
World Setting: Economic and Social Constraints [and Discussion]

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World setting: economic and social constraints

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This paper outlines some of the social and economic constraints which, particularly in developing countries, tend to slow down or even block the introduction of advances in irrigation and allied techniques which can do so much to increase efficiency and raise productivity. The nature of the constraints, chiefly affecting the achievement of the higher levels of productivity made possible by irrigation, are discussed in relation to system management and farmer motivation and incentives. The need to overcome these constraints is plain, because the scope for increased production through irrigation is so great and so necessary. Because governments and financing agencies tend to favour them, for reasons ranging from prestige to relative ease of appraisal and financing, irrigation schemes in developing countries are often large-scale projects and tend to be composed mainly of small mixed-crop farms. This combination too often generates constraints which limit, in practice, potential productivity. For the small farmer, the key constraint is seen as basic security: the removal or reduction of this constraint involves both more efficient and responsive system management and sensible economic and social policies on such issues as pricing, land tenure and credit. If the small farmer feels secure, he may readily respond to new techniques and inputs provided he is made aware of them and their potential benefits to him. The necessary information and advice is often poor or lacking. While conventional extension services obviously have a role to play, they are frequently weak and inadequately backed by research. It is suggested that, to improve the situation, advisory services provided by credit organizations should be more widely developed; private sector involvement right across the development spectrum should be strongly stimulated; and more flexible policies should be pursued in relation to size of farm unit, so that at least a proportion of larger farms or commercial estates are included in projects, the latter possibly with formal or informal linkages to neighbouring small farmers.

INTRODUCTION

This paper attempts to review, necessarily in somewhat broad terms, the impact of economic and social constraints on the successful development of irrigated agriculture. The economic justification for irrigation derives essentially from realization of the benefits made possible by the initial capital investment together with the costs to be incurred in operating the system. It is in this area – the realization of benefits – where social constraints can become really significant: mainly in the ‘developing’ countries, though the degree and nature of such constraints varies very widely between countries and even within individual countries. It is sometimes argued that investment in irrigation can be justified on social grounds alone, but while there are often very strong social benefit arguments for irrigation there seems no good reason to accept low productivity as a necessary condition in such a context. Realization of the high levels of productivity that irrigation makes possible should be the proper and necessary justification for investment. What must cause concern is the extent to which irrigation schemes fail to recover capital costs and even, in what seems to be an increasing number of cases,

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recurrent costs. In effect, many new developments are heavily subsidized; and the need for such support lies largely in the failure to achieve the results which are theoretically possible and, indeed, the results on which the initial investment has been justified at the planning stage.

The main purpose of this symposium is to review scientific advances in irrigation. The potential which such advances have for improving efficiency and productivity can be clearly demonstrated: the realization of these benefits in practice is less straightforward. The first four papers discuss different aspects of irrigation in a worldwide context. I propose to make a distinction between the so-called developed and developing countries, and to concentrate almost wholly on the latter. In the context of the subject – economic and social constraints – there are good reasons for doing so.

DIFFERENCES BETWEEN 'DEVELOPED' AND 'DEVELOPING' COUNTRIES

It is probable that few of us like the terms 'developed' and 'developing', implying as they do a rather rigid distinction between two groups of countries. In fact, of course, there is no hard and fast division: there are borderline cases difficult to characterize one way or the other, and as economic progress is made, 'developing' countries become 'developed'. There are, however, certain general characteristics of the broad 'developing' group of countries that are significant in the present context. Most have a large or predominant rural sector, a generally low *per capita* income, and most are also situated in tropical or subtropical regions. All these factors are relevant in relation to irrigation, because irrigation can be so important in mitigating or effectively eliminating uncertainties or deficiencies in rainfall, and can thus contribute to increased prosperity in those sections of the economy which most need it. The importance attached to irrigation development in these countries can be clearly demonstrated by looking at the funds provided by international agencies. The cumulative lending of the World Bank (i.e. the loans of the World Bank and I.D.A. (International Development Agency)) for irrigation and drainage totals nearly U.S. \$6000 M, nearly one-third of total spending on the agricultural sector as a whole, which includes forestry and fisheries. As agricultural lending includes large amounts devoted to, for example, agricultural credit, research and extension (a substantial proportion of which will relate to irrigated agriculture), the proportion of lending directed towards irrigation is likely to be well over 40% of the total for the sector. In fiscal 1984 alone, World Bank lending on irrigation (World Bank 1984) totalled U.S. \$675 M (U.S. \$161 M from World Bank and U.S. \$514 M from I.D.A.).

There is, however, another factor that has to be taken into account in considering economic and social constraints on irrigation in developed and developing countries. Most developed countries have, almost by definition, a more or less fully developed market economy, *per capita* incomes which allow full market prices to be paid for agricultural and horticultural products (subject to distortions deliberately introduced in some cases), relatively better educated and profit-orientated users of irrigation (whether individual farmers or commercial growers), a generally strong private sector providing equipment and agricultural inputs, and well funded and effective research organizations in both public and private sectors. In such a situation, there is usually a strong demand from the user for improvements, and a capacity for rapid appreciation of the benefits to be derived from adopting new techniques or improved inputs. In a real sense research and development are stimulated by pressure from the users, together with the commercial advantages which accrue to private sector business in encouraging new

equipment and enhanced input sales. Both economic and social constraints to the adoption of improvements tend to be minimal.

This is not always so in developing countries. While the points made above are generally valid in most developed countries, the situation in developing countries may vary (even between regions within the same country) from that where at least some new techniques and inputs are readily adopted to that where constraints are so severe that progress can only be achieved with extreme difficulty. The reasons why such constraints exist, and why they operate so differently in different countries, are far from simple, but seem mainly to relate to two main areas: the overall management and operation of irrigation systems, and the capacity and incentives of farmers to react to new opportunities and to adopt improved techniques. The two areas inevitably overlap, because management in its broadest sense should include not simply the operation of the physical water supply or drainage system but the whole range of inputs and services required by the farmer. In spite of this overlap, it may be convenient to consider operation of the system and the constraints which this may impose, and to deal with constraints relating more specifically to farmers separately.

SOME PRINCIPAL THEMES FOR DISCUSSION

To attempt to identify the nature and impact of social and economic constraints on irrigation, it seems worthwhile to state some propositions for discussion as follows:

(1) Conventional wisdom emphasizes the 'small is beautiful' concept. This is perhaps most obvious in the almost universal emphasis placed, in developing countries, on development via smallholders. It is suggested that a serious rethink is needed. A subordinate proposition is that, whatever the results of such a rethink, development based on small holders will continue to be a strong, though hopefully not exclusive, element. It is suggested that, in this case, we are poorly organized to serve the small farmer properly.

(2) The second proposition is that experience suggests that development based on the private sector is more effective than that undertaken by the public sector, and that private sector involvement should be encouraged whenever possible. But because public sector involvement is to some extent inevitable (especially on the larger schemes, where small-scale irrigation development is not feasible), there must also be a major effort to improve its performance.

SYSTEM OPERATION AND MANAGEMENT

Two approaches to improvement are considered here: one attempts to minimize operational problems by altering the emphasis on capital as opposed to recurrent costs when deciding on alternative designs for schemes; the other is concerned with improvements in management to increase responsiveness and accountability to farmers.

(a) An economic approach

Two recent papers on the economics of irrigation (Carruthers 1981; Finney 1984), have drawn attention to the central problem: that in all too many instances performance, in irrigation projects, falls short of technical projections and targets set, even when targets are at what the planners considered to be a conservatively realistic level. Finney cites inadequate standards of operation and maintenance as the main reason for the shortfalls in performance

which occur, and gives a series of factors contributing to such inadequate standards, which include (i) shortage of funds in the public sector; (ii) socio-political factors which give more weight to new projects than to proper running of existing ones; (iii) shortages of skilled and competent staff, with operation and maintenance being given low priority, a situation exacerbated by the first two factors listed; (iv) inadequate infrastructure, services and implementation capacity; (v) inadequate planning and design.

Finney suggests that the first of these is the single most important factor. Operation and maintenance funds almost always suffer when funds are allocated. Capital expenditure equates to glamour and votes: operation and maintenance expenditure gets no votes. Thus expenditure gets politically distorted. All the factors, however, are significant: though in my view inadequate planning and design is the least serious generally.

To these factors I would add one other, i.e. incentive. In most public sector agencies there is little incentive on the part of staff to improve performance and efficiency: no particular merit attaches to good work or penalty to poor work. In such circumstances it is not surprising that, as Finney puts it: 'in most countries poor operation and maintenance is more widespread in public sector than in private sector schemes'. He goes on to point out that private operators may be affected by the same constraints (lack of foreign exchange and difficulties in importing spare parts) but often seem to manage to overcome them.

Finney's view leads him to suggest that there could be important advantages, when planning irrigation projects, in examining much more critically the choice between technical alternatives with high capital costs and low recurrent costs and others with the opposite pattern of expenditure. If the final selection is based, as is usual, on least-cost economic analysis, with the use of conventional discounting methodology whereby all costs, both capital and recurrent, are discounted at the opportunity cost of capital (usually 8–15%), low-capital-high-recurrent-cost alternatives are almost inevitably preferred. For reasons already given, this may not be desirable. Finney suggests that because in many developing countries capital funds for public projects may be relatively readily available from foreign aid sources (whereas local funds for recurrent expenses are usually scarce), a better approach would be to apply different interest rates for different types of expenditure, to take account of the different opportunity costs. Where capital funds were abundant but recurrent funds scarce, capital costs and recurrent costs could be separately valued. Project evaluation, following this course, would tend to favour high-capital-low-recurrent-cost alternatives, rather than the reverse as at present.

This is an approach that seems to deserve serious attention, at least in planning new projects. Its greater application would appear to be in relation to surface-water development alternatives: groundwater development tends to involve relatively low capital expenditure, but higher operation and maintenance costs. Direct comparison between surface-water and groundwater alternatives, on the basis proposed by Finney, tend to favour the former: a choice which could ignore the advantages that groundwater development can have in relation to flexibility and greater control by the users. Singh (1979) points out that in India, cropping intensities and standards of crop husbandry on tube-well irrigated farms exceed those on all other units of agricultural production; and that small farmers in such situations have effectively increased their productivity by being able to shift to multiple cropping systems, thus greatly improving their incomes.

(b) System management

The key elements should be to encourage efficiency and responsibility towards the end user (the farmer) in management.

In public sector schemes, which seem bound to continue to dominate the large-scale sector, the following areas seem to merit increased attention.

(i) Better training for staff on public sector schemes. An obvious need, but not so easy to achieve in practice. Both on-project training and external courses have a role to play. In connexion with the latter, the Mananga Agricultural Management Centre in Swaziland (a Commonwealth Development Corporation project) has been chosen by the Commonwealth Secretariat to mount a course, in May 1985, directly concerned with management of irrigation schemes.

(ii) Increased and improved use of monitoring and evaluation as a management tool, so that management is better able to measure performance against targets, to perceive what short-term action is needed, and to anticipate longer term needs. The World Bank's publication (Casley & Lary 1982) is a valuable contribution in this context. As the authors put it 'the key to success (in management) is a combination of timely action, concise reporting, and flexibility of response to unexpected developments'. There is no doubt that monitoring, properly designed and used, is a very valuable tool, and especially appropriate on large public sector projects. It must, however, be kept as simple as possible, and geared to recording the factors which really matter. The danger, in the bureaucratic situation which results in most public sector schemes, is that monitoring becomes an end in itself, rather than a tool of management. As this publication puts it 'the tendency to include everything that may be of interest . . . must be avoided. It is this tendency which leads to monstrous book-length questionnaires and results in poor quality of data collection for the important indicators'. Apart, one might add, from undue harassment of the farmers.

(iii) Improved motivation, particularly for operation and maintenance staff. Too often these tend to become 'poor relations', given low priority by overall management and excluded from special allowances often paid to those on construction of new projects. In two projects in India recently financed by the World Bank, in West Bengal and Uttar Pradesh, this problem has been recognized and the management system reorganized so that construction and operation and maintenance are separated, with equal status for both rather than the latter being, effectively, subordinated to the former.

(iv) Improved responsibility and accountability to the farmer. A potentially interesting way of achieving this is being tried on the project in West Bengal. The aim is to take advantage of local 'grass roots' organizations – the village 'panchayats', which are elected councils – to help overcome lack of motivation and flexibility within line departments and to eliminate inefficiencies. It is argued that the local panchayats have a strong incentive to satisfy as many beneficiaries of the scheme as possible, because the panchayat committees are elected and each farmer has a vote. They are also primarily interested in the performance of works within their territory and are thus able and prepared to enforce accountability. It is further argued that using the panchayats as managing agents would be an effective way to break the power of government-employed operators, one of the most important causes of inefficient operations at present – a refreshingly candid comment and an approach that could well be adopted and modified to suit local conditions, quite widely.

(v) Encouragement of smaller schemes, or breakdown of larger schemes into management units which could be clearly seen to relate to groups of farmers. This seems to be being attempted, for example, on the Upper Pampanga Project in the Philippines, as reported by Ng & Letham (1983), where farmer groupings are organized in relation to particular water distribution units. One frequently hears general condemnation of large-scale projects, and the parallel advocacy of small schemes as the solution to overall constraints. The trouble is that even if this thesis was accepted, the alternative (a complex of small schemes instead of a single large one) is often not a real one. This, of course, is particularly so for surface-water schemes involving major dams or diversion structures, and extensive distribution systems. Groundwater development, based as it is on relatively small individual supply sources, has much greater flexibility in this context.

(vi) Encouragement of more private sector schemes. This may not be feasible except for relatively small schemes, but almost all experience to date indicates superior efficiency on private sector as opposed to public sector schemes. The early pump schemes on the White Nile in Sudan provide a good example: effective private schemes that were nationalized and have since degenerated under public management so badly that the private sector is being invited to take them back – a sad story without, at present, a happy ending because the present state of these once flourishing schemes is such that there is little incentive for the private sector to resume ownership. One example of an effective mix of public and private sector development is provided by the East Ghor Scheme in Jordan. Here the public authority has provided the essential distribution system – including piped water supplies to every farm – and a mixed population of farmers, ranging from individual smallholders to sizeable commercial units – has done the rest. The result is a vast market garden, using sophisticated techniques and inputs.

Effective action on all or any of these points would have direct impacts on farmers by improving the basic ‘security’ situation, which in irrigation is fundamentally influenced by timely and adequate water supplies, and by drawing the farmers themselves closer to management, even involving them directly.

THE FARMER – MOTIVATION AND INCENTIVES

(a) *The security factor*

The degree to which a farmer is in control of his essential resources – of which, in the context of irrigation, water is the key one – is one of the most important of the factors determining his interest in new techniques and higher inputs and his ability to adopt them. It could alternatively be described as the security factor. One is frequently told, particularly by officials in their own countries, that farmers are stupid, lazy, ignorant, conservatively resistant to new ideas, or all of these things. Farmers are criticized for not doing what the experts think they should be doing: they usually have very good reasons, if we bother to find out. The question of security is often at the heart of the problem, especially because so much of development effort is directed towards small farmers, often very poor ones. In my experience small, poor farmers are seldom lazy or stupid: ignorant they may be, and conservative too. This last should hardly surprise us, because adoption of an innovation which fails can, literally, be a matter of life or death for people living on the margin of subsistence. The degree to which a farmer will respond to or adopt innovations depends critically not only on his perception of the benefits – which may not always be what seem to be the obvious ones to outsiders – but also on what he sees as the level of risk attached. The nearer to subsistence level he is, the greater weight he will place on the risk factor. The

more he feels in control of the situation – being sure, for example, of timely and sufficient water supplies – the more likely he will be to accept innovation. This is just where inadequate standards of operation and maintenance on public sector projects hit hardest. The effects can be plainly seen, for example, in parts of Pakistan, where inadequate maintenance has led to great imbalance of water supplies between the heads and tails of canal systems. Farmers nearer the heads of canals, assured of regular and plentiful supplies, adopt high inputs and develop high cropping intensities and yields: farmers near the tails, starved of water, cling to basic subsistence low-input–low-yield farming. They really have little choice and, as a result, the irrigation scheme as a whole fails to produce the benefits it should. It should be emphasized here, however, that Pakistan is in no way unique in this respect, and the problem is to some extent inevitable in any water-short designed system. Being at the head of canal means having greater influence and more water when it is short, but the situation is made much worse by poor maintenance.

(b) *The farm size factor*

Another major issue that affects the adoption of new techniques and the achievement of higher productivity is the almost overwhelming emphasis placed on small farmers in virtually all developing country projects, an emphasis strongly sponsored by aid agencies including the World Bank – though in the Bank’s case a major internal debate on this issue seems to be in progress. The social basis for this emphasis on small farmers is obvious, and some countries have carried it to extremes by effectively killing off the larger farm sector altogether. The ‘small farmer’ ethic has received a great deal of support in the literature as has the question of conflict between small and larger farmers. Lipton (1977) has written what is essentially a discussion of urban bias in world development, a general thesis that most of those concerned with agricultural development would support. He promotes the concept that smaller farmers make better use of resources than larger farmers who produce crops for the city dweller to eat. At the same time, the capability of the larger farmer to innovate, and so to encourage follow-up innovation, by smaller farmers is questioned. Neither proposition can be accepted without challenge. Much experience suggests the opposite, and the implication that there is something wrong about producing food for city dwellers seems somewhat strange. A complementary theme, developed by Falkenmark *et al.* (1980), is that of larger farmers developing at the expense of smaller farmers – specifically, that ‘it is increasingly recognised that the introduction of any technical improvement immediately widens the gap between rich and poor, whether it is in water supplies, tube-wells, or irrigation credits’. As Carruthers & Stoner (1981), in a World Bank publication on groundwater development, rightly point out, ‘it is tempting to conclude from this that, to prevent problems of inequality, new technology should not be accepted’. As these authors go on to say, new technology always appears to threaten equality, but the longer term effects are either to diminish inequality or to raise base incomes such that any increase in inequality becomes more palatable. Furthermore, practical experience suggests that it is easier to obtain a degree of wealth and income distribution when incomes are growing and when new resources or opportunities arise (provided these have not been wholly pre-empted by a particular group). In the early years of the seed and fertilizer ‘revolution’, it was common for larger farmers to be ahead in adoption: smaller farmers tended to adopt the new inputs after a varying time lag, but adopt them they did, on a very substantial scale, and to their considerable benefit.

(c) The communication or information gap

Another problem in relation to adoption of new techniques that is posed by the current emphasis on small farmers is that of communication. Unlike farmers in the developed world (who are likely to be bombarded by literature or visited by salesmen) or larger farmers in the developing countries who may have the resources or education to keep up with scientific advances in other ways, the average small farmer has little opportunity to find out about what is available unless it is brought directly to his notice. Although many countries are now trying to encourage private sector development in supplying equipment and other inputs, this kind of commercial thrust is as yet far from reaching most farmers in most countries. Reliance is thus placed on national extension services, most of which suffer from serious deficiencies: lack of motivation, poor training, even (because of lack of funds) provision of transport to allow them to reach farmers. As Adams (1982), discussing agricultural extension in developing countries, puts it, 'extension workers are often lacking in practical ability as a result of poor training and selection. Frequently their demonstration plots show how much they have to learn from the farmers they are supposed to teach'. Worst of all, perhaps, is a general decline in agricultural research, itself a combination of lack of funds and the low priority accorded to it by too many countries, so that extension workers lack a convincing message to farmers, even if they were capable of delivering it. For some food grains, notably rice and wheat, this failure of national research has been offset by international organizations (I.R.R.I. and I.M.W.I.C.) with notable effects. Policies (or the lack of them) which eliminate larger farmers, overconcentrate on small farmers, discourage private sector development, and place most projects in public sector management, all exacerbate the difficulties of adoption of new techniques for increased production.

OVERCOMING THE CONSTRAINTS

Although these largely self-generated difficulties are quite widespread, they are by no means universal. There are plenty of bright spots and positive developments which show the way ahead. Overall, as Professor Bunting noted in a lecture to the Tropical Agriculture Association (U.K.) in December 1984 on constraints to change in agricultural development, agricultural production in the developing countries has increased, albeit patchily and least satisfactorily of all in sub-Saharan Africa. Bunting's figures indicated that in the mid 1930s cereal production in these countries, with a population of about 1350 million, was around 220 kg per head. By 1982, with more than 3400 million people, output had been increased to about 240 kg per head – obviously a substantial increase in view of the very large increase in population. Average yields had increased from 1.13 to 1.96 tons† per hectare. Although these yields are still well below average yields in developed countries, and advances in production are unevenly distributed (in some countries food production per head has actually declined), the global achievement has been impressive. Locally, it has been more impressive still: South Korea, Taiwan, Malaysia, Indonesia, and most of the Indian sub-continent countries (and recently, perhaps most impressive of all, India itself) have all made great progress and offer lessons to others for the future.

What are the ingredients which could open up the way to more rapid adoption of improved

† 1 ton \approx 1.02 tonne.

technology and thus higher productivity? Some of these ingredients have already been indicated when discussing system operation and management. These are not wholly separable from measures more directly aimed at improving farmers' capacity for and incentives towards adopting new techniques: measures that are briefly set out below.

Pricing

One of the biggest factors holding back agricultural production in developing countries has been pricing policy – usually aimed at keeping urban food prices down at the expense of profitability on the farm. The message does seem to be getting through, albeit patchily. The National Bank for Agricultural and Rural Development in India, in its annual report for 1983–84, sums up current agricultural strategy as being 'geared to raising crop yields through expansion of irrigation, provision of seeds (of high yielding varieties), fertilizer, pesticides and related inputs, remunerative output prices for farmers, and provision of credit'. The strategy is obviously working, and the increased involvement of credit agencies in supplying directly an advisory service to smaller farmers may be an important way of tackling the overall problem of extension where the conventional approach has proved less than effective. On the other side of the coin, Tanzania was reported recently as seeking additional food aid while its own farmers were withholding grain from the market because of low internal prices.

Farm inputs

Much greater emphasis should be placed on encouraging private sector development in the supply of most farm inputs, from seeds to agricultural chemicals and machinery. Public sector involvement has been notoriously inefficient in providing effective inputs, and a number of countries are now moving towards much greater private sector involvement. A vigorous private sector would also make up, in some degree, for the rather widespread ineffectiveness of Government extension services, because businesses supplying inputs would have a definite interest in increasing the awareness of farmers of available improvements. The seed industry – a crucially important input and one that farmers accept most readily – is very much a case in point, with some awful examples of public sector failure. In Pakistan I once counted 14 distinct wheat varieties in a field of 'certified' seed produced by a state organization. No attempt had been made even to rogue the crop, and when I asked about the impurity I was told it was a result of genetic instability – an answer that made little sense, even in the unlikely event of it being true, because there seems little point in promoting a genetically unstable variety. At the same time the official lamented the fact that farmers did not buy his seed.

Land tenure

This, particularly in relation to tenancy arrangements, remains an important constraint in many countries. Tenants, often share-cropping rather than cash tenants, may have no security of tenure whatsoever, yet this is something that surely could be provided for by legislation. A lot more attention is given to abolishing the practice of share-cropping, which in fact is more favourable for the small farmer than is often admitted, than to provide against arbitrary dismissal of the tenant. No farmer can be expected to invest in improvement if he cannot see security of tenure beyond the immediate crop season.

Credit

This vital input has received a great deal of attention and investment, and is producing impressive results in a number of countries. The tremendous expansion of shallow tube-wells in Bangladesh, for example, and the increased production of (mainly) wheat and rice that has followed, has been achieved largely through making credit available, on easy and simple terms, to smaller farmers or groups of farmers. Credit is vital in the context of predominantly small farmer development, where capital availability is almost non-existent, at least initially.

A mix of farm sizes

I have mentioned earlier my concern about the overwhelming emphasis on irrigation schemes and indeed in agricultural development generally that is placed on the small farmer. The social imperative which has dictated this emphasis is wholly understandable, but the almost exclusive insistence on the smallholder – and the complementary exclusion of the larger farm sector – in so many developing countries does seem to me to exacerbate the constraints on development. A study of the history of agriculture worldwide suggests that the larger farmer has been in the lead in innovation where the agricultural industry as such has been really successful, and that there has been virtually no really successful development of agriculture where the private sector has not fulfilled an important, if not the dominant, role. Where would Malaysia be, now, if the private sector had not been able to develop oil palm and rubber crops as it did? Successful public sector settlement schemes have built on that experience, not the reverse.

I would therefore argue strongly for a reversal of the policy followed by many developing countries, reinforced by many well-intentioned but fundamentally ineffective programmes of land reform, which have weakened and in some cases virtually eliminated the larger farm sector. The best farm I have ever seen in Bangladesh was run by a larger farmer: he owned 60 acres, half managed directly with the use of paid labour; the other half being farmed by share-croppers. When I saw it, the whole farm was growing wheat, with water supplied by a deep tube-well, publicly installed under the owner's management. The crops were superb, throughout the farm. The share-croppers benefitted from the owner's services: he kept the tube-well running, supplied machinery services, and tested several new wheat varieties each year (I saw the trials). He was an enlightened, go-ahead man: yet described himself as an unwanted species. He has probably now abandoned agriculture, to agriculture's loss. In spite of all that is said against the larger farmer, and the abuse which the bad ones among them may be responsible for, there should be a place for them. They, like private sector firms supplying inputs, often lead the way in innovation and can generate a spin-off among the smaller farmers with whom they are in contact.

One variation on this theme is worth noting. In certain types of commercial crop development – notably for tree crops such as oil palm and rubber, the 'beverage' crops like tea and coffee, and also sugar – commercial nucleus estates have been successfully combined with smallholder outgrowers. The estates provide a range of production and marketing services, and small farmers can also benefit from infrastructural improvements initiated by the original commercial development. The Commonwealth Development Corporation has been one of the pioneers in this kind of development, both in tree crops and in irrigation (sugar in Swaziland, for example). Is there not a case for thinking seriously about the concept within the context of a large-scale mixed crop irrigation scheme? It does seem to be worth a try.

Finally, I would enter a plea, to both planners and potential managers, to think a lot more seriously about the needs and aspirations of the farmers on irrigation schemes when proposing the form development should take – a plea that really only reinforces an unstated theme running through much of this paper. In past years, this sort of thing was almost ignored: it seemed to be assumed that farmers would automatically do what the planners reckoned they should. Schultz (1964), in his book *Transforming traditional agriculture*, made this point strongly. It has taken a long time to sink in. New settlers have different problems from those already settled, whose situation a project aims to improve. The former may need all kinds of help in establishing an entirely new life: new crops, perhaps a totally new environment. I am vividly reminded of people resettled from the cool wet uplands of Sri Lanka (to make way for a dam) into the hot ‘dry zone’ in the lower reaches of the Mahaweli basin. No one had even attempted to explain to them the differences they would encounter, hardly an encouragement to enterprise. On a project in Nepal, in the western Terai (the strip of plain between the foothills and the Indian border) I encountered almost the reverse situation. In parts of the area where irrigation improvements were being planned, settlement was long established. The land was, in geomorphological terms, a ‘meander flood plain’, with complex variations in soil and microrelief. The people had, with immense labour, created an artificial landscape, meticulously terraced, to grow their main crop of rice. The water supply derived from an uncontrolled offtake from the main river, so that the canals only operated when the river level was high. As it was subject to fierce floods, sediment (including substantial boulders) was deposited in the canal offtake, almost blocking it by the end of the flood season. Each year, before the river rose, the people descended on the canal offtake and cleared it out by hand – hundreds of people, with bullock carts, camping out on the site until the job was done. The consultants planning the feasibility study (which involved a controlled offtake by means of a weir on the river, providing dry season supplies as well as better regulated wet season flows) – and I am glad to say they were not British – totally ignored the tremendous landscaping effort which had been made and recommended ‘rationalizing’ the whole distribution system (at the cost of extensive soil damage and crop disruption) and a handing over to the state irrigation authority of the operation of the canal. Instead of building on the enterprise of the local people and designing a project to help them in a positive way, the consultants chose to ignore (perhaps they even failed to notice) what the people had achieved on their own, in favour of a tidy and more ‘efficient’ system; and, moreover, proposed to hand over operation of the system to a public authority whose track record did not inspire confidence. Fortunately these issues were recognized in the subsequent design phase.

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Discussion

MARY TIFFEN (*Overseas Development Institute, London*). I agree with most of what Mr Robertson has said, including his recommendation of a mixture of farm sizes and security of tenure. However, there is some contradiction with his commendation of the outgrower model. Commonly in Africa outgrowers are given standard-size tenancies, which causes difficulty for those with smaller than average family labour resources and they have no great security of tenure.

V. C. ROBERTSON. Whatever may have been the experience in Africa in relation to smallholder outgrowers, there is no fundamental reason why either suitably sized tenancies or security of tenure cannot be built in to nucleus-estate – smallholder outgrower projects.

There are really two approaches to this concept. One is where freeholding small farmers voluntarily associate with a nucleus estate as outgrowers, using part or all of their holding, as they wish. The other is where a scheme is designed from the start as a complex of this kind, in which case the size of smallholding (whether freehold or tenancy) has to be carefully considered in the light of the crop or crop mix in mind, target incomes, labour requirements and so on.

I would never recommend a nucleus-estate – outgrower approach which neglected the vital issues of holding size and security of tenure.

T. W. TANTON (*Institute of Irrigation Studies, University of Southampton*). Many of the points raised by Mr Robertson are important in influencing the implementation of modern farming practices by peasant farmers, but I feel that the most important issue raised is that of farm size. Farmers with 1 ha of land or less, can never produce a very large crop surplus, because much of the land is required to produce food for the farmer and his family and, in many countries, the surplus production from several farms is needed to feed one urban family. Hence, the income of the farmer is very low and is inextricably linked to being a fraction of the average income of the urban family.

It is my experience that farmers and their families will work day and night, if need be, to feed themselves and pay the most essential bills. However, once a farmer has achieved this, he will not be willing to work as hard on the land unless the returns for his labour are equal to, or greater than, his perceived value of his time. In many countries, this value appears to be closely related to the minimum wage rate and the cost of basic commodities. The successful smallholder projects mentioned clearly illustrate this point. The successful C.D.C. projects all produce high-value cash crops such as tobacco, tea, coffee, etc., and their success can be attributed to the fact that they give a favourable return for the work involved in crop production. The fact is that improved agricultural practices for food crop production often

require considerably more work and investment than traditional farming practices, and the returns for the investment do not justify adoption.

It appears, therefore, that many of the perceived constraints are little more than academic while this overriding, apparently insurmountable, problem exists.

V. C. ROBERTSON. Dr Taunton's comments really add force to my concern about the great emphasis placed on development via smallholders. He is quite right in saying that once a small farmer has managed to feed his family and pay essential bills, any further effort to achieve surpluses above these needs require rather special incentives. Yet such surpluses are essential if urban populations are to be fed. Where high-value cash crops can be produced, the situation, as Dr Taunton notes, may be more favourable: but it is in relation to food crop production that the problem seems most intractable.

The more difficult it is to move the small farmer to produce more than he needs to provide for his basic requirements, the more important it becomes to ensure that a larger farm sector is encouraged that has the incentive to generate real surpluses.