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OPPORTUNITIES IN THE GREEN REVOLUTION

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Two opposite views seem to have crystallised in the current debate on the indirect effects of the 'new agricultural policy' pursued by Government over the last few years. According to one of these views, the policy is responsible for widening the gap, and for the growing polarisation, between the rich and the poor farmers. Reliance on new agricultural technology has admittedly raised aggregate output, but at the same time it has benefited only the large farmers who possess the requisite resources to use the new technology. On the other hand, resource restraints, particularly those in regard to credit and working capital, and the risks and uncertainties involved in shifting from traditional to modern inputs have come in the way of wider adoption of the new technology by the small farmers. Consequently, their output and income have stagnated while those of the large farmers have risen substantially. According to this view, the real sharing in the benefits of the new technology and of the 'green revolution' that it has triggered off is restricted to ten, or at the most twenty per cent of the farm households[1].@

The second view, on the other hand, holds that the most important indirect effect of the new agricultural policy

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* Reproduced from Economic and Political Weekly (Review of Agriculture), Vol. V, No.13, March 28, 1970, pp. A-33 to A-40.

@ All the references other than the footnote references have been dropped.

has been the hastening of the process of modernisation of agriculture. As more and more farmers take to the new technology and modern capital equipment, there would be a shift from traditional subsistence agriculture to modern commercial agriculture. Modernisation, in this view, appears to be synonymous with use by the farmer of modern scientific inputs and modern capital equipment.

Both views seem to loose sight of the significance of and the opportunities in the so-called green revolution[2] and both seem to be based on partial analysis with ceteris paribus assumptions. The purpose of this paper is to examine these two views and to delineate the opportunities offered by the green revolution by placing it in the perspective of inter-sectoral relationships in a developing economy. We shall argue that the 'second generation' problems, of which equity is a major one, are transitory problems if the significance of the green revolution is recognised and the opportunities in it are appropriately exploited. We shall also argue that modernisation of agriculture viewed in terms of the use of new inputs alone is in effect a limited and partial modernisation. But before we go into these issues, we shall examine the relevant characteristics of the potential beneficiaries of the new technology to determine if it is indeed biased againt the small farmers.

Adopters of New Technology

Applicability of the new technology consisting of a packet of inputs--fertilisers, fertiliser-responsive high-yielding varieties of seeds and pesticides-- is limited at present to water-assured areas. This complementarity of the new inputs with water rules out the adoption of the new

technology in rainfed areas where the supply and the application of water over the growing period of the crops cannot be controlled.[3] Consequently, the number of farms that can at present shift to the new technology is limited by the distribution of the irrigated acreage by farms. In this overview, we are of course ignoring questions regarding the qualitative adequacy of current irrigation in some areas, and also overlooking the fact that the new technology is currently limited to only certain food crops, notably wheat and rice. For our purposes here these aspects are not crucial.

We assume that the current irrigation system is qualitatively adequate; we also assume that income gain from new technology roughly corresponds to additional income from irrigated acreage. In defence of the second assumption, we need only to point out that over 78 per cent of the irrigated area is covered by foodgrains, and the rest is in such high-yielding, revenue-earning crops as sugarcane, cotton, fruits, vegetables and spices; the new technology is, of course, directly relevant to the irrigated area under foodgrains, but the irrigated area under cash crops is also equally productive of income. Hence in an aggregative study such as this, it is quite reasonable to treat all irrigated acreage as yielding the same kind of income as that devoted to high-yielding varieties of food crops.

Farm Size and Irrigation

Data on farm size and irrigation presented in Table 1 have been derived by combining and averaging the Sixteenth and the Seventeenth Rounds estimates of the National Sample Survey. Estimates in the Sixteenth Round refer to the year

1959-60, while those in the Seventeenth Round refer to 1960-61.[4] Since these estimates show an almost identical pattern of land distribution among various farm size-groups, either could be used in this analysis. The estimates of number of farms with irrigation and the average irrigated area per farm with irrigation have been developed on the basis of the proportions of farms in different size-groups reporting irrigation. And here, an averaging of two years' data seems to be useful in smoothing out likely annual fluctuations in the irrigated acreage owing to paucity or abundance of seasonal rainfall. Farms in this Table are operational farms, or 'operational farm households', while area refers to the 'area operated' rather than to area owned.

Data in Table 1 show that the entire irrigated acreage is distributed among 22.7 million farms (col.4). By our assumptions, therefore, the total number of farms benefiting from the new technology would be 22.7 million or 45.4 per cent of the total.

We now ask if it is possible to identify the largest single group of farmers that will benefit from the new technology. From column 4 it appears that the largest single group of farmers with irrigation are those in size-group II, that is those with 2.64 acres per farm on an average. They constitute 46 per cent of all farmers that have irrigation and in terms of all farmers with irrigated and unirrigated holdings, they constitute about 21 per cent. If we combine this group of farmers with those in size-group I, we find that about 61 per cent of the potential beneficiaries of the new technology are the small farmers. Credit for this, in a large measure, should go to the inherited pattern of distribution of irrigated acreage

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TABLE 1 : DISTRIBUTION OF GAINS FROM NEW TECHNOLOGY

Size-Group (acres)		No. of Farms ('000)	Area Operated ('000 acres)	Average Size of Farms (acres)	No. of Farms with Irrigation ('000)	Average Irrigated Area Per Farm with Irrigation (acres)	Ratio of Irrigated Acreage Per Farm with Irrigation to Average Size of Holding (col 5/ col 3)
		1	2	3	4	5	6
I	0-1	9124	4245	0.46	3460	0.41	0.89
II	1-5	22017	58151	2.64	10532	1.68	0.63
III	5-10	9661	66647	6.89	4601	3.75	0.54
IV	10-15	3892	45986	11.81	1787	5.49	0.46
V	15-25	2967	55069	18.56	1348	7.39	0.39
VI	25-50	1788	58794	32.88	787	9.86	0.29
VII	50 and above	525	38979	74.24	204	16.65	0.22
Total		49975	327873	6.56	22725		

among farms. But credit is also due to the new technology for one significant development: that it offers a large proportion of the small farmers[5] the prospect of improving their income and of sharing in some measure in the benefits of the green revolution. Taking all small and uneconomic farms together (that is those in size-groups II and I respectively), 44 per cent of small and uneconomic farms are the beneficiaries of the new technology. No other measure, no other policy has ever given the promise of as much. This is a point which has been overlooked in the debate on the consequences of the new technology for inter-farm income distribution.

Absolute and Relative Gains

Two aspects of inequality should be sharply distinguished in this context. First, the absolute income differential across and within size-groups of farms is bound to increase as a consequence of the green revolution. The increase in the income of a farm with 10 acres of irrigated land, for instance, will be a multiple of the increase in income of a farm with 1 acre of irrigated land; likewise, a 5-acre farm with all or part of the land under irrigation will have a larger income than another farm with equal area but no irrigation. This absolute income difference will of course be a striking feature of the new technology, and there is no disputing the fact that in this sense the rich in all categories of farms are likely to get richer.

An estimate of the size of this absolute difference in income is provided in column 5 of Table 1 which shows the average irrigated acreage per farm with irrigation in each size-group of farms. Ten and a half million small farms (size-group II) with irrigation, each with an average of 2.64 acres per farm, for instance, have on an average 1.68 acres of irrigated land per farm, while 0.2 million large farms (size-group VII) each with an average of 74.24 acres per farm operate about 16.65 acres of irrigated land per farm. Per farm benefits from green revolution range from 0.41 in the smallest size-group (I) of beneficiary farms to 16.65 in the largest size-group of farms, multiplied of course by whatever the income per acre of irrigated land is, owing to the application of the new technology. In other words, the figures in column 5 are multipliers of income per acre from irrigated land, and are measures of absolute benefits of the new technology that would be reaped by farms with irrigation in each size-group. As we note, there is quite a spread in

terms of multipliers among farms. Additional income on farms with an average of 6.89 acres per farm (III), for instance, would be 3.75 times the income per acre from irrigated land, which is slightly more than double the additional income in the group of small farms (size-group II) each with 2.64 acres of land per farm. This is a measure of absolute income differential in respect of additional income attributable to the new technology between the two groups of farms.

This absolute income differential is entirely due to two factors, namely, the inherited pattern of distribution of irrigated acreage among farms, and the inherited differences in the land-base of the farms, and in the total irrigated acreage held in farm, there will be differences in total income. And as long as the unirrigated farmer does not have a comparable innovation to raise his income, the absolute differences in income between irrigated and unirrigated farms will persist.

Relative Gains

Let us now turn to the second aspect of inequality, namely, changes in relative gains among farms measured on a per farm basis. Here we ask: Given the differences among farms in respect of land-base and in respect of proportion of irrigated acreage, on which size-group of farms is the percentage increase in per farm income the largest? Two cases need to be distinguished from each other: first, inequality among beneficiary farms, and second, inequality between beneficiaries and non-beneficiaries in each size-group of farms.

The potential relative gain per farm among the beneficiaries in each size-group is shown in column 6. The

ratio of irrigated acreage per beneficiary farm (col 5) to the average area held per farm in each size-group (col 3), multiplied by hundred, gives us the percentage rate by which relative income per farm should increase. In terms of this measure of relative gain, the uneconomic farms (size-group I) with an average size of holding of 0.46 acres are likely to experience 89 per cent increase in income and the small farms (size-group II) with 2.64 acres per farm on an average could see a 63 per cent increase in income. The relative gain per farm declines as one moves from the small to the large farms; the medium-sized farms (III to VI) each with an average of 6.89, 11.81, 18.56 and 32.88 acres, respectively, are likely to increase their income by 54 per cent, 46 per cent, 39 per cent and 29 per cent, respectively. The corresponding gain is 22 per cent on the largest farms (size-group VII) each with 74.24 acres. This is the most significant conclusion to emerge from these data: that of all the farms that are likely to benefit from the new technology and the green revolution, the percentage increase in per farm income is likely to be the largest for the small and the uneconomic farms.[6]

The second aspect of inequality, namely, income disparity between beneficiaries and non-beneficiaries in each size-group is also illustrated by column 6. Here too we note a parallel phenomenon--that the disparity is the largest in the case of the uneconomic farms (size-group I). Whereas in the case of the largest farms, the beneficiaries would be able to raise their per farm income by 22 per cent as against the non-beneficiaries, in the case of the uneconomic and the small farms, the difference between the beneficiary and the non-beneficiary farms would be 89 and 63 per cent respectively.

When we look across the size-group between the beneficiary and the non-beneficiary farms, we find a large relative increase in income inequality. While one would not like to belittle its importance, one should just as well refrain from exaggerating it. Without reference to size-group, the statement that inequality is bound to increase between irrigated farmer and non-irrigated farmer is somewhat misleading. Surely, a small farmer with 2 to 3 acres of irrigated land has now got the prospect of raising income to the level of a farmer with perhaps 10 to 15 acres of dry land. This represents not an increase in inequality but a levelling of income between a small farmer with irrigation and a large farmer without it. This levelling of income becomes obscured in any comparison between irrigated and non-irrigated farmers without reference to the size-group to which they belong.[7]

Potential vs. Realised Gains

Our inquiry has perforce centered round the potential gains accruing to beneficiary farms; the data we have, do not permit any estimation of the realised gains. There are, of course, the subjective estimates of such casual observers as Francine Frankel and Wolf Ladejinsky, based solely on selective intefviewing and impressions from selective field trips. Unfortunately, this method of estimation is wide open to all kinds of errors and biases, entertained not necessarily by the estimators but by those interviewed; and so far as impressions from field trips are concerned, it is well known that only the extremes and the striking exceptions to the average and the normal, are apt to catch the eye.

But in addition to these impressionistic estimates, we do have some studies made by competent organisations and

analysts. These studies, however, do not appear to be conclusive and certainly not unanimous about the relative sharing of the gains by the beneficiary farms. Until more evidence comes in, it is necessary to keep an open mind on the question. All that we can do at this stage is to take a hard look at the constraint that may be imposed by the non-availability of credit.[8] This has been singled out by most observers as the constraint that is responsible for preventing the small farmers from fully sharing in the gains from the new technology.

We note, first, that the money value of the new inputs (fertilisers and high-yielding varieties of seeds) that the farmer with less than half an acre or one and a half acres of irrigated land requires is too little to pose much of a risk to the suppliers of credit. At fifty per cent of the recommended package of inputs (which seems to be the farmer usage in general), perhaps the money needed to purchase the inputs can be supplied by the farm family itself. But even if the farmer cannot raise this money himself, and even if the credit institutions pass him by, there should be no difficulty in raising this amount from money-lenders. In fact, where gains to farmers could very well be 300 to 400 per cent from the use of fertilisers, it is almost a certainty that the farmer will somehow raise this money.

Credit a Major Constraint?

The proposition that farmer appreciation of potential gains would lead to greater farmer use of the new inputs is corroborated somewhat by the NSS data. The question we ask is: what is the proportion of farmers in each size-group reporting fertiliser use? If credit is a major constraint

for the small farms, we should expect a very small proportion of small farmers using fertiliser. The relevant data compiled from the NSS Sixteenth and Seventeenth Rounds are presented in Table 2. The data are two years' averages for 1959-60 and 1960-61, a period long before the new technology appeared on the scene and opened up possibilities of large gains from fertiliser use in the cultivation of foodgrains. In all likelihood, fertiliser use was mostly restricted to cash crops and vegetables; in all likelihood again, fertiliser use was confined to only those farmers with irrigation facilities. Even so, more than 9 per cent of all farmers used fertiliser. We note that the proportion of uneconomic farms (size-group I) using fertiliser was only 5.5 per cent. This is not surprising at all, given the fact that these farmers are essentially subsistence farmers growing mainly foodcrops for family consumption. In fact, the surprising thing is that more than 5.5 per cent of these subsistence farmers used fertiliser even in 1959-61. Though the proportion of small farmers (size-group II) using fertiliser was less than proportions in larger size-groups (III to VII), it was higher than the average. The difference among small and other farms in this respect is small and could be due to the lags in the adoption process. In any event the data provide no firm evidence that credit was a constraint for the small farmers intending to use fertiliser in 1959-61; on the contrary, the data seem to suggest that they were able to raise the necessary working capital to utilise whatever limited gains there were to be had from the application of fertiliser.[9]

We are not arguing that credit is no problem. Credit availability will be a problem whenever a small farmer wishes to go in a big way for fixed capital equipment; and it may be a constraint for at least some farmers without

adequate working capital to shift to the new technology. What needs to be recognised is that credit is a policy variable; if credit is indeed the kind of limiting factor that the critics of the new technology claim it to be, no effort should be spared to make it available to the needy farmers. Surely, the credit institutions could be pursuaded to adopt more liberal policies, so that small farmers could realise the income that is offered to them by the new technology. Our argument is merely that credit as a constraint has been over-played by the critics of the new technology, and that we cannot accept the proposition of a widening gap between potential and realised gains on this ground alone.

No Bias Against Small Farmers

The issue here is whether the current technological change in agriculture is necessarily biased against a broad-based distribution of income among farms; whether it necessarily favours the large farmers. Clearly, the effect of a technological change in agriculture on inter-farm income distribution would depend on the nature of the new technology itself. If, for instance, the new technology is capital-intensive it would be biased against the capital-poor farmers; again if it is applicable only to the irrigated land it would be biased against farmers operating exclusively non-irrigated land.

Our examination of the subject has focused attention to the importance of the inherited pattern of distribution of irrigated acreage among farms. In this pattern, the largest proportion of farms having irrigation belong to the category of small farms; hence, the largest proportion of farms benefiting from the new technology would be those with small holdings. Again, among the beneficiary farms, it is the small

farms that have the larger proportion of land held per farm under irrigation; hence, it appears that the percentage increase in per farm income owing to the use of new technology is the largest in the case of the small farms, although their absolute income gain is restricted by their small irrigated land-base. What the new technology seems to do is to distribute relative per farm gains in accordance with the proportion of irrigated acreage in farms; since this proportion is inversely related to farm size, the relative income gains from the adoption of the new technology are also inversely related to the farm size. But the absolute gains depend upon the land-base, particularly the irrigated land-base of farms, which in the inherited pattern of distribution of irrigated acreage is positively associated with farm size; hence, absolute income gains would follow the land-base of the farms.

These results are in the nature of first approximation to the most probable immediate consequences of a broad-based technological change in Indian agriculture. Departure from these results may, however, occur owing to resource constraints (other than those imposed by the presence or absence of irrigation) among farms. In that event realised gains may fall short of potential gains, the shortfall depending upon the magnitude of the constraint itself. One such contraint, particularly relevant to the small farms could be the inadequacy of working capital. As we have argued earlier, this does not appear to be so severe a constraint as to cause a large gap between the potential and the realised gains. The difference between the small and the large farms in respect of the use of fertiliser and high-yielding varieties of seeds noted in some cross-section studies, could

TABLE 2 : PROPORTION OF FARMERS REPORTING FERTILISER-USE

Size-Group No.	Average size of Farms (Acres)	Per Cent of Farms Reporting Fertiliser-Use
I	0.46	5.54
II	2.64	10.06
III	6.89	11.99
IV	11.81	11.71
V	18.56	11.51
VI	32.88	11.12
VII	74.24	11.53
All farms		9.86

just as well be due to lags in the adoption of the new technology by a season or so on the part of the small farms; the lags could be due to the novelty of and the risks and uncertainties associated with the new inputs. If that is so, there would be no departure from the predicted pattern. This should not, however, be taken to mean that a vigorous credit policy to enable farmers to shift to new technology has no relevance here. Surely, the credit institutions need to be persuaded to follow a more liberal credit policy.

The Uneconomic Farm

Implicit in our analysis is the recognition that some farms (those that have less than 2.61 acres of land on an average) are palpably uneconomic, and that nothing can be done to make them economic and viable units of crop production. Currently three types of measures to solve the problems of

small farmers are being discussed : (a) engaging them in ancillary activities ; (b) assisting them through the Small Farmers Development Agency; and (c) land reforms. The Small Farmers Development Agency is, however, designed to help only the potentially viable small farms, that is those with more than 2.5 acres of land. Hence by implication there are only two measures through which the uneconomic farms can be helped.

The problem here is one of how to make the farmers with uneconomic holdings break away from traditional subsistence agriculture, and of how to make them full-fledged participants in the wider growing economy in their own right. Admittedly, there is some scope for these farmers to shift from crop production to other enterprises within agriculture, such as livestock and poultry farming, vegetable growing and nurseries especially if the farms are located around town and market centres. These are activities which permit some income-rise despite limitations imposed by a small land-base. Handicrafts as a source of supplementary income are no solution; the demand for handicraft products does not seem to be growing in a manner that a large number of workers are stagnating in these activities without gainful employment and adequate income. Programmes to engage uneconomic farmers in ancillary activities to supplement their income from crop production are essentially relief measures. They neither reduce over-crowding on land, nor do they enable farmers to participate in and to benefit from a growing activity. They seem to condemn the small farmers to subsistence agriculture for perpetuity. In fact, even land reform would condemn them to subsistence farming without prospect of viability and income growth; and if it is a radical reform, it may even increase the subsistence orientation of all farmers and reduce the quantum of marketed

surplus and saving. The outcome may be tolerable from the equity point of view, but it would hardly be a condition that can be maintained long. Land reform is essentially a static solution in a static setting. In a dynamic setting where more than 2 million new entrants join the labour force in agriculture every year, creating ever-increasing pressure on limited land resources, it may not qualify even as a welfare measure.

Implicit in these measures is the idea that the uneconomic farmers be retained in crop production somehow. But there is no reason why they must be so retained in crop production, unless one rules out completely the possibility of adequate growth in the non-farm sector of the economy. The choice here is between equity without growth on the one hand, and equity through growth on the other. And the new technology, as we shall argue in the following pages, provides the opportunity to establish the latter.

Implications of Modernisation of Agriculture

Modern agriculture, according to current literature on agricultural development, is distinguished by its dependence on purchased inputs. The index of modernisation following this definition is the ratio of purchased to total inputs in a farm.

It should be noted that the definition covers both the modern technology--that is the new inputs like fertiliser, high-yielding varieties of seeds, pesticides, that are developed and produced outside of the agricultural sector and have to be purchased for use--and also inputs that are not new, and that are traditional. Farms may be purchasing and using modern inputs, but the proportion of purchased modern

inputs may be insignificantly small; the bulk of the inputs may still be traditional and unpurchased. In that event, there is only limited modernisation. Alternatively, there may be farms depending on the market for the hiring of traditional inputs, but unable to use the newer inputs either because they are not yet available, or because their profitability has not yet been established; such farms are by definition modern farms, because they are dependent on the market for the inputs used in the production process. Thus viewed, use of modern inputs is neither a necessary nor a sufficient condition for modernisation of agriculture.

The rationale for this view is intuitively obvious. In a modern agriculture, farms are integrated with the larger economy and with the world through linkages provided by the product and the factor markets. The linkages through the product market mean that the farms produce and market their surplus in accordance with the demand generated for their products in the larger economy, which is signalled through changing relative prices. Such integration through product market implies specialisation and a continuous adjustment of products and enterprises to changing prices. The linkages through factor markets ensure efficiency in production and raise labour productivity. It is when production is carried out with purchased inputs rather than with family-owned, and/or traditionally procured resources (that have zero opportunity cost) that the equalisation of costs and returns becomes an imperative of the market; and it is only then that the principles underlying production organisation need to conform to the dictates of the market. Integration through factor markets also means on the one hand the inflow of productivity-raising modern inputs from the expanding non-farm sector, and on the other hand, outflow of redundant

and surplus resources, chiefly labour, to the non-farm sector, enabling an increase in productivity and income per remaining worker in agriculture, and a decrease in the pressure on land. It implies a functioning efficient labour market directing labour into uses where it would be most productive. If a labour market has to work efficiently, there must be alternative uses for labour. It is in this sense that the development of the non-agricultural sectors--industry and services--is a condition for the development and efficient functioning of labour market, and consequently for the modernisation of agriculture.[10]

We can now see why the modern inputs have limited value as agents of modernisation. As long as the dominant inputs of labour has no alternative employment opportunities outside agriculture, and therefore, has no alternative cost, the equalisation of cost and revenue and the imperative to conform to the rules of efficiency are absent. Farms may be using modern inputs, but they may have excess family labour unutilised; that is, they may not have been integrated with the larger economy through the labour market at all and consequently they would carry on with inefficient use of resources and with low productivity. The use of modern inputs would then signify no more than a grafting of these inputs on to traditional agriculture, very much like the grafting of cash crops on to peasant agriculture at the time when these economies were first exposed to the Western world. Again, a farm could use modern inputs and yet not be integrated with the product market, for the simple reason that owing to its inadequate land-base it has no marketable surplus. Such farms may still survive in agriculture owing to rigidities and the lack of development of the non-farm sector.

Limited Modernisation

Given the characteristic of the new technology (that it can at present be used only on irrigated land), nearly 23 million out of 50 million of farms, or 46 per cent, that have some irrigated land can use the modern inputs. This also means that an equally large (in fact larger) number of farms--about 27 million or 54 per cent of farms would continue to use traditional inputs. Since more than half the farms will remain traditional by this standard, modernisation through new technology would at best be a partial and limited transformation.

So far as the farms in size-groups I and II are concerned, it is questionable if these can indeed be integrated with the product and the labour markets and through them with the rest of the economy, given the utterly inadequate land-base of these farms. In all likelihood, the use of new inputs on these farms will enable them to strengthen their subsistence orientation; they may have more food for family consumption. Possibly, part of the family labour that was unemployed or underemployed before, will also be more productively employed. To the extent this happens, these farms will be better-off, and this in itself will be no mean achievement. But they would remain unintegrated with the larger economy, and their transformation from subsistence traditional farming to modern farming would be a long way off.

In view of these considerations, the number of farms with irrigation that would be converted to modern farming dwindles to about 8.9 million farms or about 17 per cent of all farms. But then are not these farms already modernised and integrated with the rest of the economy through linkages

in product and factor markets? Historical development over the last century and a half had already jarred these farms away from traditional agriculture and connected them with the rest of the economy, long before the new technology had appeared on the scene. What then does their use of newer inputs signify except bringing them more sharply in contrast with the rest of the farms?[11]

Current Opportunities

The real significance of the green revolution lies in the fact that it makes available for the first time a sizeable agricultural surplus which can now serve several functions. One of these is the most obvious--meeting the food requirement of the growing urban (and also to some extent rural) population; this purpose is served automatically by the market without requiring any policy intervention. After all, the surplus above the reservation demand of the farmers has got to be sold in the market sometime or other; so it does somewhat automatically flow into the market. At the same time, the increased income of farmers may partly be spent on consumption goods and partly on agricultural inputs that are produced in the non-farm sector of the economy; this represents an expansion of the domestic market and larger sales and income for the non-farm industries.

If that were all, the increased agricultural surplus would be no more than a relief to the economy; it would not be a growth-generating force. But in fact, an agricultural surplus represents more than relief; it represents a potential investible capital, all or at least a part of which can be utilised for investment in any sector of the economy. It may or may not be so utilised, for unlike the other functions mentioned above, there is no automaticity

involved here; there is no guarantee that all or part of the surplus will automatically flow into savings and thence into investment. And therein lies the opportunity afforded by the green revolution: to tap part of this investible capital for generating a faster rate of growth in the non-agricultural sector through appropriate policy measures.

Japanese Experience

The experience of Japan appears to be illustrative of the opportunities that can be utilised in the current green revolution in India. In Japan, too, the increase in the size of agricultural surplus was generated initially by a set of policies and measures, prominent among which were the measures for increasing agricultural productivity with small capital investment (chiefly in the form of fertilisers), land-saving innovations and a network of agricultural research and extension services. And Johnston observes that "a significant part of the increment in national product that resulted from rising agricultural productivity was available for capital formation, partly as a result of agriculture's direct contribution via the land tax to financing government investment and in part through the private investment financed by the increased profits and savings of landlords".

The current Indian scene differs from the earliest phase of Japanese economic development in two respects: first, the institutional framework of "entrepreneurial landlordism" characteristic of the Japanese agriculture is absent in India; and second, the role of private investment and indeed the private sector itself in the development process of India is somewhat restricted. Even so, some increase in private

investment and capital formation in agriculture is bound to take place here, as recently evidenced by the increased demand for capital equipment in agriculture in some areas. To the extent the industries in the non-farm sector can supply these capital equipment, some out-flow of the rural saving will take place. But two points need to be emphasised here: first, that the required or potential investment in agriculture would be small in comparison with the savings generated in this sector, so that a substantial amount of investible surplus will continue to remain in agriculture; second, increased farmer investment in capital equipment and increased farmer consumption of non-farm goods would depend upon whether or not the non-farm sector is growing. If the non-farm sector is stagnant now, or if its rate of growth is not raised substantially, the factoral terms of trade could move against the farm sector, drying up the surplus at its very source, and setting off a decline in farm income and in non-farm employment; the opportunity to absorb rural labour in the non-farm sector and to modernise agriculture would then be irretrievably lost.

These considerations strengthen the view that the real opportunity in the green revolution is not the provision of relief, but growth and modernisation. As part of the investible surplus is mobilised for capital formation in the non-farm sector, output per capita--the index of development--would rise; alongside it would become possible to absorb in the non-farm sector an increasing proportion of the low productivity farmer and farm worker a higher level of wages and income. As this transfer occurs, an efficient labour market for agriculture would begin to emerge and with the pressure on limited land resources diminished, a more efficient structure of farming would emerge, and agriculture would be modernised.

Growth and Equity

An attribute of this process of growth and modernisation is that it enforces equity in a way which no other measure (not excluding land redistribution) can. If we accept the estimate of Rs 1000 per acre income from irrigated land with new technology, and if we assume that 50 per cent of it is attributable to the newer inputs then, the additional investible surplus generated would be about Rs 16,000 million per year (leaving out the farms in the size-groups I and II and assuming an extensive use of the new technology over the entire irrigated area). If only 20 per cent of this is mobilised on a progressive basis so that the higher incidence falls on the larger size-groups of farms, the additional resources for financing planned development in the non-farm sector comes to Rs 1600 crores over a Plan period of 5 years;[12] this represents about 50 per cent of the outlay allocated to the industries and about 70 per cent of the entire outlay on agriculture and allied sectors in the Fourth Plan period. Assuming an average capital-labour ratio of Rs 32,000:1 in the non-farm sector, close to half a million new workers can be employed additionally. Considering the fact that there are about 2 million new entrants to the rural labour force every year, this additional employment would help raise the rate of labour transfer and modernisation of agriculture. At the same time, the income disparity between farmers can be effectively reduced. Considering the fact that there is hardly any agricultural income tax worth the name in force, and also the fact that land revenue--traditionally the only form of direct transfer of income from agriculture to the state--has been abolished in a number of States (and some more States are committed

to its abolition), the need for appropriate fiscal measures for equity purposes can hardly be overemphasised. And in this instance fiscal measures for equity would become truly growth generating.

The policy most appropriate for the occasion seems to be one that would mobilise part of the investible surplus generated by the green revolution in order to pursue a vigorous drive for non-farm development, while at the same time one that would serve the aims of equity through fiscal measures. It is also appropriate to supplement this policy with adequate measures for providing credit to expand irrigated acreage in the small farm-size groups and for developing a new technology for unirrigated farming. The choice is there between equity and stagnation (leading over time to greater inequality) on the one hand, and growth with equity on the other, and whichever alternative is chosen now the economic future of the country for decades to come will be profoundly influenced.

NOTES

1 The estimate that the real sharing of the benefits of the new technology is restricted to 10 or at most 20 per cent of the farmers, has been made by Ladejinsky for Punjab.

2 While it will be readily granted that the new technology has helped in raising foodgrain output, there may be doubts whether a green revolution has already set in. For the purposes of this paper, it is enough for us to assume that the changes effected by the new technology, if they are not already far-reaching, are likely to be so in the near future.

3 For a discussion of the complementarity of new technology with irrigation, and the implications of this complementarity for regional distribution of agricultural income see B. Sen, "Regional Dispersion of Agricultural Income : Implications of the New Technology", Economic and Political Weekly, December 27, 1969.

4 Data in Table 1 may appear somewhat dated--they refer to the years 1959-60 and 1960-61; but they are useful as indicative of the current pattern of land distribution since there is no evidence that a structural change has occurred or that a shift has taken place in the pattern of land distribution since that date.

Legislation abolishing intermediaries, affording security to tenants, establishing ceilings on landholdings and enabling tenants to purchase ownership rights had been enacted by the State Legislatures early in the decade of the fifties. It is reasonable to assume that whatever change occurred in the inherited pattern of land distribution had taken place before the sixties decade. On this basis, the data in Table 1 may be taken to reflect the post-reform pattern of distribution of land among farms.

5 There is no consensus about the definition of 'small farmers', although they can be easily identified as such for practical purposes. Definitions

in terms of acreage are necessarily arbitrary, for land is not homogeneous; irrigation too can make a large difference inasmuch as it raises the size of the effective land input through multiple cropping and, therefore, raises the size of farm. Clearly, some small farms are viable and some are not. Those that are not viable are palpably uneconomic and should perhaps be excluded from the category of small farms for analytical purposes. Recently, the All-India Rural Credit Review Committee (1969) refused to adopt the customary grouping of farmers into small, medium and large, and instead classified farmers into 'medium to large' (7.50 acres and above), 'small to medium' (2.50 to 7.50 acres), and 'very small to small' (less than 2.50 acres). It held that small farms with more than 2.50 acres of land were viable, while those with less than 2.50 acres were not. We do recognise the logic behind such a classification, but in our analysis here we take the farmers in the size-group 1 to 5 acres (with an average of 2.68 acres per farm) as small farmers.

6 Ladejinsky estimates that holdings upto 7.50 acres accounted for roughly 73 per cent of the total number of farm households and roughly for 20 per cent of the land in Punjab.

Ladejinsky's figures would be correct if (a) his 'farm households' are taken to mean 'rural households', including those with and without land (labourers, artisans and others); and (b) the proportion of households without land is added to the size-group cultivating less than half an acre of land. But such a procedure would be misleading. The question is not: what proportion of rural households is likely to benefit? The question is : what proportion of operating farm households is likely to benefit from the green revolution? Of the total operational holdings in the Punjab in 1960-61, 12.09 per cent was less than 1 acre in size, 25.53 per cent was between 1 and 5 acres, and 14.61 per cent was between 5 and 7.50 acres. Thus the proportion of operational holdings below 7.50 acres in size was 51.23 per cent and not 73 per cent as Ladejinsky claims; and

together they accounted for 16.87 per cent of the operated area. Even if we were to accept Ladejinsky's view that farms with less than 7.50 acres of land would not benefit, there is no reason why 49 per cent of all farms (those with more than 7.50 acres of land) should not benefit from the new technology. And if, following the All-India Rural Credit Review Committee, we exclude the palpably uneconomic farms alone (those with less than 2.50 acres), there is no reason why 76.58 per cent of all operating farm households should not benefit.

The direct beneficiaries of the green revolution are of course those operational farm households that have some irrigated land. Hence, the proportion of the beneficiary farms would be somewhat smaller than the figure above. We have no breakdown of farms with irrigation in Punjab. But if the proportion of irrigated area in Punjab farms is approximately the same as that established in the farm management surveys in Punjab, perhaps more than 60 per cent of the farms with less than 7.50 acres of land would be direct beneficiaries of the green revolution. In Punjab, as elsewhere, the largest single group of beneficiaries is the small farms and the potential gains are also relatively larger for them. In view of these considerations, we find ourselves unable to accept Ladejinsky's estimate that the <u>real</u> sharing in the progress, "is restricted to relatively few, perhaps only 10 and surely not more than 20 per cent of the farm households of Punjab".

The focus of this paper is interfarm distribution of income; consequently the analysis above does not extend to the landless rural households. Admittedly, the green revolution will not directly benefit the landless rural households; nor is it meant to. But there may be considerable indirect benefits that are likely to flow to them--greater employment in agriculture and therefore increased money income, and (in common with the urban population) an increase in <u>real</u> income following a decline in the prices of agricultural products, particularly foodgrains.

7 We have not considered the position of tenants in relation to the green revolution. Recent investigations into farm tenancy indicate: (1) The weight of tenancy is on the decline owing to a variety of reasons--resumption of land for personal cultivation, fear of losing land rented out to tenants and the like. Relevant reports have been reviewed in "Magnitude of Agricultural Tenancy" by Dharm Narain, and P.C. Joshi, Economic and Political Weekly, Review of Agriculture, September 1969. Comparison of NSS results from the Sixteenth Round with the Eighth Round shows that whereas in 1953-54 the area leased-in as per cent of total operated area was 20.34, in 1960-61 it was only 12.53. (2) The extent of pure tenancy is insignificant (only 7.7 per cent of farm households were tenants in 1959-60) and can be left out of the purview of an aggregative analysis such as the present one; however, the incidence of pure tenancy is the greatest in certain States--West Bengal, UP, Jammu and Kashmir, Kerala, Tamil Nadu and Bihar--and, what is worse, is concentrated specially in small sized holdings in these States; when dealing with these States, therefore, it will be inadmissible to leave out pure tenants and their relative position in respect of green revolution. (3) About 15 per cent of all farm households appear to be under mixed tenancy. Here, however, we have no firm knowledge of distribution of mixed tenancy among farmers. The farm management surveys have shown that even the small farms both lease-in and lease-out land; there may not be any firm correlation between mixed tenancy and farm size.

If mixed tenancy indeed affects farmers' ability to participate fully and share in the green revolution, the disadvantage seems to be somewhat equally scattered among all farms. On the other hand, if land values and rents rise in consequence of green revolution, then the small farmers too are likely to gain from the scramble for land, because they too lease-out land. Hence the result is somewhat obscure, and more data are needed to judge which farmer will gain. On the same grounds, the pure tenants may be complete losers.

There is no question but that invidious share-cropping systems should be replaced by equitable arrangements, and that tenancy should be regulated.

But in view of the considerations above, we are unable to accept the generalised proposition that tenancy would come in the way of a large proportion of small farmers shifting to the new technology.

8 Lack of credit is but one among many constraints that could impinge upon the small farmers' ability to shift to new technology. Fragmentation of holdings, insecurity of tenure, inadequate and untimely supply of inputs (including water) have also been mentioned in some studies as constraints.

9 In addition, the reports on the IADP also show that small farmers are in innovative as the large farmers, and that there is not much difference among farmers in respect of fertiliser-use.

Evaluating the studies made by the PEO and the Directorate of Economics and Statistics, B. Venkatappiah argues that the small holders readily participate in HYV programmes, though in some cases they may lag by a season.

10 It may be recalled that in the two-sector models of growth, marketisation of labour with MVPL=W, through a growing non-farm sector absorbing the redundant rural labour, signals the turning point-- a point when commercialisation of agriculture begins.

11 Recent rise in wages of farm labour has been cited as evidence of the functioning of an efficient agricultural labour market. An examination of the agricultural labour market will take us far away from the subject of this paper; hence we do not attempt it here. It should be noted, however, that from the viewpoint of our thesis, rise in agricultural wages is of little relevance. The question is: what is the extent of alternative employment opportunities for farmers and farm workers in the non-farm sector? We have not gone into the question of whether or not the farm family labour has any alternative cost. An extensive body

of literature exists, showing that on the small farms farm family labour has little alternative cost and little employment opportunity for off-farm work.

12 Farms in the size-groups I and II operated 18.4 million out of a total of 59.8 million irrigated acres in 1959/60. Assuming that 78 per cent of the remaining 41.4 million irrigated acres are under foodgrains, about 32 million acres should be eventually covered by the new technology. If income per acre attributable to new inputs is Rs 500, the total additional income would be about Rs 16,000 million.