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REPORT ON REGIONAL EXPERT CONSULTATION ON THE IMPACT OF  
TECHNOLOGY ON RURAL DEVELOPMENT IN AFRICA, ECA

ADDIS ABABA, 4 to 8 AUGUST 1986

### Executive summary

The basic cause of needless poverty and hunger in the rural Africa to-day is the stagnation of its main economic base - agriculture. It has settled down to a low level of equilibrium of income, saving and investment over time. Hence, most of the rural people of the region is caught in a vicious circle of a poverty trap. They are below the "absolute poverty line".

(i) The country studies show all of them are food-deficit. In Uganda, the breakdown of law and order and expulsion of expatriate community since 1972 were the major reasons for its set-back in rural development and in food self-sufficiency. In Sierra Leone, the pre-dominance of hand-hoes and inadequate use of bio-chemical inputs are the contributory factors. The same is true of Ghana. Mauritius is a study in contrast in respect of technology and its benefits. Its limiting factor is soil, most of which is comparatively unsuitable for rice cultivation.

(ii) If the four country studies may be regarded as broadly indicative of the impact of technology and technological policies on rural development in the region, the effect has been marginal, (except in such relatively advanced country like Mauritius). Even in those cases where increased production has been achieved, these have not been matched by corresponding increases for the majority of the rural population in income and employment. There has been some growth but accompanied by growing disparity.

(iii) The reasons for poor technological progress are economic, social, political and organizational. Economic policies have ignored key micro- and macro-variables, pursued conflicting goals and used inappropriate instruments. Rural development has to be technology-based. The studies, however, show the diffusion of technology at the small farmers' level in the region suffers from various limitations, which are mostly external to them.

(iv) Africa has the favourable factor-endowments and great potential for self-sustained development. To realize the potential, the region thus needs to adopt a socially sensitive and yet pragmatic technological policy to benefit largely the small scale farmers. Such a policy, complemented by other inputs, institutional support, fiscal and price policy, should help Africa recover from the current socio-economic crisis and gradually have a self-sustained economic base for rural development, which is synonymous with national development of the member-States of the region.

### Recommendations

(v) To release rural Africa from the "poverty trap" and develop it, with equity, the following major recommendations are made for consideration by the Conference of African Ministers of Social Affairs to:

#### A. Short term:

- (i) formulate explicit overall national technology policy with well defined objectives. Such objectives may include, inter-alia, the development and diffusion of technology which stress the full utilization of indigenous factor-endowments and which are within the reach of average producers and

consistent with a country's stage of development and socio-cultural and institutional heritage;

- (ii) substantially increase the allocation of resources for science and technology to reach the target of one percent of GDP;
- (iii) allocate adequate resources for research to identify the optimal mix of hand-tools, animal- and mechanically-powered technologies for field operations;
- (iv) encourage the use of bio-chemical inputs by making them available in time at farm level and at a reasonable price to raise their current utilisation rate;
- (v) exploit fully the irrigation potential existing in the region by efficiently utilizing existing irrigation facilities and increasing the area under irrigation. There is a need to shift emphasis away from large scale irrigation projects to building national networks of small- and medium-scale irrigation facilities;
- (vi) establish appropriate institutional modalities for monitoring the implementation and consequences of rural technology policy and programmes. National workshop should be organized to sensitize policy-makers and the general public to critical issues in the generation, promotion, dissemination and consequences of new rural technologies;
- (vii) take urgent steps to launch national grassroot farm credit schemes that are accessible to all rural income groups, especially the poorest of the poor. This will ameliorate the adverse income inequality consequences of new technology during the transition period.

#### B. Medium Term:

- (viii) expand indigenous technical capacity. This will mean, besides others,
  - (a) agricultural research and development should be inter-disciplinary, location specific and adaptive;
  - (b) there should be farm testing units to conduct tests and demonstrations on new technology packages;
  - (c) local production of appropriate implements and yield raising inputs; and
  - (d) promotion of acceptability and use of locally designed implements.
- (ix) Revamp and revitalize existing extension services;
- (x) streamline under one unified ministry of agriculture all departments, dealing with crops, forestry, fishery, livestock, co-operatives and marketing.

C. Long term:

- (xi) launch national programmes in rural feeder road and rural market networks;
- (xii) incorporate vocational courses in school curricula and introduce basic education to facilitate technological awareness;
- (xiii) streamline existing institutional arrangements to place science and technology at the highest possible level of political authority. This is needed to ensure that the priorities of rural development and of agriculture are translated into priorities in science and technology research, resulting in timely development of appropriate technologies;
- (xiv) strengthen existing mechanisms for co-ordination of technological development and its dissemination to optimize the pay-off from technological innovations to all concerned.
- (xv) request ECA to assist member States in harmonization of technology policies at national, sub-regional and regional levels and
- (xvi) authorize ECA for monitoring progress and submitting periodic report on the implementation of the above-mentioned recommendations, based on a region-wide study of the impact of technology on food production and rural development.

## SECTION I: INTRODUCTION

Background

1. Africa is predominantly rural and may remain so at the year 2000 and possibly beyond. Hence rural development of the member States of the region is synonymous with their national development. The development of rural life, institutions and economy is the main basis by which Africa can expect to pull itself out of the current socio-economic crisis, with dignity and equity.
2. In fact, the Lagos Plan of Action (LPA) states, inter-alia, "member States should direct their efforts to spelling out a strategy for development, which should guide their thinking, planning and action on bringing about socio-economic changes necessary for improving the quality of life of the majority of the people. This objective requires them to invest in science and technology resources for raising African standard of living and for relieving misery in the rural areas."<sup>1/</sup>
3. The LPA further goes on to add: "attention should, therefore, be paid to the role of science and technology in integrated rural development. This would require, among other things, the generation of financial resources and political will and courage on the part of policy and decision-makers of the continent to induce profound change with far-reaching effects on the use of science and technology as the basis of socio-economic development as a matter of the utmost importance and urgency at this fateful juncture of history."<sup>2/</sup>
4. Integrated rural development (IRD) is production-based but rural poverty-alleviation oriented concept. It is multi-sectoral but its main economic base is generally agriculture in the African region. The poor performance of this sector is at the root of the region's socio-economic crisis.<sup>3/</sup>
5. A major activity of this sector is food production. Food comes first and is the most basic of the basic needs for survival. And yet, the food self-sufficiency in Africa has been declining since the 1960s. It was 86 per cent in the 1980s and may fall to 71 per cent for cereals by the year 2008.<sup>4/</sup> A major consequence of this declining trend is the erosion of the economic base of IRD. Over a million people have paid the sad price with their lives in the recent past.<sup>5/</sup> Many more millions are barely clinically alive and are sustained through massive aid at the cost of their dignity.
6. Such tragedy was neither unavoidable. For, despite all the emphasis placed on increased food production within the region by the LPA, the share of the public sector allocation for agriculture averaged 7 per cent in the 1978-1982 period.<sup>6/</sup> If the FAO survey results are indicative, African countries have been allocating a lower percentage of public resources to agriculture than those in Asia and the Pacific.

<sup>1/</sup> OAU, Lagos Plan of Action for the Economic Development of Africa, 1980-2000, International Institute for Labour Studies, Geneva, 1981, p.45.

<sup>2/</sup> Ibid, p.345.

<sup>3/</sup> A. Adedeji, The Paralysis of Multiple Debilitating Crises, ECA, 1985, p. 18.

<sup>4/</sup> Ibid, p. 19.

7. Similarly, despite the recommendation of the LPA to gradually allocate upto 1 per cent of the GDP to develop appropriate technology, the resource allocation by the member States as of 1985 varied from 0.2 to 0.3 per cent of the GDP. 7/ Hence, the decreasing self-sufficiency is a logical corollary of inadequate investment to improve farm productivity. In fact, it has been argued that "... Africa's current problems have less to do with drought than with the fact it cannot feed itself whatever the weather..." 8/, given, inter-alia, the current level of technology, unattractive farm prices and degradation of soil.

8. It has also been maintained the problems of African agriculture and of hunger are not primarily weather-related. "Rain alone will not wash away hunger". 9/ Radical change "will come only if there is genuine resolve to correct what is wrong at home - what has failed to work - what has worked to produce greater unfairness and alienation - models that have proved unsuitable to Africa's people. This is not a plea to move to the left or to the right, but to move in those directions that the needs of real development dictate..." 10/ This then is the background of this report.

#### Scope of the paper

9. The rationale for sharp focus on increased food production, with equity, has been stated in the preceding paragraphs. After hunger has been met, other facilities and amenities of life can then be taken care of either sequentially or simultaneously, depending on factor-endowments and indigenous productive capacity. It is important, therefore to bear in mind this legitimate concern, which is priority number one. In this connection, it should be noted that productivity is essentially a function of investment. There has to be a transition from hand-hoes to more efficient technology if the productivity potential of African agriculture is to be realized. FAO's study "Agriculture: Towards the year 2000" shows 60 per cent of the anticipated increases in farm production has to come from higher productivity and the rest from extension of acreage from greater intensity of cropping.

5/ ECA, Second Special Memorandum by the ECA Conference of Ministers: International Action for Relaunching the Initiative for Long Term Development and Economic Growth in Africa, Addis Ababa, 1985, p.5.

6/ ECA, Evaluation of the Implementation of the Regional Food Plan for Africa (1978-1984) and a Preliminary Assessment of the Food and Agricultural Aspects of the Lagos Plan of Action (E/ECA/CM.11/37 of February 1985), p.15.

7/ ECA, Current Economic and Social Crisis Facing Africa and some Concrete Project Proposals on the Role of Science and Technology (S&T/IGCESTD/1/7 of 25 September 1985), Addis Ababa, 1985, p.3.

8/ S. Woods, Africa: A Prophecy of Boom, not Doom, in Development and Co-operation DSE, Berlin, September/October 1985, p.2.

9/ ECA, Agricultural Credit and the Mobilization of Resources in Rural Areas, Addis Ababa, (ECA/PBD.4/7), 1986, p.3.

10/ S.S. Ramphal, The Trampling of the Grass, ECA, Addis Ababa, 1985, pp.20-21.

10. The purpose of the report is, therefore, to:

- (a) review the current level of rural technology;
- (b) discuss existing national technological policy and its appropriateness;
- (c) consider current institutional and infrastructural support;
- (d) evaluate the impact of existing rural technology and national technological policies on food production, employment, income levels and distribution and
- (e) propose policy recommendations.

#### Basis of the report

11. The report is primarily based on the four country case studies (viz., Ghana, Mauritius, Sierra Leone and Uganda); which were commissioned by the secretariat in 1985. It also draws on the technical papers and the proceedings of the Regional Expert Consultation on the Impact of Technology on Rural Development in Africa, which was organized by the Secretariat at Addis Ababa and held from 4 to 8 August 1986.

#### Limitations of the report

12. The Secretariat serves fifty member States. However, due to budgetary constraints, only four country studies could be commissioned. Hence, the primary basis of the report is not as representative as one would expect. It was initially intended to supplement the country case studies by a desk study, covering the region. But, due to unanticipated staff-constraint in the secretariat, the study could not be carried out.

### SECTION II: REVIEW OF THE CURRENT LEVEL OF TECHNOLOGY

13. Agriculture is the predominant sector in all the four countries, viz., Ghana, Mauritius, Sierra Leone and Uganda. 80 per cent of the farmers in Uganda depend entirely on primitive hand-hoes for cultivating the land. <sup>11/</sup> These are in serious short supply. The production of hand-hoes has gone down from 200 thousands (1977) to 113 thousands (1984). The effect of shortage of hand-hoes has been aggravated by:

- (i) departure of migrant workers and
- (ii) increased enrollment of rural children to school.

Experiments with tractors in Uganda have been failure so far. Similarly, ox-plough for tillage has not been a viable alternative. "Present production is 50 ox-plough per month far below to satisfy the backlog estimated at 50,000 and annual replacement requirements of about 5,000." <sup>12/</sup>

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<sup>11/</sup> E. Lugujjo, Impact of Rural Technology and National Technological Policies on Food Production, Productivity, Employment and Income Level and Distribution in Uganda, ECA, Addis Ababa, p.1 (Herein after referred to in the text as Uganda Study).

<sup>12/</sup> J.D. Rogers, the Impact of Rural Technology and National Technological Policies on Food Production, Productivity, Employment and Income Level and Distribution in Sierra Leone, ECA, Addis Ababa, 1985, p. 1 (Herein after referred to in the text as Sierra Leone study).

14. In Uganda planting is done by broadcasting seeds, weeding by sharpened sticks and knives, harvesting by hand and knives, processing by sticks, storage on farm in receptacles structures, transport of farm products mostly by roads and their marketing by private sector.

15. In Sierra Leone hand-hoes, axes, machetes and sickles constitute 80 per cent of farm equipments. <sup>13/</sup> Tractors and animal drawn ploughs are limited in use. The various stages of production from ploughing to processing are broadly similar to that in Uganda. Land and labour is relatively in abundant supply in Sierra Leone. Hence, there is no felt need at farm level to adopt capital-intensive technology.

16. In Ghana labour technology currently dominates the farm operations (85 per cent of the cultivated area), followed by mechanical technology (10 per cent) and animal traction (5 per cent). The introduction of animal traction in the 1930s was the first attempt to technological advance in the Ghanaian agriculture. This modest attempt was abruptly abandoned in favour of large scale mechanical technology (10 per cent) and animal traction (5 per cent). The introduction of animal traction in the 1930s was the first attempt to technological advance in the Ghanaian agriculture. This modest attempt was abruptly abandoned in favour of large scale mechanisation in the 1960s, to be revived after 1966 with external aid. <sup>14/</sup>

17. The case of Mauritius provides a sharp contrast. The preference there is to "move straight from hand-tools and hand-operated implements to sophisticated mechanized equipment" <sup>15/</sup>, partly due to sharp decline in population growth from 3.12 per cent (1952-62) to 1.4 per cent (1972-82). All the processes of production, except harvesting, have been largely mechanized. The use of hand tools is generally limited to some vegetables and fishery.

18. All the four countries are food-deficit. However, the case of Mauritius is virtually dictated by economic choice.

### SECTION III

#### EXISTING NATIONAL RURAL TECHNOLOGICAL POLICY AND ITS APPROPRIATENESS

19. Uganda's policy was intended to "ensure adequate food supply and improve the quality and increase the quantity of export crops". <sup>16/</sup> The country was divided into eleven agro-ecological zones to make technological policy location-specific. It had an effective information network upto 1972. Uganda, taking a top-down approach, also established large and subsidized co-operatives called Group Farmers' Scheme and provided them 800 tractors by 1968. It also set up a Tractor and Agricultural Implements Hire Scheme. The former proved to be a costly failure due to farmers' resistance. The latter is still in operation but on a very limited scale.

<sup>13/</sup> Ibid., p.8

<sup>14/</sup> J.A. Dadson, The Impact of Rural Technology and National Technological Policies on Food Production, Productivity, Employment and Income Level and Distribution in Ghana, ECA, Addis Ababa, 1986 p.3 (Herein after referred to in the text as the Ghana study).

<sup>15/</sup> A. Y. Maudarbocus, the Impact of Rural Technology and National Technological Policies on Food Production, Productivity, Employment and Income Level and Distribution in Mauritius, ECA, Addis Ababa, 1985, p.6 (Herein after referred to in the text as the Mauritius study).

<sup>16/</sup> E. Lugujjo, op.cit., p.16.



20. Its research programme was geared to raise yield in "laboratory conditions" without consideration to cost-effectiveness, replicability in different areas and acceptability by farmers. Moreover, improved varieties of seeds were in short supply, so also agro-chemicals, fertilizers and farm implements. Besides, the country's technological policy over-looked the need of "making the best use of 'informal' innovative capacities that are organized outside it". <sup>17/</sup> Hence, Uganda still continues to have subsistence agriculture.

21. It has recently adopted more pragmatic policies to:

- (i) incorporate vocational courses in farm schools' curricula;
- (ii) introduce basic education to facilitate technological awareness, increase imaginative innovation and technological diffusion in rural areas;
- (iii) rehabilitate agro-industries;
- (iv) encourage small-scale industries to produce farm implements;
- (v) re-introduce effective extension services; and
- (vi) give greater emphasis on non-traditional cash crops and diversified agriculture.

22. Sierra Leone does not have an explicit rural technological policy. <sup>18/</sup> Its two successive Five-Year Plans mentioned about a "more efficient mechanical cultivation programme" and "a techno-economic transformation" of agriculture. And the favoured strategy was to import tractors to mechanize cultivation. It proved to be inappropriate for the majority of the small farmers for a variety of reasons. "The technical efficiency of a technology is a dimension of its appropriateness which can be evaluated irrespective of the set of policies under which agricultural production takes place. But in the final analysis, whether a given technology is introduced to farmers and popularized is largely determined by the agro-mechanization policies of the Government". <sup>19/</sup>

23. Mauritius' preference for mechanized agriculture is consistent with its factor endowments. However, the stress on productivity in subsectors other than sugar is insufficient. The rural development programme is heavily subsidized by Government, with the intention to motivate the villagers to work for economic self-reliance. The replacement of informal sector by large mechanized enterprises could be more beneficial to the over-all national economy. However, the informal sector forms part of the cultural heritage and official policy to retain it has to be seen in this context. The policy to promote traditional agriculture and rural informal enterprises, which are labour intensive, enables to offset the adverse employment effect of mechanization of the dominant activity, viz., sugar production.

24. Ghana case study shows the usual propensity to opt for imported, capital-intensive and inappropriate farm machineries; the choice has been unrealistically portrayed as between hand-hoes and tractors. It was a costly propensity in terms of uneconomic use of scarce resources. <sup>20/</sup> It has not increased rural employment or raised labour

<sup>17/</sup> Ibid, pp. 16-17.

<sup>18/</sup> J. D. Rogers, *op. cit.*, p. 4.

<sup>19/</sup> Ibid., p. 5.

<sup>20/</sup> J. A. Dadson, *op. cit.*, p. 16.

productivity. Animal traction in Ghana, at its present stage of development, would have been economic since:

- (a) small farmers can afford it;
- (b) it saves scarce foreign exchange;
- (c) it requires less investment in supportive services;
- (d) it is less sensitive to poor management or price fluctuations. And it fits into the culture and production practices of the country. 21/

25. The country studies show, inspite of post-independence intensive development efforts, African rural economies are generally characterized by predominantly small-scale producers and some medium- and large-scale producers. These categories have different production and technological systems, means and resources. The over-all productivity is low, reflecting inappropriate policies.

26. These policies, among other things, have the following features: they are based on a top-down approach with a simplistic but unrealized expectation of a trickle-down effect; countries have attempted to by-pass instead of focussing on the main producers, the small-scale; the role and needs of women and the youth have not been adequately addressed. In those countries where technological policies exist, they lack clearly defined principles and often follow conflicting goals and means. They have not been based on local resource endowments and have ignored local manufacturing capabilities. The instruments used have provided wrong signals and encouraged the transfer of inappropriate technologies. For example, price policies, comprising subsidies, tax concessions and overvalued exchange rates, etc., have favoured large against small producers and high-level technology over intermediate/appropriate stages. Furthermore, the efficacy of the existing rural socio-cultural and technological practices to maximize the effect of technological development and diffusion have not been fully considered. 22/ Similarly, the institutional support for implementing technological policies such as research and extension, credit and distribution services has so far been inadequate. 23/

#### SECTION IV

#### CURRENT INSTITUTIONAL AND INFRASTRUCTURAL SUPPORT

27. Uganda has five centres for scientific and technological development. In addition, it has twenty three institutions-university college, training centres, co-operative colleges and district farm institutes. These are specifically geared to agriculture. They provide courses ranging from one day on demonstration plots to graduate degree in veterinary science and to non-degree training in forestry, fishery, co-operative marketing and extension services.

28. However, historically dating back to colonial days, these organized facilities including 4,000 extension workers are generally geared to cash crops (cotton and

21/ J. A. Dadson, *op. cit.*, p. 16.

22/ African Regional Centre for Technology, Diffusion and Adoption of Technologies by Rural Communities in Africa, Dakar, 1986, p.21.

23/ Z. Alam, ILO/JASPA Experience on Agricultural Technology in Africa, Addis Ababa 1986, pp. 5-9.

coffee) and animal disease control. Most of them are not effective due to lack of adequate resources, low morale of researchers and total absence of inter-face between researchers and extension workers. Similarly, technological transfer by researchers have been constrained by limited budgetary allocations, increased cost of imported inputs and scarcity of foreign exchange.

29. There are 3,500 primary co-operatives which are primarily intended for agricultural marketing, of which 2,300 mainly deal with processing and marketing of cotton and coffee. Thus, while the marketing of export crops is well organized, the same cannot be said of the delivery mechanism of inputs and farm implements; which are in serious short supply. The short supply of implements is largely due to continued decline in the indigenous manufacturing capacity.

30. However, Uganda has been trying to recover and encourage indigenous innovations/innovators. It appreciates the need of building blocks by a mix of local knowledge and imported ones for national technological development. In Uganda, opportunities for technical education and training exist at various levels, including four vocational training centres. "Government is currently busy establishing awareness and importance of the indigenous innovation within the general populace. In order to achieve this, work options other than those in the formal sector of the economy are encouraged and funded". 24/

31. In addition, several non-governmental organizations are actively promoting technological development through indigenous research, one of which is joint energy and environment project. 25/

32. In Sierra Leone, research and development in agriculture, with farm technology components, are undertaken by several institutes, including the University of Sierra Leone. Their research so far focussed on crop production and processing equipments. Some large scale manufacturers are currently fabricating a wide range of hand tools, animal drawn ploughs and crop processing equipment. In addition, small village workshops also produce farm implements.

33. The marketing and distribution of the farm implements are now in the hands of a large number of indigenous and exploitative trading enterprises, upon whom depend a tangled web of small intermediaries. Moreover, the Government has no effective outreach programme. However, non-governmental organizations try to reach out, on a limited scale, farmers with their advisory services and farm equipments. The repairs and maintenance of the equipments are mostly provided by the rural blacksmiths.

34. There has been a recent shift in Government's tractorization policy in favour of identification of rural non-farm activities including the fabrication of farm technology and provision of various support services to upgrade and make them more productive. This policy shift should facilitate indigenous innovations and promote innovators.

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24/ E. Lugujjo, *op. cit.*, p. 25.

25/ *Ibid.*, pp. 25-26.

35. In Mauritius the bulk of agricultural research in the non-sugar sector is undertaken by various departments of Ministry of Agriculture and by the University of Mauritius. The Mauritius sugar Industry Research Institute was originally set up to carry out research in sugar. It has recently started doing research in cereal crops as well to:

- (i) attain food self-sufficiency and
- (ii) diversify crop production.

36. In addition to the Agricultural Extension Service of the Government and private training centres, there are eleven institutions which provide extension services and training facilities of various levels of sophistication and in different occupations, such as manufacture of farm equipments, their repair and maintenance, fishery, handicrafts and building construction. Their activities are co-ordinated by a Central Training Office. It will thus be seen Mauritius has a network of organizations to carry out an outreach programme for research and development. The result of this inter-face is reflected in growing indigenous capacity of Mauritius to manufacture boilers and heavy machinery for the sugar estates, mechanical harvesters, food-crop driers, seed processors, fertilizers and a number of simple tools, most of which is in the private sector. This partly explains its preference for mechanization to use of manual labour in farm and non-farm activities.

37. The main centres of technology research and development in Ghana are the three universities and the Council for Scientific and Industrial Research. Of these, the most important is the University of Science and Technology, which has a Technology Consultancy Centre (TCC). In addition to promoting rural industries, it operates model income-generating production units on the University Campus, undertakes consultancy services and does research and development in rural development technology.

38. The efforts of TCC are supplemented by indigenous manufacturing capacity. The local blacksmiths were until recently the principal manufacturers of the basic tools, e.g. hoes, ox-drawn implements and cutlasses. Several factories have been set up to produce farm implements but their combined output is less than the total capacity. Hence, acute shortage of implements occur occasionally. Tractors, combines and power saws are mostly imported. They operate below rated capacity. The Ghana study maintains, "in sum, local manufacturing capacity is absolutely limited and lacks comparative advantage; for animal traction and improved hand tools and equipment, it is inadequate". 26/

39. The country case studies show that the institutional arrangements for implementing policies and promoting rural development need particular attention. Typically, several agencies are involved in rural development programmes and rural technology production and transfer. Most are in the public sector; some are in the private sector. The Ministries of Agriculture, Industry, Science and Technology, besides the autonomous parastatals are involved in technology research and transfer. In addition, there are private agencies, e.g. machinery suppliers, donor agencies and non-governmental organizations. They all operate in the rural sector without much co-ordination or collaboration. This leads to avoidable waste of resources and reduces the overall impact.

40. While national research systems are established to generate knowledge, budgetary allocations are not adequate for their work. Also, the task and process of diffusion as distinct from the generation of knowledge of technology, is relatively neglected. Extension systems have generally deteriorated.

41. The general lack of objective conditions in the countries conducive to formation of rural people themselves into organizations, or as pressure groups and bargaining forces to improve their access to technology and services is also a reality.

42. Another neglected potential resource is the informal sector. Nearly all African countries have "way-side" mechanics and craftsmen, who are important in producing and maintaining simple equipments and sometimes modern machinery in rural areas. They represent a potential capability in technology advancement if properly assisted through training and credit schemes.

#### SECTION V

#### EVALUATION OF THE IMPACT OF EXISTING RURAL TECHNOLOGY AND NATIONAL TECHNOLOGICAL POLICIES

##### Productivity

43. The Uganda study shows the demonstrated scope for impressive gains in productivity as two examples given below indicate: 27/

Crop	Normal farm with improved Husbandry but no irrigation	Experimental station
	(kg/ha)	(kg/ha)
Maize	1,500	3,000
Rice	2,000	7,000

Hand-hoe continued to remain the major constraint in realizing the potential productivity increase. 28/ Hence, agriculture (specially cereal subsector) continues to remain subsistence-oriented. The productivity of the fishery, although is better than that of agriculture, could be considerably increased. "The livestock industry is still in its infancy and technology has yet to be applied". 29/ The commercial poultry farming collapsed in the 1970s. The use of imported engine-powered saw to cut down trees has resulted in indiscriminate felling and deforestation. In the "informal sector", the metal working group is meeting the critical shortage of farm implements.

44. In Sierra Leone too the farm productivity is considerably low. The estimated 330,000 farm families depend on simple hand tools, family labour, small acreage and very little bio-chemical inputs with some exceptions. There has been no attempt to introduce yield increasing technologies (mechanical and bio-chemical). Hence, "under conditions of shifting cultivation... yields have been falling as fallow periods have had to be reduced in the face of population pressure" 30/ over fertile land.

27/ E. Lugujo, op. cit., p. 27.

28/ Ibid. p. 30.

29/ Ibid., p. 29.

30/ J. D. Rogers, op. cit., p. 8.

45. The staple food-rice is grown under upland cultivation, where, because of the use of primitive technology and limited use of biochemical inputs, productivity is very low. However, the yield of rice per acre is comparatively higher in swampland. And yet, the farmers are reluctant to switch on the swampland for a variety of reasons.<sup>31/</sup>

46. In Mauritius, there is not enough fertile land suitable to increase domestic food supply. The area under rice is only 4,000 hectares.<sup>32/</sup> Even then experiments under different irrigation systems to produce more cereals are being carried out. Their comparative results are not yet available. However, the Mauritius case study states that the productivity of its land is higher in the food crop subsector than in the sugar. The comparative advantage is of marginal benefit to the country since the Mauritian soil is such that only a fraction of it is suitable to grow rice.

47. A study in Ghana concluded "from the financial analysis ... profitability increases with the degree of technology used, whereas the economic analysis points to the reverse. This divergence may be explained by factor price distortions ... The sources of such distortions included:

- (a) subsidies for inputs; and
- (b) the maintenance of overvalued exchange rate ... using corrected prices economic costs of production were altered in favour of less capital intensive systems" <sup>33/</sup>

#### Employment

48. In Uganda 80 per cent of the labour force is engaged in agriculture. However, there is under-employment and seasonal unemployment due to (i) structural, (ii) cultural and (iii) technological reasons. In the 1970s use of ox-drawn cultivators, weeder and seeder units resulted in unemployment in agriculture in the Teso system. In the Northern system, communal cultivation is practised. Unemployment is generally critical during the long dry periods.

49. The Sierra Leone study shows technology does have an important impact on the level of intensity of labour use, labour productivity, seasonality of labour demand in farming and unemployment. The latter is on the increase. It rose from 3.3 per cent (1963) to 8 per cent (1974).

50. Seasonality of farm labour is an usual phenomenon. However, in Sierra Leone its shortage is accentuated by the predominance of seasonal crops, the use of traditional tools and implements and the practice of shifting cultivation. A study shows there is wide dispersion in seasonality of labour demand. The peak demand is more than twice the slack in six out of eight regions. <sup>34/</sup> The availability of improved tools and implements could narrow the gap.

<sup>31/</sup> Ibid., p. 10.

<sup>32/</sup> A. Y. Maudarbocus, op. cit., p. 16.

<sup>33/</sup> J. A. Dadson, op. cit., p. 31.

<sup>34/</sup> J. D. Rogers, op. cit., p. 14.

51. In Mauritius most of the jobs are outside the agricultural sector, which has very little scope for job creation. In fact, employment in this sector has fallen by about 12,000 since 1977. The main reason for it is the increasing preference to go for labour-saving technology in the dominant sugar cane subsector. Unemployment is worse during the cane intercrop season.

#### Income level and distribution

52. The rural per capita income (at 1966 prices) in Uganda dropped by about fifty per cent during the period 1970-80. Assuming an average GDP growth at 5 per cent per annum for 1985-90 period, the estimated rural per capita income in 1986 is 355 Shs. There is no reasonably reliable data regarding the distribution of income in the rural sector. However, surveys reveal distribution is influenced by (i) farm organization, its size and speciality, (ii) investment in tools and equipment to raise productivity and (iii) education level of the farmers.

53. In non-farm activities, fishermen, owning motor-powered canoes, earn ten times more than those, with no motor-powered canoes. Farmers, specializing in livestock, earn even more than the fishermen, owning the mechanized canoes.

54. In Sierra Leone the average income of a farmer was around Le 800 in 1981-82. But, there is some dispersion in income between an upland rice cultivator and a swamp rice grower. The dispersion is largely due to mechanical and biochemical technology, adopted by upland farmers through various support services. The Gini co-efficient is 0.32. It indicates income inequality in rural sector is rather moderate since the conditions in agriculture are similar, i.e. "similar technology, similar crop-mix and rather similar acreages using the simplest tools. Income differences arise when farmers divert from the norm by adopting different technology or growing different crops (cash crops - coffee, cacao, etc.) or growing larger acreages..." 35/

55. In Mauritius 95 per cent of the households had a monthly income of less than Rs. 6,000 in 1980/81. The median monthly income was Rs. 1,518 and the mean monthly income Rs. 2,212. The substantial divergence of the mean from the median indicates an uneven income distribution. The Gini co-efficient is 0.44 as against 0.42 in 1975. The mechanization of the sugar sector has made and is still making a number of rural workers redundant thereby decreasing the income per rural family.

56. Most of Ghana's farmers derive their livelihood from cultivating small farms. The median size of a holding in 1970 was 3.6 acrea and some 55 per cent of all holdings were below 3.9 acres, occupying or claiming only 10 per cent of all cultivated area while the top claimed over 57 per cent. The overall Gini coefficient was 0.64. The contributory factors for such serious income disparity was the concentration of cocoa cultivation in the hands of a small minority of farmers, introduction of rice and mechanical technology, scale of operations and long-term investments.

35/ Ibid., p. 15.

57. If the four country studies may be regarded as broadly indicative of the impact of technology and technological policies on rural development in the region, the effect has been very limited (except in such relatively advanced country like Mauritius). Even in those cases where increased production has been achieved, these have not been matched by corresponding increases for the majority of the rural population in income and employment. There has been some growth, but without general improvement in equity. In some cases, growth has been accompanied by declining equity and growing disparities. The quality of life has changed unevenly; and insecurity has increased. Indiscriminate use of inappropriate technology is destroying the environment, in some cases irreversibly. Large segments of the rural population are untouched, in particular women and the youth. Growing disparities are probably endemic to growth, especially rapid growth, perhaps even inevitable.

58. The reasons for poor technological progress are economic, social and organizational, as set out above. Economic policies have ignored key micro- and macro-variables, pursued conflicting goals and used inappropriate instruments.

## SECTION VI: CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

59. The economic base of rural development in Africa is generally agriculture. The relative share of the small farmers in terms of their total acreage in agriculture, contribution to food self-sufficiency, generation of employment and poverty alleviation is crucial. And yet their productivity is very low due to marginal investment in appropriate mechanical, chemical and biological technology. The consequence has been, inter-alia, serious erosion of the economic base of rural development. Hence, pauperization of the overwhelming majority of the rural population and alarming dependency of Africa on external goodwill at the cost of its dignity.

60. Rural development has to be technology-based. Experience, however, shows the diffusion of technology at the small farmers' level in the region suffers from lack of communication and co-operation among, besides others, ministries with responsibility for the rural sector and from poor infrastructure.

61. Thus, there is a need for policies that:

- (a) accord due priority to rural development, agricultural as well as non-agricultural;
- (b) focus on the generation as well as the diffusion of technologies appropriate to the endowments, needs and capabilities of the region;
- (c) are based on appropriate and consistent principles, goals and means;
- (d) recognize the role of complementary measures; e.g. infrastructural systems and organizational structures and arrangements and the need to increase investments in research and development for rural development.

62. Assuming these steps are taken, the technological package - viz., mechanical, chemical and biological - to raise productivity may still result in greater income disparity at least in the transition stage due to unequal access of the overwhelming majority of the rural people to the new sources of income and power. It is quite



possible that the decision-making authorities at macro level may not be able to anticipate such unintended consequences. The risk of such contingency, in which wealth accumulates and men decay, needs to be guarded against.

63. Africa has the favourable factor-endowments and great potential for self-sustained development. To realize the potential, Africa thus needs to adopt a socially sensitive and yet pragmatic technological policy and measures to benefit largely the small scale farmers. Such a policy, complemented by other inputs, institutional support, fiscal and price policy, should help Africa recover from the current socio-economic crisis and gradually have a self-sustained economic base for integrated rural development, which is synonymous with national development of the member States of the African region.

#### Recommendations

64. In light of this broad objective, the following recommendations are made to the member States to:

##### A. Short-Term:

- (i) formulate explicit overall national technology policy statements with clearly defined objectives. Such objectives may include: the development of technology that stresses the full utilization of those raw materials and natural resources in which a country is relatively well endowed; technologies with low foreign exchange intensity and import dependence; technologies that are within the reach of average producers and the development of technologies that are not only of high productivity but are consistent with a country's socio-cultural and institutional heritage. Rural technology policy with respect to mechanical, biological and chemical technology should then be derived from the general guidelines and principles of national technology policy;
- (ii) starting with the fiscal year 1987, substantially increase the allocation of resources for the development and dissemination of appropriate mechanical and bio-chemical inputs for raising the productivity of agriculture, especially its cereal subsector. The increased allocation should be consistent with the requirements of the sector and with the recommendations made by, besides others, the Lagos Plan of Action and the African Priority Plan for Economic Recovery and Development;
- (iii) Augment the power on the farm available for critical farm operations (e.g. primary and secondary tillage; planting, weeding, etc.). This will not only enhance the productivity of the available labour but also reduce drudgery of agricultural operations, attract the youth to remain in the rural areas; and exploit optimally the short-rainy seasons for crop production. The increment in farm power can be realized by use of animal powered implements and mechanically powered technologies (tractors, etc.). Where conditions allow (i.e. tse-tse free areas) emphasis should be on the use of animal powered mechanization. Where conditions are unfavourable for animal powered mechanization, efforts should be directed at introducing appropriate machinery and implements. These policies and plans are required to upgrade power sources for farming and non-farming activities in the rural areas. They should aim at:

- (a) reducing the current dependence on human efforts as the major source of power and promote the use of other sources of power derived from suitable new and renewable energy resources; and
- (b) providing the required infrastructure and facilities for the efficient use of new and renewable energy sources. These should include facilities for training of technicians and engineers on the fabrication and maintenance of agricultural and other implements, manufacture and assemble of parts and components in rural workshops;
- (iv) Invest adequate resources in both research and training. The training should be at artisan (agricultural mechanics, etc.), technician and managerial levels (agricultural engineers, etc.). The research efforts should be directed at identifying the economically optimal mix of handtools, animal powered and mechanically powered technologies which can be used for field operations;
- (v) Encourage the use of bio-chemical inputs by making them available in time at farm level and at a reasonable price to raise their current utilization rate. To facilitate this it is important to identify the socio-economic as well as technical constraints which hinder the increased utilization of such inputs in particular in the range of small holder agricultural activity. Most fertilizers and pesticides currently in use in African agriculture are imported, representing extension of technologies developed largely in the industrial world. These may not always be suitable for tropical climate, especially after sustained applications. Hence, appropriate bio-chemical technologies, based on available resources and suitable for the tropical areas need to be developed to ensure sustainable increased production and to protect the environment;
- (vi) Exploit fully the irrigation potential existing in Africa by both efficiently utilizing existing irrigation facilities and increasing the area under irrigation. Governments should accelerate plans to train required manpower -- at farms, artisan, technician and managerial levels -- for irrigation farming and to undertake research on cheaper ways of constructing and managing of irrigation infrastructure and water harvesting techniques. Of fundamental importance is the need to shift emphasis away from a large scale irrigation projects to building national networks of small-scale and medium-scale irrigation facilities;
- (vii) Allocate resources to develop and disseminate new technologies in storage and processing that are not only effective in reducing post-harvest losses but are also within the economic reach of ordinary operators. This is necessary to minimize post-harvest crop losses due to existing poor storage, processing and transportation;
- (viii) Take urgent steps to launch national grass root farm credit schemes that are accessible to all rural income groups, especially the poorest of the poor. This will ameliorate the adverse income inequality consequences of new technology during the transition period;

- (ix) Establish appropriate institutional modalities for monitoring the implementation and consequences of rural technology policy and programmes. National workshops should be organized to sensitize the policymakers and the general public to critical issues in the generation, promotion, dissemination and consequences of new rural technologies.

B. Medium Term:

- (i) Member States should adopt a number of measures to expand indigenous technical capacity. This will mean:
- (a) agricultural research and development should be inter-disciplinary, location specific and adaptive;
  - (b) there should be farm testing units to conduct tests and demonstrations of new technology packages;
  - (c) on-farm research to develop and improve upon the existing simple low-cost technology packages, which fit different farming system. Such research, inter-alia, will give thorough knowledge of the farming system of small farmers;
  - (d) local production of appropriate implements and yield raising inputs;
  - (e) promotion and encouragement of acceptability and use of locally designed implements;
  - (f) emphasis on informal technical education exchange between rural craftsmen and their counterparts in urban areas;
  - (g) upgrading blacksmith sector through training, provision of workshops and simple tools.
- (ii) Member States should revamp and revitalize existing extension services through:
- (a) training, motivation and adequate transport to enable extension workers to reach farmers;
  - (b) improved marketing and distribution channels of alternative technology;
  - (c) regional survey to assess the market for various technologies made within or around a given area; and
  - (d) incentives for effective interface between farmers and extensionists on one hand and extensionists and researchers on the other.

- (iii) In order to ensure co-ordination among subsectors, member States should take urgent steps to unify and streamline under one ministry of agriculture, all departments, dealing with crops, forestry, fishery, livestock, co-operatives and marketing;
- (iv) The member States may take steps to diversify production to reduce socio-economic risk by:
  - (a) shifting to alternative non-traditional agricultural exports;
  - (b) modernising traditional agriculture and
  - (c) developing new technologies in subsistence food production.

C. Long Term:

- (i) The member States should in the long run; launch national programmes in rural feeder roads and rural market networks. Where existing facilities have broken down, they should be reconstructed and rehabilitated. Unless rural infrastructures are provided on a massive scale, technology policies will continue to have limited impact;
- (ii) Adequately fund detailed farm management studies within the broad framework of social and economic policies of respective countries;
- (iii) Incorporate vocational courses in school curricula and introduce basic education to facilitate technological awareness. The detailed project proposals for technology transfer, development and diffusion should be worked out at national level and presented to potential financiers as joint ventures. The project ideas should be worked out at national level and the detailed projects submitted to potential financiers as joint venture enterprises;
- (iv) Science and technology establishments in different countries will have limited impact when they are not properly integrated with ministries with executive responsibility for agriculture and rural development. Governments should streamline existing institutional arrangements with emphasis on the need to give science and technology the highest possible level of political authority. In this way, priorities in agriculture and rural development can be directly translated into priorities in science and technology, resulting in timely development of appropriate technologies;
- (v) Existing mechanisms for co-ordination of technological development and dissemination should be supported and strengthened to optimize the pay-off from technological innovations to all concerned;
- (vi) Request ECA to assist them in harmonization of technology policies at national, sub-regional and regional levels;
- (vii) Authorize ECA for monitoring progress and submit periodic reports on the implementation of the above-mentioned recommendations, based on a region-wide study of the impact of technology on food production and rural development.