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SUMMARIES OF GROUP DISCUSSION

SOME DETERMINANTS OF AGRICULTURAL GROWTH AND DEVELOPMENT IN INDIA*

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The gigantic size of the Indian economy is itself a predisposing factor to the colossal socio-economic ailments the country suffers from. Yet, at the same time, it affords considerable resilience and capacity for withstanding the ill-effects of inappropriate policy prescriptions and their misadministration. A population of about 700 million persons, growing at an annual rate of 1.97 per cent, adds over 1.4 million mouths to be fed, and bodies to be clothed from almost an inflexible size of the resource endowment of the country. Simultaneously, this growth also adds double the number of human hands, generating corresponding work capacities. But, the country already has more than enough of this so-called human capital. The result is, some eighteen million persons today suffer from involuntary unemployment and, may be, at least an equal number suffers from under-employment. The presence of stark poverty is borne out by the fact that over 55 per cent of the population of the country lives below the poverty line. The situation has led to a widespread unhealthy scramble for grabbing unearned gains. Moral values, the sense of social responsibility and national pride are at a discount. It is no use dilating on the situation, yet I must observe, with all the seriousness at my command, that though political, administrative and financial dishonesty and corruption may be rampant in every society of today, yet the nation which complacently accepts this situation, as we seem to be doing in India, is doomed to suffer irretrievable degradation in all spheres of life. I often wonder what kind of sophisticated mathematical or conceptual socio-economic development models can be applicable or remain functional under such a situation when the objective function of the political problem-matrix is only to remain in power by all sorts of dubious means. Whereas politicians may have their own compulsions in a democratic set-up, to put political objectives above everything else, scientists, especially the social scientists, need to realise and meet their own responsibility to the society. There is a pressing need today for developing normative socio-economic situational growth models, as may be possible within the constraints of a given political framework. The dominating objective of research and policy advice should be economic growth and development with a built-in process of maximum social welfare. Ideally, the political objectives of any political entity should emerge from within the framework of such a dynamic socio-economic matrix, expanded and enriched by the contributions of scientists and thinkers.

It is with this assumption, and against this background, that I would endeavour to develop a framework of some selected and important determi-

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nants of growth and development for the agricultural sector of the Indian economy. One should normally deal with the economic system as a whole, in the first instance, in order to provide necessary backdrop, but that would be too longish a matter to do justice to within the ambit of a presidential address. Even while dealing with the agricultural sector, I will have to confine myself mostly to the general observations, rather than the in-depth specifications of each of the components of the sub-system.

It needs no stressing that growth can take place either through an increased use of factors, which would mean traversing a given production function, determined by a given set of production technology, or it can occur through an improvement in the production technology which would mean an upward shift in the production function. In practice, growth is a continuing phenomenon and it occurs through a combination of both of these changes. In India, if we analyse the situation of foodgrains for the past one decade (1970-71 through 1980-81), we would notice that the total foodgrain production increased at the rate of 2.28 per cent. The crop area under foodgrains increased at the rate of 0.38 per cent and productivity (yield per unit of land) increased at the rate of 1.88 per cent. Thus the overall growth rate remained quite low. The growth of productivity contributed more than what the area expansion did. A disquieting aspect, however, is that four States of India, *i.e.*, Tamil Nadu, Kerala, Madhya Pradesh, and Himachal Pradesh, occupying almost one-fifth (19 per cent) of the foodgrains area, have experienced a negative growth rate. The other eight States, *i.e.*, Rajasthan, Orissa, West Bengal, Bihar, Assam, Uttar Pradesh, Gujarat and Karnataka, comprising over 55 per cent of the area, experienced a growth rate below the national average. Of these eight States, four States, namely, Rajasthan, Orissa, West Bengal and Bihar, comprising 28 per cent of the area, achieved equal to or less than one per cent growth rate. Thus it is only five States in India, *i.e.*, Maharashtra, Punjab, Haryana, Andhra Pradesh and Jammu & Kashmir, having about 26 per cent of the foodgrains area, that have shown above average growth rates. The highest growth rate in foodgrain production has been recorded for Maharashtra (9.79 per cent) followed by Punjab (5.68 per cent), Haryana (3.93 per cent), Andhra Pradesh (3.56 per cent) and Jammu & Kashmir (2.87 per cent).

As regards acreage expansion, seven States, comprising over 34 per cent of the foodgrains area, have shown a negative growth rate. It is only in the States of Punjab, Maharashtra, Assam and Orissa that the growth rate has been above one per cent, although for different reasons. Whereas in Punjab and Maharashtra it is the increased productivity of crops and enhanced economic returns that dictated the area expansion, in Orissa and Assam it is the new settlements and the expansion of cultivation to marginal lands and the felling of forests that brought more areas under the plough. However, it is the problem of productivity that causes the deepest concern. Four States, *i.e.*, Madhya Pradesh, Himachal Pradesh, Orissa and Assam, comprising 22 per cent of the area, have shown negative growth rates. The other six States, *i.e.*, Uttar Pradesh, Bihar, West Bengal, Rajasthan, Tamil Nadu and Kerala,

having over 40 per cent of foodgrains area, have shown productivity growth less than the national average of 1.88 per cent.

Thus, of the high growth rate States, production in Maharashtra has increased mainly through increase in productivity (7.78 per cent) and in Punjab both through the productivity increase (3.16 per cent) and the cropped area expansion (2.44 per cent). In Haryana, Andhra Pradesh, Karnataka and Gujarat, production has increased mainly through an improvement in productivity. In the latter three States the cropped area showed a negative growth rate. For an in-depth analysis of these poor performances, especially on the productivity front, one would need to look into all the crops, individually, in every State, in terms of their place in the overall production patterns, along with the inhibiting factors, general and specific to the crops. This aspect has been adequately covered under the three Regional Symposia on the subject of Constraints to Agricultural Production, held under the auspices of the Indian Society of Agricultural Economics this year. I can, therefore, easily afford to skip that aspect which otherwise should have been an important part of this address.

Reverting to the theme of agricultural growth, *i.e.*, productivity and expansion in area, let me estimate the scope for further growth in agricultural production. Since it would be a stupendous task to estimate the scope for all the crops, I will confine myself to the foodgrains only. If only the negative growth rate of productivity is checked and the below average productivity is brought to the level of the average, this alone will increase production by over 40 per cent in one decade. If, further normal growth rate occurs in the average and the above average growth States, it will add about 20 per cent to the total production. Thus, mainly through the management factors, with normal or trend improvements in the production technology, there is a scope for increasing production by over 60 per cent within a period of one decade. How to achieve this will be dealt with later, when I detail the framework of determinants. Here, it would suffice to say that with reasonable effort and concern, foodgrains production and, for that matter, agricultural production, can be considerably increased through an improvement in productivity. The better, and the best, among the farms in the local areas, provide scope and guidance for improving the performance of the average and the below average farms in different parts of the country.

Viewing the matter from a perspective of the gap between potential productivity shown by research, and the actual performance of different crops on the farmer's fields, one cannot fail to observe that the gap ranges between 30 per cent to over 300 per cent. This means even on the best managed farms, and the best looked-after crops, there is ample scope for improvement in productivity. On the poorly managed farms and fields, the scope for improvement is often between two and three folds. Thus, even with the available production technology and, the given cropping patterns in different agro-climatic zones of the country, there is tremendous potential for increasing productivity, through the application of additional inputs and the better management of resource use. Again, if we assume normal or trend improvement in

the production technology which, by all indications, is supposed to take an upward shift because of the massive and co-ordinated effort of the central research institutes and the Agricultural Universities, we would notice that the scope for improvements in productivity has considerably widened.

In respect of the expansion of the crop area, this can occur horizontally, through bringing additional land under cultivation, and/or vertically through increasing the intensity of cropping, in relation to the number of crops per unit of land per year. India is a vast country, having considerable scope for an expansion of the cultivated area. Over 39 per cent of the total cultivable land still remains to be brought under the plough. Forty per cent of this area is classified as 'current fallow' or 'permanent fallow' land, and, 60 per cent remains uncultivated altogether. Although with the fast developing production technology no land remains a marginal land, in the strict traditional sense of the term, yet the fact remains that for sometime to come, these areas would remain low productivity lands. However, if social investments with regard to the provision of water and development infrastructure are made in a rationally phased manner, there is no reason why a major part of these lands cannot be brought under cultivation within one decade. One example of such a programme could be through the solution of the waterlogging and salinity problems of the south-western parts of Punjab and similar adjoining areas of Haryana State, and the provision of the irrigation water to the parched desert lands of Rajasthan. In most parts of the waterlogged areas of Punjab and Haryana, where underground water is of brackish nature, the level of land is lower than the level of the river bed which is expected to drain these lands. Hence natural drainage gets choked and the dug-out drainage channels go ineffective. Thus, these areas suffer from lack of drainage and acute salinity problems, while just less than 100 km. away, very productive Rajasthan lands suffer from lack of irrigation water. If underground brackish water from these Punjab and Haryana areas is pumped into drains and taken to the Rajasthan desert lands, through lined canals, it could be very productively used for the sandy soils and for the interdunal cultivation. The supply of fresh sweet canal water to the salt affected waterlogged Punjab and Haryana areas and the pumping out of underground brackish water will rehabilitate these lands for two bumper crops a year. Besides, a conjunctive use of brackish water with canal water in dunal areas can yield good crops of all types since the structure of these sandy soils is such that water with even three thousand ppm salt concentration can be easily used without any adverse effect. One good rain shower in a year in these areas is enough to wash the salts down below the root zone of the crops. This has been demonstrated very effectively in Israel and the results at the Central Arid Zone Research Institute, Jodhpur, confirm these findings. What is needed is an integrated approach, transcending the political boundaries of the States.

Turning again to the scope for increasing production through increasing cultivated area, even if no improvement in production technology is assumed, which is not at all a logical assumption in a dynamic situation, I may observe

that there is an easy possibility of enhancing production by 30 per cent over a period of one decade. This does not assume any increase in the intensity of cropping. The average intensity of cropping in India is around 122 per cent. Some 59 per cent of the net sown area has an intensity of cropping below this level. If the intensity of these areas is brought to the level of the national average through the irrigation and infrastructure improvements and the extension of the available improved technology, production in these areas can be easily increased by 25 to 30 per cent. Except for Rajasthan and some parts of Gujarat, Karnataka and Maharashtra these areas do not suffer from lack of water. In most of the areas, the application of available water, the harvesting and management technology can go a long way in increasing crop productivity and cropping intensity. In other areas, it is the problem of managing excess water for which, too, the available technology offers good hope. Further, there is enough scope for increasing cropping intensity in areas with average and above average intensity. A ten per cent increase in cropping intensity, which can easily come through the management factor alone, can raise production by about 10 per cent. Thus, merely by increasing the intensity of cropping through the management factors, there is a good possibility of enhancing agricultural production by over 20 per cent. Thus, the horizontal and vertical expansion of the crop area, assuming the productivity level to be the same, holds a promise of over 50 per cent increase in production which can be attained within a period of one decade. Thus, taking different possibilities together, one could expect an increase in production to the tune of about 110 per cent in the next one decade.

How to go about it, is a crucial question. A careful look into the enabling factors, which made certain States and areas of the country achieve an outstanding success, would enable us to find out what is lacking and needs to be done, for areas that are lagging behind, or are not moving on an optimal growth path. This would lead us to conceptualise the framework of the determinants of growth and development in the agricultural sector. Regional differences in this framework would largely explain the differences in levels and the rate of growth in different parts of the country. Let me now briefly dwell on some of these important determinants, individually.

1. Research Infrastructure

Research infrastructure, with a capacity and capability to analyse the existing situation and potentials with rigour and to develop location specific alternative approaches, the techniques and technology suited to the local economy is a pre-requisite of an optimal growth and development of any region or area. Without this, any production technology and practices would exploit the potential in a sub-optimal manner. This aspect is vividly demonstrated by the varying degrees of agricultural growth and development in different States and regions of the country. The received theory on the growth models has so far been overly emphasizing the role of savings and investment, assuming most of the time a given capital-output ratio, estimated

on a global basis. But the innovations and improvements in technology have been considered as an exogenous factor. Only recently, through the works of Solow, Denison and some others, it has been realised that not more than 10 to 20 per cent of growth in the western countries has come through capital accumulation, while 80 to 90 per cent has been achieved through the advances in knowledge and economies of scale. It has been further estimated that advance in knowledge has contributed over 46 per cent to the growth, compared to only a little over 11 per cent, contributed by 'capital input', increased education per worker, economies of scale and improved resource allocation, accounting for 21 per cent, 18 per cent and 15 per cent respectively (Denison, 1974).

Thus, emphasis in development planning, especially in the agricultural sector, needs to shift from savings and investment, inducing to-the-right movement, on a given response function, to a consciously managed constant shifting of the response function upwards. Indeed, capital investment should be consequential to such improvements in the production technology. You would recall, in the late fifties and early sixties, several studies on farm management had shown farming as a capital surplus enterprise at that level of production technology. As series of technological improvements occurred in the wake of the green revolution, beginning mid-sixties, agriculture turned a capital-short sector. The investment requirements increased as a consequence of improvements in the production technology. Thus, traditionally the exogenous factor (*i.e.*, technological innovations) becomes crucial to the growth of the agricultural sector in the green revolution areas. Thus, a direct high degree correlation between agricultural growth and research capacity, to generate constantly a series of technological improvements, has been amply proved.

It is often argued that technology can be borrowed and adopted from abroad, specially from the neighbouring countries or the agro-climatically similar areas and regions at comparatively much lower costs, compared to the costs involved in developing elaborate research infrastructure and capabilities within every State or every agro-climatic zone. It needs to be understood that even for borrowed technology to be adopted effectively, adequate research capacity and capability is absolutely essential. No technique or technology can be adopted as such, with hundred per cent success. Any technique would require appropriate modifications before it becomes suitable and applicable under local conditions. Also, heavy dependence on borrowed technology, modified or otherwise, is a static approach which lacks the needed capacity and dynamism to cope with the ever-changing environmental factors and expectations aroused in the rural sector. There are several cases of areas and regions which can be quoted to have demonstrated the relationship of agricultural growth with the development of research capacity. Punjab, Haryana and Western Uttar Pradesh provide us with vivid examples of what the development of adequate research infrastructure and capabilities can contribute towards agricultural progress, through the tailoring of appropriate techniques and technology to suit the local conditions. It may be recalled

that the seeds of Mexican dwarf wheats were distributed from International Center for the Improvement of Maize and Wheat (CYMMIT) to all the research centres and the wheat growing countries of the world in the mid-sixties. Yet, it was in these States and areas that the green revolution, based on a large scale adoption of the dwarf Mexican wheats, took a cognizable shape. This is because the Agricultural Universities of Punjab, Haryana and Western Uttar Pradesh as well as the Indian Agricultural Research Institute located at Delhi had enough research capacities and capabilities to improve these seed materials further to suit the local conditions. The crop improvement programmes launched by these institutes were strong enough to select and breed new genotypes, incorporating desirable characters from diverse sources of germplasm. Thus red wheats were changed to amber coloured varieties, with improved grain luster and cooking qualities, preferred by the local populations. Improvements in yield and quality of these wheats could not have been possible without the research infrastructure, which was developed in these universities and research institutes.

Further, every change in the seed material requires appropriate changes in agronomic practices to be followed, which only the local research centres can develop through the location specific field level research. This line of argument is often discounted in respect of the wheat revolution, because north-western India is mainly a wheat-belt and any effort regarding research and the adoption of technology for wheat crop is bound to make a better success in these areas. But, the case of rice cultivation in this area strengthens the argument that adequate and capable local research infrastructure is absolutely essential for the adoption of any technology, made available from outside. High-yielding dwarf paddy material was made available by the International Rice Research Institute (IRRI) to all the countries and research institutes in South-East Asia. This material was received in north-western India also, which was not a traditionally rice growing area. Yet the miracle produced by these research institutes/universities is that today they are almost the only and major paddy surplus producing areas, with distinct genotypes and related production technology, developed at these institutions. A decade ago, only a negligible area was occupied by rice crop in the production patterns of Punjab and Haryana. Today, more than 1.3 million hectares of paddy crop is raised in Punjab alone, and the State contributes more than 60 per cent of the marketed surplus procured in the country. This could not have become possible if universities in these regions had not developed adequate research infrastructure for selecting, breeding and developing suitable plant types and appropriate agronomic plant protection and crop management practices, around new varieties. If even a cursory review is made of different regions and States, in respect of their development and growth in the agricultural and rural sector vis-a-vis the development of research infrastructure, one would find a high degree of positive correlation between these two variables. It is, however, unfortunate that due consideration is not being given to the development of research institutes and Agricultural Universities at this stage. Most of the State Universities are feeling tight on research

funds and have to draw heavily on ad hoc ICAR projects and financial provision. It has to be realised that the new better yielding varieties of crops when adopted on a larger scale raise the expectations of the farmers, generating pressures for further crop improvements. Because of this, the eco-system becomes more fragile and new diseases and their biotypes and pests develop with changing virulence patterns. Also, the introduction of new crop types and technology affects socio-economic superstructure. This requires an ever-increasing demand on the basic sciences research and socio-economic studies. The research plant needs constant expansion with respect to the disciplines involved, and the comprehensiveness and sophistication in research techniques, laboratories and equipment. The very expanding size of the research plant creates additional needs for further expansion and sophistication. Yet, the same very bigger size of the research plant becomes highly visible and tempts the administrator to put squeeze on funds. Thus, the same very developed research institutes and universities, which have uniquely contributed to the agricultural growth and development in their command areas, are now experiencing a financial squeeze which puts them at a disadvantage in the race between man and nature. Learning a lesson from the past, research investment in every agro-climatic zone of the country must be made adequate enough to develop the research plant with sufficient research capacity. There is no justification for starving the developed institutions of their increasing financial requirements. Unless a regular flow of funds is ensured, there is always a possibility that different States and regions in the country will traverse a below-optimal growth path in the agricultural sector.

2. Delivery and Recipient Systems

No technology is of any consequence unless it is carried to the ultimate user in a usable form and gets adopted. At present, a large number of new techniques and practices do not leave the four walls of laboratories and research farms and those that are carried to the farmers get considerably distorted or lopped off by the time and the stage they get adopted at the field level. Often, these techniques and practices are adopted piecemeal and several necessary components of the package are either not adopted/used at all, or are used below the recommended levels. No doubt, differences in the conditions prevailing at the farmer's fields and laboratory/experimental farm situation leave enough gap between the experimental data and field results, less than full adoption of the complete package of recommendations is the major cause of large differences between the potential and the actual results. The different components of the package have their independent and interaction effect. Often the interaction effects are larger than the independent effects. One cannot, therefore, expect results of field adoption, matching with the experimental results, unless the interaction effect is fully understood and the packages of recommendations are adopted in full.

In India, we have varying patterns of agricultural extension service. In most of the States, extension service is completely controlled by the State

Governments through their Departments of Agriculture. In several cases, even the research activity is carried on by the States. Consequently, the State departments have to perform dual functions of control and extension education. This is not conducive to the effectiveness of the extension service input. A law enforcing agency can never function as an effective and readily acceptable education agency. These two roles are somewhat contradictory in nature. As a result, the malady of the quantitative target-oriented approach, which has already seriously affected the agricultural management system in India, gets accentuated. We have a partial model of what should be available in the States of Punjab and Haryana. It is partial because only part of the extension education system is attached to the seats of learning and research. The base-level extension service still remains with the State Departments of Agriculture. Even this partial responsibility given to the universities has yielded good results in the adoption of new technology. If extension education service is left to the responsibility of the universities, it would break fresh ground and the gap that exists between the genetic potential and the field results could be drastically reduced. We often confuse effective extension service with the mass media approach. Whereas mass media is an essential component, more important is what is carried with what conviction and by whom. A Government controlled extension service which is entrusted with disseminating knowledge, generated at the universities or research institutes, among the farmers with conjunctive performance of control activities, can at best dress up only quantitative targets. This cannot evoke the desired level of interest and response in the recipient system.

A responsive recipient system is absolutely essential for effective absorption and adoption of any technique or technology. Unfortunately, agricultural management system in India has been patently oblivious of this aspect and the entire effort remained concentrated on the delivery system only. Extension Service, therefore, developed only as a delivery system in terms of the number of workers and the extent of the subject-matter specialities covered. Consequently, the farmers and rural communities have been subjected to a bombardment of new methods, practices and techniques, without generating absorptive capacity and the desired level of responsiveness among the respondent groups and the targeted individuals. It amounts to the pouring of food into partially opened or closed mouths.

Responsiveness of the recipient system is a pre-requisite of an effective functioning of the delivery system. An unresponsive or not so responsive recipient system, as is common in India, is the major reason for the adoption gap we are experiencing today. This aspect has been amply demonstrated by some private voluntary organizations such as the Ram Krishna Mission and the Xavier Institute in the tribal areas of Bihar. When for decades, the government agencies remained ineffective in protecting forests, introducing social forestry and carrying of improved agricultural production technology to the rural society and the farming communities, these organizations have created an irreversible impact of their effort on rural development, primarily because they approach the problem from the premises of the rural recipient

system. A similar outstanding replicable success story is that of Sukhomajri village at the foothills of the Shivalik range, where approaching from the villagers' premises, the recipient system was made responsive to the stimuli provided by the government delivery systems in respect of soil conservation, social forestry, and water harvesting techniques. These examples of a successful dovetailing of the recipient and delivery systems, in the face of prevalent indifference and low responsiveness of the rural farming communities to the extension effort in India, indicate the indispensability of developing effective interplay between the two systems as an important determinant of growth and development of the agricultural sector in India.

It is yet another pointer to the dire need for launching a mental health programme for the physical and emotional well-being of the rural masses to generate constructive responses to the exogenous stimuli within the prevalent rural social environment. This would go a long way in preparing the recipient system to be more receptive to the delivery system, not only in respect of the agricultural development programme, but also in other welfare programmes such as family planning, village sanitation, community services and the like.

3. *Policy Environment*

An all-encompassing determinant of agricultural growth and development is the environment created by the agricultural policy elements within which interactions between the stimuli and responses take place. Although agricultural policy is a comprehensive subject, which includes even research and extension sub-systems as creations of policy decisions, yet attention here is focused on the production and marketing policy as an integral whole which determines the environment for other elements and factors to operate. Farmers and rural communities and, for that matter, any socio-economic entity would not adopt a new technique, method, approach or practice, unless it is socially accepted, economically viable, and financially feasible. The agricultural policy-mix must, therefore, provide a built-in system of incentives and disincentives in order to steer the economy on an optimum growth path. If the agricultural policy does not create a conducive economic environment and does not generate right impulses through a system of rewards and punishment, other stimuli, such as the development of new technology and the extension education input, remain ineffective. On production front, policies like the abolition of the Zamindari and Jagirdari systems, consolidation of holdings, provision of credit for farm investment, such as irrigation and land development, long and short-term credits for purchase of tractors, machinery, implements and tools as well as farm inputs, provision of electric power at comparatively lower costs (through flat rate systems) have created a conducive environment for the adoption of new technology and have provided a right type of climate for economic growth and development to occur in the agricultural sector. Wherever all these elements of the agricultural production policy have been administered on a sustained pattern, agricultural production has

increased and the pace of development accelerated. However, there are certain policy measures that have proved to be ineffective and even counter-productive. These measures include the Laws of inheritance and land reforms aiming at the imposition of very low ceilings on land holdings and the distribution of the surplus lands to the landless labourers. These measures may be socially justifiable, and politically expedient, but they have created a climate of uncertainty in the agricultural sector and have tended to be counter-productive. It is not possible here to go into the details of every policy, having a bearing on agricultural production. Suffice it to say, but for a progressive and dynamic agricultural policy, which changes an indifferent socio-economic environment to a conducive and supportive environment in the agricultural sector, no measure or step aimed at accelerating growth and development can be effective enough to move the economy forward. Contradictory and counter-productive policy measures not only reduce the effectiveness of positive and supportive measures, they indirectly create a kind of indifferent, if not hostile, socio-economic environment, militating against the development efforts. This leads to strong compulsions on the part of political system to resort to widespread subsidies on farm inputs. The programme of farm subsidies, if managed judiciously, can be helpful in promoting growth. But it is bound to degenerate into a widespread distribution of financial support on political considerations, which rather than providing an initial boost to the production, makes the recipients more or less addict to these financial dole-outs. Such an environment further puts pressures for easy options on the part of political system for writing off such public loans, which is suicidal to the proper development of agricultural banking and the institutional credit system of the country.

On the marketing front, the development of markets and marketing system, pricing of inputs and outputs and procurement of agricultural produce are an inter-connected integral whole. It is common knowledge that in most of the under-developed or developing countries, production efforts of the farmers get thwarted at the doorsteps of the markets. It is an irony of fate that the agricultural producer is almost the only seller who has to take his produce to the premises of the buyer and can neither dictate the price nor the quantity to be lifted by the buyer. As a result, uncertainties of market and price govern and condition his decision-making on the production front. The availability of accessible market, the certainty of remunerative price and the surety that the produce will be lifted at the given price in whatever quantity it is offered, would be the right type of market situation, conducive to the growth of any agricultural commodity. The example of the pricing and procurement system for wheat and rice in India is an ample proof of the desirable impact that such a policy can have on the agricultural sector. It is not possible here to go into the details of the type of market and the level of price that would be most effective. This has now become more of a textbook material. My point of emphasis is that apart from the logic and desirability of the favourable terms of trade for agriculture, it is the level of individual commodity price in the total matrix of input and output prices, which matters for its growth. Commodities neglected in this matrix invariably suffer on their acreage and pro-

duction and no amount of technological improvements and extension efforts can find a place for these commodities in the product-mix of the farmer. I quote an example from Punjab which is considered to be agriculturally the most progressive State of India. It is only the wheat and rice crops which have experienced an unprecedented growth. All this happened largely because of the high degree (rather absolute) of certainty regarding prices and procurement. The production of other crops either declined in comparative terms or fluctuated in cyclical fashion since there was neither certainty of prices nor surety of the market. Oilseeds and pulses suffered the most in this process as prices of these products remained totally unpredictable. Being sensitive crops, weather uncertainty as well as disease and pest risks dominated the decisions of the farmers. It would be pertinent to present here the comparative economics and break-even points where these crops can compete with wheat or rice, depending upon the season in which they are grown (Table I).

TABLE I—COMPARATIVE ECONOMICS OF COMPETING CROPS WITH AVAILABLE IMPROVED PRODUCTION TECHNOLOGY, PUNJAB, 1983

Competing seasonal crop	Average yield (qtls./ha.)	Market price (Rs./qtl.)	Levels at which returns over variable costs break-even with wheat in *rabi* and paddy in *kharif*	
			Yield (qtls./ha.)	Price (Rs./qtl.)
A. *Rabi* season				
Barley	40·00	94·50	72·5	160·00
Gram	15·00	264·50	22·0	386·00
Lentil	12·88	311·85	19·5	461·00
Toria	9·75	354·00	18·0	645·00
Raya	14·38	434·00	20·0	489·00
Linseed	12·50	358·00	17·75	494·00
B. *Kharif* season				
Maize	39·00	160·76	66·50	255·00
Moong	13·00	289·00	30·00	633·00
Arhar	13·75	228·75	37·00	577·00
Cotton (American)	15·00	465·00	22·00	661·00
Groundnut	22·25	305·50	32·75	442·00

Evidently, wheat in *rabi*, and paddy in *kharif* are far superior economic enterprises both in terms of returns and the level of certainty, compared to any competing crop in the season. Thus either the production technology in these competing crops must be upgraded considerably to increase yields, *i.e.*, gram by 47 per cent, lentil by 51 per cent, *toria* by 85 per cent, barley and *raya* by 39 per cent, and linseed by 42 per cent in the *rabi* season to compete with wheat, or supported by a system of procurement, the prices of these crops should be assured at a higher level, incorporating 69 per cent increase in barley, 46 per cent in gram, 48 per cent in lentil, 82 per cent in *toria*, 130 per cent in *raya* and

38 per cent in linseed. Similarly, in order to compete with rice, either the production technology must be improved to increase the yields of competing crops, *i.e.*, maize by over 70 per cent, *moong* by 130 per cent, *arhar* by 169 per cent, cotton and groundnut by 47 per cent. Or else, the prices must be assured at a higher level to the tune of 59 per cent increase in maize, 119 per cent in *moong*, 152 per cent in *arhar*, 42 per cent in cotton and 45 per cent in groundnut. Interestingly, these normative price levels for these competing commodities are being maintained at the retail level, providing an unduly high profit marketing margin for the trade. The problem of price imbalance (and also technology gap) is prevalent only at the level of the producer-seller.

Thus, pulses and oilseeds are at odd with the economic environment. It is only an imaginative price and procurement policy which can turn the situation favourable. Wheat and rice have a special advantage because their quality can be easily determined and the produce can be acceptably graded for pricing. Also, these are easily transportable and storable products. But oilseeds and pulses cannot be quality-graded so easily. They quickly lose in quality because of the development of rancidity. They cannot be, therefore, stored so easily and for long.

Reverting to the pricing system, even for wheat and rice there is too much arbitrariness involved. The data generated through a comprehensive scheme on cost of cultivation for important crops do not present the prevalent cost structure at any time. Often, the data brought out are over two years old and do not depict the picture of the season for which they are used for determining the level of procurement prices. The system leaves much to be desired. If production is to be increased, the prices must progressively cover the cost of production of a larger percentage of the producers. Though the cost of production cannot be made a sole basis for fixing procurement prices, one cannot afford to ignore production costs altogether. Price determination again is a vast and complex subject. I would not venture to expatiate upon this subject in this address. However, I should like to emphasize that the element of opportunity cost of inputs must not be disregarded in the process of determining the level of administered prices. The determination of paddy price in a drought season can be taken as a good example when a vicious circle operates, whereby the crop needs more water due to the high rate of evapotranspiration. There is scarcity of canal water because of the lower level of water available in the reservoirs. Consequently, the demand for electricity for pumping water increases but the generation of electricity is reduced, since there is inadequate water in the reservoir to release. What happens then is that electricity is diverted from industry and other non-agricultural undertakings, as also from the consumers to the agricultural sector. This electricity has a high social opportunity cost, which never finds any place in the cost calculations of agricultural commodities. For the State of Punjab, the per unit cost of production of electricity is around Re. 0.54, yet to the farmers the charges work out to be not more than Re. 0.13 per unit. Thus, for every unit of electricity consumed in the agricultural sector, the State incurs a subsidy cost of Re. 0.40, amounting to between Rs. 100 and

120 crores total expenditure every year. This cost to the State does not figure in any cost calculations for determining the prices of agricultural commodities. A similar pattern prevails in the Haryana State. Thus, the producer States directly subsidise the consumers of the deficit States without being fully conscious of this significant fact. Thus, year after year, there is a continuous depletion of the resources of these States which need to be replenished in some form or the other. One way of achieving this objective would be to determine the administered prices of the agricultural commodities in two parts. One component, meant directly for the farmers, based on their cost of cultivation and other related considerations, and the other component for the State, based on the surplus quantities of foodgrain, moved out of the State, in order to recoup the social costs. The latter part must also take into account the social opportunity costs of the State investments/subsidies, made in the agricultural sector. Or else, the producer States should charge these costs from the farmers at par with the other sectors and the consequent higher cost of such inputs be accounted for in the price determination for the producer-sellers. If consumers are to be subsidised, which may be quite desirable, specially in the case of foodgrains, this must be done out of the consumer State exchequers or the Central budget. This burden must not be shifted to the producer States, because it adversely affects their resource position and development effort, which is not in the larger interest of the nation itself. Under such a drought condition, farmers on their part try to save rice crop by diverting irrigation water from other less certain and less remunerative crops, such as fodders, sugarcane, pulses and maize. The total or partial loss of these crops is the individual opportunity cost the farmer incurs on raising rice crop, even if electricity is charged on the flat rate basis. This cost never figures in the cost calculations for determining paddy or wheat prices.

Recapitulating the issue, it must be stressed that the agricultural marketing and price policy should provide for an incentive-oriented economic environment which adequately compensates for the real costs incurred on raising different crops within the framework of a multi-crop rational matrix of input-output prices. The easy accessibility to the market and the certainty of market clearance are equally essential elements of this economic environment, which is an all important determinant of growth and development in the agricultural sector.

4. Rural Infrastructure

Most of the village populations in India are small and are dispersed over the countryside. This makes it financially and administratively difficult to provide the required amenities and the development infrastructure to all these populations. Usually, the remote villages suffer the most. They often have poorer soils and lack irrigation facilities. Their poverty calls for urgent and utmost attention, but being comparatively difficult locations, they receive the scantiest consideration. The lack of easy approach to these villages is the

major reason for their having been left out of the main stream of development. In most of the agro-climatically homogeneous regions, villages which have asphalted approach roads have always experienced higher growth and development, compared to those which do not have any such approach roads. Similarly, if we examine the road development per square kilometre area in different States vis-a-vis the agricultural growth rate experienced in these States, we will find a high degree of correlation between these two variables. In fact, when we think of the rural infrastructure to support dynamic socio-economic superstructures, the village approach roads assume primary importance. One major factor, which has made a singular contribution to the agricultural/rural development of Punjab and Haryana, is the priority given to the village approach roads. Today, all the villages are approachable through the asphalt roads. Not only that, villages have circular roads around, making the asphalt road accessible to every village household. This reduces the communication gap between the villages and the urban-based socio-economic, cultural and political centres of activity. Education leading to a bilateral flow of knowledge and understanding, makes demonstration effects more visible. Public transport too increases the extent and frequency of travel between villages and the city centres. Students, workers and employees, while living in their village homes, get easy access to education and jobs. Often, even women from villages travel to the cities by bicycles, scooters and buses for education and jobs. Thus the village and urban markets become more integrated. A free flow of goods and services reduces the element of market apportionment. It becomes possible to set up the needed focal points and roadside centres for remote villages to provide marketing services both for input supplies and output sales and procurement. All these factors, put together, *i.e.*, improvement of knowledge and education, demonstration effect, easy availability of essential inputs, easy access to the produce market and, above all, interaction between the village communities and the urban-based extension services as well as the socio-cultural, economic and political organizations, provide strong stimuli to the growth and development in the agricultural and rural sector. This model which operates effectively in Punjab, can be, and should be, replicated in other parts and States of India.

Next comes the provision of electricity for agricultural purposes and household consumption. Once, I put a question to a farmer in a remote hill village, where down below from his place hydel power was being generated, as to what was his most pressing need ? His answer was one lightbulb, may be, even that hangs from a tree in his courtyard! Electricity for lifting irrigation water and other farm operations is neat and cheap, compared to any other motive power used. The very presence of an electric motor at the farm gives it a new configuration and changes the farmer's whole outlook. Similarly, the availability of electricity in village homes changes the perceived status and the outlook of the farming/rural families altogether. They become more responsive to new ideas and develop an urge to progress, which is a great motivating force for improving their farm efficiency and living standards. With the presence of the approach roads it becomes easy to install and main-

tain the electricity infrastructure in the villages and the later subsequent defaults can be corrected easily and promptly. Roads and electricity have a great interaction effect on the growth and development of agriculture, ameliorating the living conditions in the villages.

The third important element of the rural infrastructure is the provision of school level education. The development of roads and availability of electricity make it easy to take school education to the doorsteps of the village communities. Teachers can easily travel from the adjoining urban centres. This attracts comparatively more qualified and better talented and trained teachers than would be the case if they were to stay in the villages. This also promotes rural and urban cultural interactions and improves the human capital in the villages a great deal.

These three factors put together, *i.e.*, roads, electricity and education, enhance the mobility of the rural populations, and lend dynamism to their outlook. These factors, interacting together, encourage consciously conceived out-migration. The State of Punjab provides a typical example of this interaction and out-migration. Although an average skilled mason would earn Rs. 50 per day and a labourer Rs. 25 and above, all the labour force available for road work and construction comes from Uttar Pradesh, Bihar and Rajasthan. Were this labour unavailable, there would be a total chaos in the construction and agricultural sectors of the State and the only answer would be large scale mechanization. How to account for such a phenomenon? Access to education, demonstration effect and mobility created an insatiable urge in the village youngsters to move out for better incomes. While out of the country, they absorb different values, develop work habits which are highly productive, and also accumulate financial resources. When they return to their farms and villages, they are different personalities who work in a more productive and progressive manner. They have also the required capital resources with them. On the contrary, illiterate labour or those who migrate into Punjab from other States, no doubt, get exposure to a new culture, but their sensitivities are not sharp enough to absorb its wealth and beauty so that when they go back to their villages, they are richer only in terms of their monetary gains but the mode and moorings of their lives remain essentially unchanged. Naturally, therefore, they soon lapse back into the tradition-bound socio-economic cob-web of their own, and this leaves almost no imprint on their farming operations and standards of living. These three elements of rural infrastructure, *i.e.*, roads, electricity, and education, have a direct impact on agricultural growth and rural development, by improving and enhancing human capital, social and economic mobility and inter-community interactions for a healthy social, cultural and economic environment, both at the farm level and in the rural households.

There are, no doubt, other important elements of socio-economic infrastructure, such as provision of health services, marketing services, banking, post and telegraphic services, play grounds, community halls. I am emphasizing the trio of roads, electricity and school education, as crucial and basic

elements of rural infrastructure, enabling the other elements and factors of growth to interact more effectively.

5. Responsive Farming Community

It is often the constant and repeated exposure of the community to the outside influences that makes it more dynamic and outgoing. Punjab, parts of Haryana, parts of Western Uttar Pradesh and Eastern Rajasthan have very responsive farming communities, always willing to adopt new practices and try new methods and techniques in their farm enterprises. The gap in the research findings and techniques developed in laboratories and experimental farms, and their adoption at the field level, is the lowest in these areas. Hence the higher rates of growth and development. One factor that has rendered these communities more dynamic in their attitudes is the repeated dislocations they suffered in the past. With every disturbance, just like a transplant, they re-established and flourished even better than before. The Partition of Punjab in 1947 rendered a large number of farming families homeless. These families settled down in these areas. Now they are the leading farmers, providing excellent examples of rehabilitation, growth and development in the agricultural sector. Another factor, making these communities more responsive, is that they have a large share in the defence services. When they retire from service, especially the officers, they prefer to settle down on their own farms. They bring back discipline, aptitude for work and a progressive outlook. For the adjoining areas, these farms serve as demonstration units for improved farming techniques. Similarly, most land owning civil servants revert to farming after their retirement. Also, those who go abroad ultimately return to their lands. This process over a period of decades has lent the farming sector a high degree of dynamism and responsiveness to the new ideas manifest in the adoption of new techniques. This responsive recipient system has enhanced the efficiency of the delivery system in the farm sector. How far this model can be replicable or applicable in other parts of the country is a big question as it involves humans and their families. Perhaps, diversification introduced in the defence services will have a good influence on the farming sector when these officers and other ranks return to their villages after retiring from the services. It is most desirable that the land owning defence and civil service employees be encouraged to return to their villages.

For the extension agency, these farmers can play the role of innovators and early adopters of the new technology. In several States, laws inhibiting or altogether blocking the owning of agricultural lands by outsiders are not conducive to the process of inter-community interaction from different regions and with different experiences. New entries of progressive families into an otherwise closed society help open up the traditional social system. This makes the recipient system in the village communities more responsive.

The set of five determinants of growth and development in the agricultural sector, *i.e.*, adequate and growing research capacity, extension education

through matching delivery and recipient systems, adequate rural infrastructure to interact with socio-economic superstructure, conducive agricultural policy environment and responsive and dynamic farming community, in addition to the independent effects of these determinants, have a high degree of interaction effect. Such a framework is a pre-requisite for achieving rapid agricultural growth and development in any area, region or State of the country. Any slowing down of the pace of growth and development can be attributed to the lack or inadequacy of one or more of these elements.

The framework of determinants of agricultural growth and development will, however, depend for its efficiency on the basic structure of the man-land ratio and the management of these two crucial resources, *i.e.*, land and the population. India is a country of small farms which suffer from inherent inefficiencies. Legislative measures, relating to the ceilings on land holdings, have aggravated the situation further. The farming sector does not have any built-in mechanism for automatic adjustment to the changed economic and social environment. In a dynamic situation, the land-man ratio must improve and farm population must keep shifting from the farming sector. But land reforms and laws relating to land management in the agricultural sector in India envisage containing the agricultural population in the villages, irrespective of what happens to the farm size and economies of scale in the farming sector. This might have led to a marginal increase in agricultural production due to the higher input of labour per unit of land, but it is not conducive to generating agricultural surpluses and wage goods, consistent with the surplus labour, which must be siphoned off the agricultural sector. Further, small farms with low land-man ratio cannot effectively absorb the elements of developing modern technology. As a result, increasing proportion of rural agricultural population with an inadequate land base is bound to fall below the poverty line. It is, therefore, imperative that our land ownership and management policy must aim at increasing the farm size and shifting the population out of the agricultural sector. This can come about in two ways. One is to create alternative gainful opportunities in the industrial/urban sector through an injection of exogenous investment and absorption of the surpluses of capital or wage goods, generated in the agricultural sector, leading to the inevitable absorption of the surplus labour force from the rural sector. This expands the urban sector with an industrial base and aggravates the accompanying economic, social and cultural problems, creating conditions hardly conducive to the development of healthy and balanced rural and urban societies. The other alternative is to locate industries right in the rural areas or at the approachable distances from the village concentrations so that farming progressively becomes a part-time occupation as it is in Japan and Taiwan. This will help the farming families earn a large proportion of their incomes from the non-agricultural pursuits. The farm-steads and villages would provide a home base to the rural population to live in and operate from for earning their livelihood both from agricultural and non-agricultural pursuits. This model can relieve the agricultural sector from pressures of rural population and will lend it necessary dynamism. As the situation is,

farms cannot be expected to provide total wherewithal to the farming families and, at the same time, generate surpluses for the urban industrial sector.

The element of population in the duality of the land-man ratio is a very crucial factor. So far, emphasis in the country has mainly been placed on population control. Little has been done on population planning and management. As a result, the progressive regions as well as socially conscious, educated and higher income groups and individuals have taken to family planning more effectively. Under the prevalent socio-economic situation, whereas an additional child is regarded a liability by the well-to-do families, it is considered as an economic asset by the poor. This has led to the higher growth rates of population among the poor groups, sections and regions, of the Indian society. It is here that population control is absolutely essential. This has created, and is progressively aggravating, an imbalance in the quality of the population in India. It should receive very serious attention of our population planners and policy makers.

What I have said is fairly specific. Yet economists and other social scientists need to further study the areas and regions with different levels of growth and development, within a framework of these cause and effect relationships, and quantify the ingredients and elements of the systems and subsystems, responsible for inhibiting growth. We have reached a stage where agricultural production and productivity is tending to level off. Yet there is a tremendous scope for further growth. What is inhibiting the growth should be of topical interest to us all. Agricultural policy makers, too, need to shed their traditional approach of dispensing policy prescriptions from the ivory tower. They ought to establish a close and meaningful rapport with the economists and researchers at the field level, so as to breathe a new life into the national policy on agricultural growth and development.