Makerere University College

Department of Rural Economy and Extension

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Planning Methods for Agriculture in Less-Developed Countries

by

D. G. R. Belshaw

5th August, 1969.

Makerere University College

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This paper will consider agricultural planning methodology under four heads. Firstly, the major features and problems of the typical agricultural sector in a less-developed country are discussed with particular reference to the economic planning process. Secondly, standard planning procedures for the inter-sectoral allocation of resources are assessed from the point of view of their feasibility and accuracy for the agricultural sector. The identification of alternative strategies for agricultural development is then discussed briefly and finally the main features of a systematic planning procedure for the agricultural sector are presented.

The Characteristics of Agriculture and the Construction of Plans:

We are concerned here with the low-income economy where agriculture provides the major source of foreign exchange earnings and supports directly on the land at relatively low levels of real income the majority of the population.. Most agricultural production is derived from small-scale family-operated holdings typified by low productivities of land and labour, the major factor inputs. A large proportion of output is either consumed directly on the farm or is sold in rural markets outside the recorded monetary sector. There may also be a smaller plantation or large-scale family sub-sector, often based originally on foreign private capital investment, but probably with an important element of more recent public sector participation through para-statal companies, state farms, etc. A larger proportion of production inputs in this sub-sector will be purchased in factor markets. The land-man ratio will vary widely between economies, and

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1. This paper was prepared for the Planning Methodology Course run by the Economic Development Institute of the World Bank at University College, Nairobi, July - August 1969.

2. Reader in Agricultural Economics and Head, Department of Rural Economy and Extension, Makerere University College.

within them; given a reasonable degree of labour mobility it is possible, and necessary,[1] to distinguish between land-surplus and labour-surplus economies.(1)

The population growth rate is typically of the order of 2 - 3.5% p.a. and although the urban sector may be expanding even more rapidly its relatively small share of total population dictates that for one or two generations in the future the absolute size of the rural population will continue to increase.(5)

The industrial sector typically have received high planning priority and the most obvious opportunities for import-substituting industrial development will have already been exploited. Unless there are special circumstances enabling a rising level of exports of industrial products, the rate of growth of the industrial sector after this first phase of import-substitution will be dependent mainly on the rate of increase in national income, which in turn is dependent largely upon the progress of the dominant agricultural sector.

The nature of the agricultural sector itself poses special problems for the planning process.

(i) As the major user of the country's natural resources, productive activity in agriculture is subject to the high degree of heterogeneity commonly found in the areal distribution of soil fertility, rainfall reliability, altitude, etc. Also, distance itself is a major variable affecting agricultural productivity, so that transport and processing plant location decisions have important implications for agriculture. Consequently, production programmes must be disaggragated sufficiently, and contain sufficient flexibility, to adjust to local environmental consitions. Effective regional (i.e. sub-national) planning procedures are particularly important for the agricultural sector if the inaccuracies of centrally-determined programmes are to be minimised.

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1. It is particularly important to avoid the uncritical transfer of an economic model derived from a labour-surplus economy to a land-surplus economy, as this will result in the underestimation of the potential gains from the autonomous expansion of low-cost small-scale agriculture using present or only marginally improved techniques of production. See, for example, the cautionary case of experience with agricultural development in Tanzania (2, 3, 4).

(ii) The fact that the majority of the population is dependent upon agriculture for their livelihood usually subjects the planning process for agriculture to strong, conflicting but very specific political pressures. The political pressure for income - generating projects is usually focussed on specific crops or projects which may be technically unsuitable or non-viable in that particular area. The ability to avoid resource-allocation to low-yielding projects often depends largely on the ability to provide politicians with alternative higher-yielding projects, given their strong motivation to secure some tangible form of development for their constituents. In other words, the comprehensiveness of ex ante appraisal work for all the important rural areas is most important.

(iii) To meet these two requirements of agricultural planning, a considerable body of statistical data is required, disaggegated by region and by commodity. At the same time, the costs of data collection are considerable because of
a) the very extensiveness of agricultural production
b) the typical small-scale organisation of agricultural production and marketing, and of much agricultural processing activity, and
c) the prevalence of illiteracy or inadequate education making self-recording and accounting schemes impracticable in most cases. Consequently, accurate production data exists usually only for the large farm/plantation sector and for export crops not subject to subsistence consumption e.g. cotton and coffee. A less-developed country is relatively well-placed if, like Uganda, it has reasonable estimates of crop acreages, livestock numbers and yields. Even then, data is typically missing or fragmentary on intra-rural sales of agricultural produce, small-scale agricultural processing, (especially beer brewing and spirit distillation), net capital formation, technical and economic aspects of farm systems, (especially labour inputs, supply elasticities and substitution effects), the rural labour market, and rural income, expenditure and cost of living studies.

(iv) The lack of planning data will be more serious the stronger the emphasis on direct central-planning for the private sector and the larger the control of the public sector over required inputs. Whilst the risks of errors in capital investment decisions will be less where more indirect, indicative planning methods are used, even here absence of data and accompanying economic analyses of, for example, rates of private capital formation and supply elasticities will place economic decision-making in a risky environment.

The Use of Aggregated Statistics to Determine Agricultural Sector Plans:

The absence of much basic data and the high cost of assembling it (particularly the opportunity costs of employing economists and statisticans to collect, tabulate and analyse it) inevitably means that agricultural planning tends to be a rather subjective art, relying heavily, at some points at least, on the intuitive judgement of the planner. The construction of sophisticated, highly disaggregated projection or input-output models, such as have been compiled by Dutch(6) and French (7) agricultural economists is clearly out of the question in most less-developed countries for the present. If there are reasonably reliable household consumption and agricultural production statistics, then these can be coupled with data for the international trade sector to provide detailed national projections for supply and demand of marketed agricultural products as has been attempted for Ghana(8). Even in this case, however, the unreliability of data for agricultural production appears to put many of the ensuing calculations on dubious ground. Nevertheless, such attempts are valuable in indicating key areas where strengthening of agricultural statistics would have a high pay-off in enabling more reliable and additional projections to be made as a basis for investment planning andother policy decisions.

The use of short-cut estimating procedures for determining the role of the agricultural sector in a national development plan has been reviewed recently by Ayazi(9). He discusses first the use of national income accounts to determine the required rate of growth of agricultural sector output over a plan period.

A simple equation enables the determination of a growth rate for agriculture which will be consistent with a previously selected growth rate for industry (assuming reliable data). Ayazi states dogmatically that the industrial growth rate should be selected first, as it is less dependent on agriculture than the other way round. This would appear not to be a universal situation, however, for the following reasons: a) A large proportion of the agricultural sector's inputs consist ofland, labour and internally generated capital (auto-investment) e.g. seeds, breeding stock, wooden structures, etc., b) The supply of purchased inputs is not usually dependent on the existence of domestic industry; in fact, a protected tractor or fertiliser plant may raise input prices, c) The growth rate of the industrial sector is often constrained by the bouyancy of domestic

demand, which, as we have mentioned already, is likely to be dominated by rural incomes. If agricultural crops fail, for example, domestic industrial and commercial activity becomes depressed. Where this situation prevails, it is clearly safer to gear expected rates of industrial growth, social service expansion etc, to the highest 'safe' rate of growth of which the agricultural sector is capable. Initial planning attention should then be focussed intensively on agriculture. The other sequence tends, in my experience, to lead to inflated growth rates for industry etc. founded upon a large measure of wishful thinking about possible agricultural sector performance.[1]

The use of perspective planning models founded upon estimated sectoral incremental capital-output ratio's (I.C.O.R's) has received a fair amount of critical discussion in the planning literature (planning methods are outlined in (10)). As far as agriculture is concerned, apart from faulty data and unrecorded auto-investment, the major objective of technical and structural innovation is, of course, to improve on past capital: output ratios in the sector.

The use of a disaggegated input-output table for the agricultural sector becomes increasingly desirable as the complexity of forward and backward linkages increases (see 6). However, Ayazi concludes: "Can the input-output technique be applied to the agricultural sector of a developing country? When one considers the pros and cons of the case, the answer is most likely to be in the negative" (9:6). Reasons are similar to the dangers of using I.C.O.R's - paucity of data, the non-applicability of fixed coefficients - and the weak degree of structural inter-dependence in early phase, open economies.

Greater returns to the efforts of planning and research economists seem much more likely to accrue to detailed micro-economic, partial equlibrum analyses of particular markets, farming systems, new techniques, projects etc., especially in view of the prevailing absence of economic analysis at this level. We shall give some instances of the need for this kind of work in the final section.

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1. For example, the Uganda Second Five Year Plan contains a highly inflated cotton production target; this was raised in in the last stages of plan formulation. This had the doubtful advantage of appearing to justify higher rates of growth in other sectors.

The Choice of Agricultural Development Strategy:

The major tasks of the agricultural sector in the economic development of the national economy are generally similar in most less-developed countries. These are: (i) a major, rapid increase in net foreign exchange earnings, mainly through increased export earnings even in the face of falling prices, but also through import substitution; (ii) providing raw materials to domestic industry; (iii) providing the food supply of the rapidly growing urban sector at constant prices; (iv) supplying capital, through taxation and/or private profits, to finance investment in the non-agricultural sectors of the economy; (v) providing the major market for the products of the protected industrial sector, and (vi) the creation of employment and, preferably, rising incomes for the major part of the national labour force in the early phases of growth, and then latterly releasing a net outflow of labour to the more rapidly growing urban areas.

Some of these tasks may conflict with others e.g. (iv) with (vi), and different projects and policies will contribute more to one objective than another. Questions of balance between objectives should be resolved within the planning process in the light of detailed assessment of the range of alternative possibilities. However, a broad concensus on the type of strategy to be followed is likely to increase the efficiency of planning.

For example, we have already mentioned that high overall rates of population increase coupled with the small urban base mean that even with the most optimistic assumptions about urban expansion, the rural population will continue increasing in numbers for at least a further one to two generations. This implies that in many rural areas farm sizes will continue to decline through the process of subdivision and that the real cost of farm labour will also continue to fall in areas away from the major cash crop developments. It is these realities which make fallacious a widespread 'large farm' approach to agricultural development. This is usually combined with a veneration for labour-saving mechanisation on the assumption that what is modern and technically impressive must be an improvement on labour-intensive techniques. Clearly, if the real cost of farm-labour is likely to fall, labour-saving capital investment will tend to become less economic, not more so. In some cases, large-scale farming may be economically, as well as financially, viable because the increased output offsets the higher input costs. But the uncritical adoption of much imported farm machinery from overseas ignores the fact that it has been evolved to displace farm labour costing several times (in terms of equal work performance) the cost of farm labour in the less-developed countries. The inevitability of further rural population growth also casts doubt on the wisdom of limiting land registration to a

minimum full-time holding. De facto sub-division will occur in any case, so that the value of legally secure title will be lost. The increasing emergence of part-time farming in the vicinity of towns on the Central European pattern, rather than a "broad acres" pattern as in England or the Mid-west, would seem to be inevitable, and has major implications for the design of agricultural research and extension activities.

These considerations, coupled with much adverse experience with capital-intensive development projects has led to an increasing recognition of the probable superiority of the 'improvement approach' to agricultural development i.e. the injection into the existing pattern of small-holder agriculture of improved practices and products based on the findings of applied research which are reinforced by technical and economic advice and credit facilities. This approach promises to combine the scarce factors of management know-how and capital with the greatest quantity of relatively plentiful and under-utilised factors - agricultural land[1] and rural labour.

Some such choice of broad development strategy for agriculture, based on an a priori economic appreciation of the trend of relative factor proportions in the rural economy, together with ex post evaluation of the real impact of the various projects and programmes (with accompanying explanatory analyses) should underly the construction of a detailed sectoral plan for agriculture. Firstly, it should help focus scarce planning and research resources upon potential areas likely to yield high-priority projects. Secondly, it should reinforce a critical attitude to expensive projects lying outside the adopted strategy. The possibility remains that some transformation schemes could show, for example, high benefit: cost ratios. The onus, however, would now lie on the scheme's proponents to demonstrate the liklihood of this event, rather than a major effort having to be made by planning economists to register a negative achievement, the exclusion of a sub-economic project from the plan.

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1. Even if land is presently fully cultivated, it is typically giving low physical yields of low-value crops. If opportunities exist for profitable technical innovation to increase yields or to switch to higher-value products, then the land resource is being under-utilised in an economic sense. /currently

A Systematic Planning Procedure for the Agricultural Sector:

A strategy for agricultural development must be expressed through the agricultural plan, which contains an array of specific emprirical programmes, projects and policies; this must then be implemented rapidly and effectively. In each case quantitative decisions on scale, timing, location, organisation etc. must be made. If this micro-level decision making is of poor quality the broad strategy itself will become discredited, and the fashion pendulum will probably start to swing again in search of another strategy that appears to promise better results.

The real effectiveness of the agricultural sector plan depends largely on the accuracy of *ex ante* selection of projects, programmes and policies on the one hand, and on the modification of these approaches both on the basis of careful *ex post* evaluations of their actual impact upon productivity and of changes in exogenous factors over time. Applied economic analysis has only recently begun to be used at this grass-roots level in Tropical agriculture and then only in a spotty fashion. The agricultural sector plan should include the following major elements:

(i) The creation of a framework of commodity priorities, based on careful market research, which can inform the selection of specific projects or programmes.

(ii) The consistent application to all new projects of the benefit: cost appraisal framework, requiring estimates of the project's impact on national income, foreign exhange earnings, government revenue, high level manpower, employment and regional income distribution. Particular care is necessary in correctly calculating shadow prices for agricultural output, given the common occurence of supply restriction schemes, import quotas, price regulation, subsideies, etc.

Development priorities should be accorded only when as full an array of projects as possible can be compared with each other. At present in East Africa benefit: cost analysis is used mainly on single projects at the stage when supporting evidence is required for submission to a potential aid donor, i.e. as a window-dressing device to justify previous selection of the project. It may even have been written into a 'Plant', but unless it has been properly appraised doubt should remain about the inclusion, or whether a more efficient version might not have been designed.

(iii) Detailed micro-economic analyses are a necessary component in this aspect of agricultural development plan formulation. They are needed not only in the assessment of new projects or programmes. A very large part of public resources allocated to agriculture is of a

recurrent nature, especially on agricultural extension work, research and farmers training. This expenditure is only justified if it contributes sufficiently to increased production; it is therefore 'developmental' in object if not in form. The effectiveness of this expenditure should be evaluated systematically, e.g. by providing information on the expected time flow of costs and benefits of the several research projects. Economic analysis should also inform the design of many individual research projects, especially in the areas of agronomy and animal management research (1?). The parameters measured should include those necessary to relate the proposed innovation to typical farm level situations, e.g. experimental data on seasonal labour requirements. A full set of data would enable pretesting the experimental results in one or more farm models which have in turn been constructed on the basis of farm management field surveys. This work requires the establishment of production economists on the staff of major research stations.

Three main dimensions are involved in the evaluation of effectiveness of agricultural extension and farmers' education: a) measuring the physical and value productivities of agricultural personnel with different levels of training; (b) devising optimal allocations of existing staff cadres between commodity production programmes and projects;(c) deciding on the appropriate size and mix of agricultural manpower training programmes, including retraining of existing staff. It is clear that a positive manpower planning approach is absent from current decision-making in this area and that economists have the task of evolving workable procedures which will improve on present methods.

(iv) The smallest coherent and comprehensive administrative unit for implementation of public sector activity should form the basic module in designing and implementing the agricultural plan. Proposals should emanate upwards from this level, the implications of the final plan should be tested at this level, and finally District agricultural programmes, output targets etc., should be published as part of District Plans.

(v) Policy targets specific to agriculture should be made explicit and alternative agricultural plans, comprising different project selections should be tested against these. It is particularly important to make explicit judgements about trends in producers' real incomes in the private sector, given the key role of incentives in calling forth extra effort from the private sector (12). The national food balance sheet is another such policy

variable lying almost wholly within this sector.

(vi) Provision should be made for modifications to the plan, on the basis of ex post evaluation, new market information, etc. A 'rolling plan' has many attractions in this regard. The plan should itself specify research studies and statistical data required to improve the planning process over time (see 13). This is a major topic which would justify several other papers; farm management and adoption surveys should be mentioned as particularly important, however.

(vii) The agricultural plan must, of course, be checked for consistency against sum total of all other proposals. Major adjustments, however, may more probably be adviseable in the other, dependent, sectors rather than in agriculture.

Fitting these elements together, the planning sequence would logically take the following form:

Stage I: Evaluation Stage

(a) Effectiveness of individual Projects and Programmes

(b) Achivement of agricultural policy goals, e.g. diversification, farmers' incomes, etc.

(c) Contribution to National Development objectives.

Stage II Project Appraisal Stage:

(a) District-level proposals for projects, programmes, etc.

(b) Commodity Production Proposals:

i Market Research
ii Financial profitability Farmer/tenant level
iii Scheme Profitability
iv B.C. analysis

Stage III Forward Linkage Implications

(a) Transport

(b) Marketing organisation:

Internal

International

Regional Groupings

(c) Storage capacity

(d) Pricing Policy incl. fiscal aspects.

(e) Processing industries

Stage IV: Backward Linkage Implications

(a) Research

(b) High-level agricultural manpower

(c) Land tenure

(d) Agricultural credit

(e) Agricultural extension and farmer training

(f) Fertiliser and other chemicals, machinery, seed, feed, breading stock supplies

(g) Domestic industries producing agricultural inputs.

Stage V: Project Selection: Trial Agricultural Policy Balance

(a) Foreign Exchange: totals and risk element

(b) Food Balance

(c) Farmers average incomes

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(d) Regional Income Distribution and Employment
(e) Government Revenue
(f) Raw Material supplies to Domestic Industry
(g) Savings and Investment
(h) Land-use

Stage VI: Agricultural Sector Plan Formulation: Trial National Plan Consistency Check

(a) Foreign exchange
(b) Government Revenue
(c) High-level Manpower
(d) Employment
(e) Regional Income distribution
(f) Size of rural market for domestic industry

Stage VII: Implementation Preparation: National Plan

(a) Section in published Regional Plan
(b) Project descriptions for donors etc.
(c) Ministry targets and guidelines
(d) District Development plans
(e) Contingency plans
(f) Periodic review sessions
(g) Evaluations ex post
(h) Collection basic statistical series, improved planning data, detailed project/ policy studies, etc.

The stages would not necessarily be followed in strict chronological sequence. Work on stages I - IV could be started smoultaneously by separate planning teams. Stages V and VI would follow each other closely, whilst much of stage VII would have to await final approval of the National Development Plan.

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