due to the intensive use of family helpers, and this balanced the otherwise high cost of production.

This is in contrast with the data on large farms, where some owners were conspicuously absent and totally dependent on salaried help; here, the increased productivity was inferior to that of smaller owners. But other large landowners who decided to invest large amounts of capital and assumed the direct management of their farms obtained increased productivity, far higher than that of the smaller farmers.

Table 7, taken from Dasgupta (1977), highlights in three villages of the Indian Punjab the gross income, cost of production and net income for different sizes of farm in the first years of their adoption of the Green Revolution, when empirical studies were conducted in order to ascertain the validity, also from an economic point of view, of the new technology.

The gross income per production acre is strictly connected with the productivity; the table highlights the U-shaped curve that relates hectare production with the dimension of the farm. This tendency was also observed in other Indian areas, which supports the hypothesis of increased production, for hybrid seeds, for small or big farms.

From these observations, several conclusions follow:

a) An initial availability of capital to invest in irrigation, without resorting to credit, greatly favours the adoption of a new technology that guarantees a conspicuous production increase.
b) Public intervention is essential for the small producers in order to obtain services in irrigation and information on the use of technology that otherwise would not be accessible. Where this has been realized (Japan and Taiwan Province of China), small producers can acquire an economic advantage that enables them to stay in the market;
c) Small farms can only be protected from the concentration of land by a public market body; on the other hand, they do obtain a high hectare productivity.

In the absence of rigid control of these variables on the part of the government, the adoption of an external technology in a pre-capitalistic society where the social structure is not equal risks exacerbating the impoverishment of the population whose subsistence is derived from small farms.

The effect on occupation

Another aspect considered by the researchers is the effect on occupation, and consequently on the level of income of a large part of the rural population which survives through seasonal work. The literature contains both optimistic and pessimistic views.

For some (Ladejinsky, 1969; Wharton, 1969; Frankel, 1969; Falcon, 1970; Byres, 1972;

Shiva, 1993), the Green Revolution increased the social tensions, risking to turn into a "red revolution" for the following reasons:

- It denied the small farmers (peasants) and the landless labourers the gains realized through the Green Revolution.
- It diminished their real income by mechanizing part of rural activities.

From another point of view, the Green Revolution has benefited some more than others, but in general everybody enjoyed some profit (Sen, 1970; Bhalla and Chadha, 1982), as attested by a higher per capita income, better levels of education and health and reduction in prices for agricultural products (which reduced the basic food expense for both the urban and the rural population).

Singh Sidhu (1991) reminds us that the Green Revolution consists of two aspects: the biochemical aspect (i.e. the innovations adopted for irrigation systems, seeds and fertilizers) and the mechanical aspect (i.e. the ground-preparation work, sowing, reaping, transport of agricultural products and use of tractors).

For Singh Sidhu, the biochemical aspect, on its own, creates work, because the introduction of permanent irrigation systems extends the agriculture season, and thus entails a higher use of human resources. Besides, the multiple-cropping system and the precocious ripening of the hybrid plants favour a bigger harvest, and therefore require more labour.

The mechanical aspect, instead, obviously tends to reduce the use of human resources. Thus, the effect of the new technology on occupation and consequently on the levels of income of the poorest layer of population that lives in rural areas depends on a combination of the two aspects. This can result in various scenarios:

- increased occupation, if the biochemical aspect prevails over the mechanical one (this can be seen at the initial stages of the Green Revolution);
- reduction of occupation, if the mechanical aspect prevails over the biochemical one (in the study by Pearse [1980] conducted in the Haryana and Punjab states, the female occupation has been reduced, whereas the male occupation seems to have stayed roughly the same).

CONCLUSIONS

Views of poverty and of the methods that should be adopted in order to reduce it progressively have always been the centre of international debate. During the second half of the twentieth century, various schools of thought formed, according to the prevailing economic theories: from the view of economic growth as the necessary instrument to better livelihoods (1950s and 1960s), to the new view of poverty as a "process", for the amelioration of which economic growth is not sufficient.

In the 1970s, after the adoption of the Green Revolution, development economists moved their attention towards questions regarding occupation and income distribution. Setting aside macroeconomic theories, they preferred to concentrate on microstudies at village or single farmer level. The target was "growth with equity" instead of economic "growth and modernization", because the latter, when considered on its own, did not guarantee automatic poverty reduction.

Growth is therefore an indispensable but not sufficient factor for reducing poverty in the various geopolitical contexts. Other aspects have to be taken into account: the social, political and institutional processes that are realized in poor economies and that strongly determine the success or the failure of policies designed to reduce poverty (1970s and 1980s).

The 1980s and 1990s also witnessed the dawning of awareness about environmental resources and of the necessity to safeguard them adequately in order to ensure that development is sustainable. Their dissipation could exacerbate the dichotomy of wealth distribution, adversely affecting the indigent at the borders of the social hierarchy. On the basis of this history one should read the theoretical and practical experience of the Green Revolution, which was originally based on the assumption

Table 8
Incidence of poverty in Asia (percent), 1990 and 2002

Years	East Asia	South Asia	Southeast Asia	Central Asia	Total
		US$1-a-day poverty index			
1990	33.0	41.3	23.9	1.9	34.3
2002	15.9	31.6	9.6	7.4	21.5
		US$2-a-day-poverty index			
1990	72.2	85.5	65.0	13.9	75.3
2002	45.6	78.3	48.3	39.9	59.9

Source: United Nations, 2002.

that economic growth, beginning with the development of the primary sector, would on its own better the livelihood of most of the poor population in the developing countries.

The increases in cereal production realized in Asia during the 1960s and 1970s have deeply affected the order of rural structures. Nevertheless, the Asian context, where the growth of productivity has been more marked, still shows even now a relevant percentage of the population living in poverty. The international estimates taken from the United Nations Population Division state that 21.5 percent of the population in Asia survive on less than a dollar a day, and 59.9 percent with less than two dollars a day (see Table 8).

It is necessary to adopt a vision of the development process where the components "economic growth", "social, political and institutional factors" and "natural resources" are adequately weighed and valued in their reciprocal interaction. Within this conceptual structure, fighting poverty should start first by rethinking the growth processes. The following are only some areas to consider.

1) Investments in human capital, achieved through health programmes, training and better nourishment, would widen the spectrum of opportunities for the poorest population.
2) Renewed research on farming should focus on the issues faced by the poor population, paying particular attention to local production and the methods needed to increase it incrementally.
3) There should be measures to ensure more equal access to land ownership.
4) Microcredit and microfinance are needed to aid the poor farmer at the stage of purchasing the production inputs.
5) Encouragement should be given to spur rural non-farm activities in order to start an integrated rural system.
6) Monitoring prices both at a national and at an international level is necessary in order to capture the right information at the most opportune time.
7) The adoption of efficient participation schemes, so as to ensure that the benefits are more equally distributed in all the social layers, should be pursued.

The sustainable development approach aims exactly at these measures, and tries to convert into practice the lessons learned during previous decades.

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