



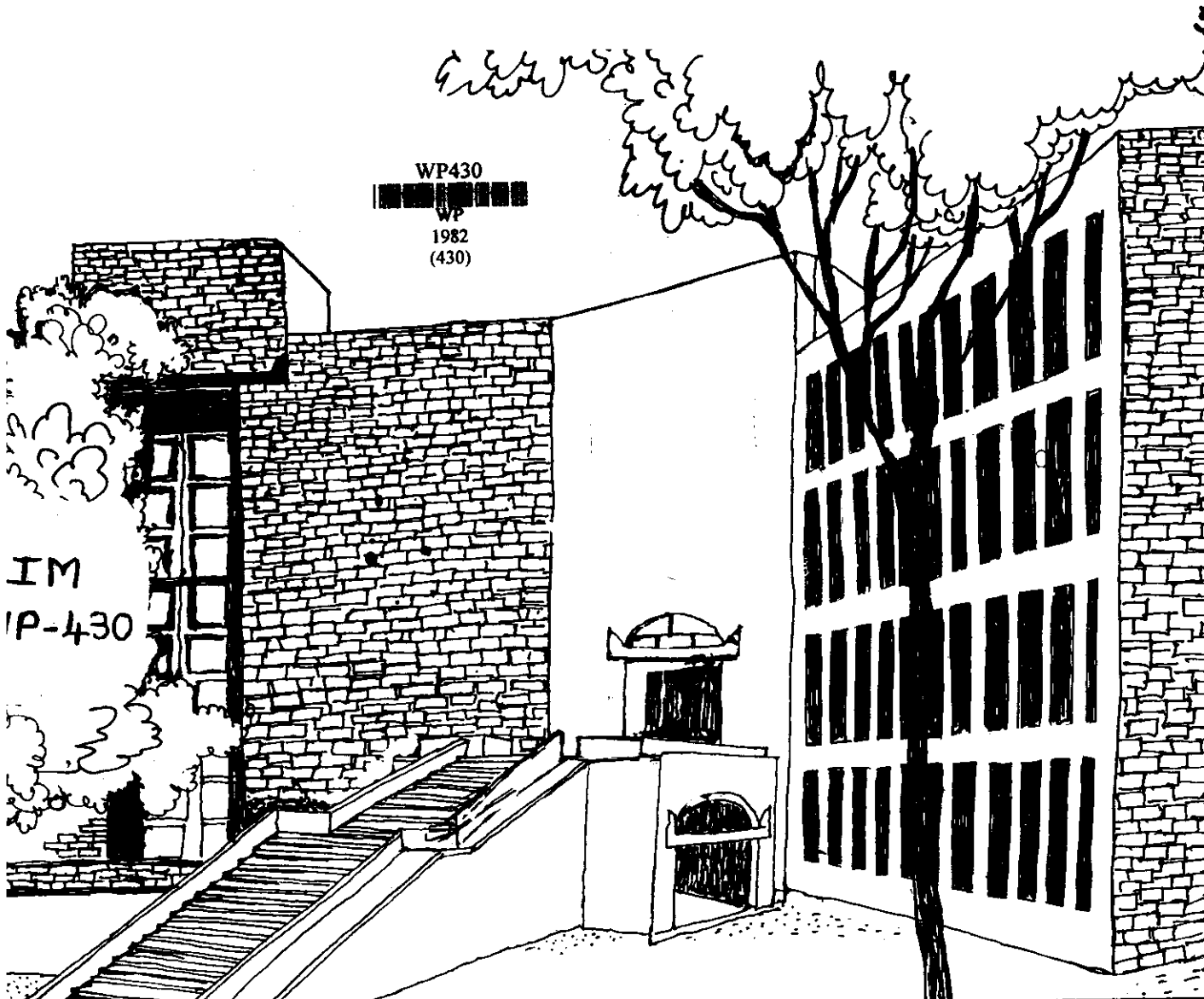
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Working Paper

SOUTH ASIAN EXPERIENCE IN AGRICULTURAL
MECHANIZATION

By

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South Asian Experience in Agricultural Mechanization*

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An analysis of mechanization in South Asia should begin with an overview of agricultural growth as it has unfolded in the last few years. Therefore, an attempt will be made here to summarize the growth experience underlining the main forces shaping and guiding agricultural development in countries of South Asia. Reference will also be made to the interplay of various features of these economies which have influenced the outcome. Although the South Asian region comprises of eight countries, which differ in their size, stages of development, agrarian structure, and socio-political institutions, my interpretation of facts and assessment of policies is bound to be influenced by my closer acquaintance with Indian economy. I may mention at the outset that the statements I shall be making in the course of this lecture are, to a large extent, supported by facts and figures. However, keeping in mind the general nature of my talk I will refrain from quoting statistics.

2. A remarkable feature of economic growth in South Asia during the last decade or so, is the emergence of agriculture as a buoyant sector. During 1970s, the rate of growth of foodgrains output was faster than

* Based on lectures delivered at Hangzhou and Beijing, Peoples Republic of China, in May 1982, under the auspices of Chinese Academy of Farm mechanization. The author is grateful to his colleague Prof. Girja Sharan for the comments on an earlier draft.

the rate of growth of population in almost all the countries of the region; in several countries the output of foodgrains was faster than the growth in effective demand; food self-sufficiency ratio for the region and for the majority of countries improved, the growth of agricultural exports outpaced the growth of agricultural imports. Some of the countries where agriculture had stagnated in the 1960s turned the corner, and others could maintain the high tempo of the previous decade. Although growth in agricultural production in South Asia was not as fast as in South East Asia or East Asia, its performance was superior to Africa or Middle East.

3. The engine of growth was irrigation sided by a technology which revolved round the high yielding varieties (HYV) of seeds and chemical fertilizers. The countries of this region have, since time immemorial, constructed and maintained large, and complicated irrigation systems. In recent years there has been a further spurt in this activity. Apart from publicly funded flow irrigation schemes, ground-water development has also received substantial impetus. Through tube-wells, artisan wells, and dug wells, large areas of land are brought under irrigation. This process has been further facilitated with the popularization of mechanical water lifting devices.

4. With the availability of assured water supply, the HYV varieties of wheat and rice (in some areas HYV of other crops, such as cotton also spread with a remarkable speed. In less than a decade, more than

two-thirds of the area under wheat and approximately 40 per cent of the area under rice were brought under the HYVs. If one takes irrigated area sown under wheat or rice the proportion covered by the HYV will be still higher. Three main features of the HYVs make them eminently suitable for the land scarce, labour abundant countries of this region. These are: (i) they are size neutral, (ii) they are labour intensive, and (iii) their short-maturing characteristic facilitates introduction of multiple-cropping.

5. Impressive though the growth of agricultural production was, it was not adequate to make a substantial impact on the problem of poverty which is most acute in this region (This region has the dubious distinction of having the largest concentration of the poor in the world). From all available indications one is forced to conclude that there has not been any measurable reduction in the proportion of the poor among the rural population of these countries.

6. It is now well recognized that in countries of South Asia, the problem of poverty has to be tackled in a large measure within the rural areas, and agriculture has to play a pivotal role in providing, directly or indirectly, opportunities for gainful employment to the rural workforce. So far, the movement of workforce from agriculture to industry has been insubstantial. Occupational diversification within the rural areas is still less satisfactory. Traditional rural arts and crafts are withering away, and modern household and rural

industries are not filling-in the gap fast enough. As a result, the dependence of rural workforce on agriculture is increasing.

7. The pattern of industrialization in the poor, over populated countries of Asia may turn out to be different from that observed in countries of the West. We will have to divest ourselves of the notion that industrialization means a set of distinct and separate activities pursued by a workforce which is totally detached from land. In countries of South Asia, as in the countries of the East Asia during their development phase, the phenomenon of part-time farm households will become progressively more important, i.e. some members of the agricultural household will be engaged, full-time or part-time, in industrial activities, or what you call in China as "sideline activities". The phase of industrialization as symbolized by capital intensive, skill intensive, machine centred activities manned by a sizable workforce exclusively dependent on such activities will come much later.

8. The impetus to complementary and supplementary non-agricultural activities can come only from a dynamic agriculture. A buoyant agriculture will forge backward linkages by asking for more non-agricultural inputs, and induce forward linkages by stimulating agro-based industries. More importantly, the rising income of agriculturists will create demand induced linkages with consumer goods industries. The generation of employment by a number of such induced activities will be specific to rural locations. All such linkages have remained weak in South Asian

countries and as a result only very few non-farm activities could be stimulated in rural areas.

9. As for the future, there are four aspects of agricultural growth which are relevant for our discussion. The overall rate of growth of agricultural output in countries of South Asia, as mentioned earlier, was faster than the population growth. Yet it was not fast enough to permit automatic percolation of benefits to the lower strata of society (which would occur only when total linkage coefficient is high enough to put large demand on agricultural and industrial products, and thus raise wages of rural workers). The first and foremost requirement of South Asian economy is not only to maintain the tempo but to accelerate the rate of growth of agricultural output. Second, the incremental growth in output is contributed to a large extent by areas with assured rainfall or dependable irrigation. In the remaining areas agricultural production has virtually stagnated. This has led to growing regional inequalities. Third, although size-neutral technology centering round the HYV has enabled even the small farmers to contribute to the growth in output, their access to resources being limited, their share in the additional output has remained meagre. Fourth, the lands of South Asia are supporting a large number of livestock. To make optimal use of these animals is a task which is intimately connected with the pattern of agricultural growth. Apart from briefly commenting on all these four aspects, I would also endeavour to suggest how the process of mechanization has contributed to resolving, or compounding, these and other related problems.

10. From the available studies, it is clear that the rate of growth in agricultural output in South Asian countries should increase from the current 3 to 3.5 per cent per annum to 4 to 4.5 per cent per annum to enable them to provide productive work in agricultural and related occupations to their growing rural workforce. This rate of growth is also necessary to remove the wage-goods constraint, especially the constraints imposed by foodgrains supplied. It is a well recognised fact that most of the increase in agricultural output can be obtained by augmenting the yield per hectare. The scope for expansion of arable land in those countries is very limited. The area of extension will be restricted, by and large, to multiple-cropping. Irrigation will prove a critical factor in the intensive use of land and mechanical water lifting equipments, diesel, and electric pumps will continue to play an important role. One of the laudable features of farm mechanization has been the spread of pumps and motors. Credit and subsidy policies pursued by the government of the region consisted in the remarkable spread of these equipments in the region. This form of mechanization had no adverse side effects. But leaving aside the water-lifting devices at the farm level and moving on to the technology of creating irrigation infrastructure, the usual conflict between the labour intensive construction technology and the capital intensive technology raises its head. It is difficult to pass any summary judgement, but keeping in view the large pay-off of irrigation schemes, the saving

in time which the machine ensured, and problems of organizing large public works through extensive use of labour, the selective use of machines on large irrigation projects is fully defensible. In fact, this was the strategy largely adopted by the countries of the region.

11. In the labour abundant economies of this region, it is difficult to justify large power driven machinery for cultivation purposes, i.e. for land preparation and related activities, except in areas where animal draft power is a major constraint. Some times a plea is made for introduction of mechanical harvesting on the ground of timely operations between two crop seasons in areas where possibilities of multiple-cropping exist. The results from several studies of this region have questioned the need for mechanization of harvesting operations as a pre-requisite for extension of area under multiple-cropping. In fact, multiple-cropping and mechanization of harvesting operations have progressed independently. At this stage of land-labour ratio and the level of real wages, power-driven machines do not have superiority over manual and animal driven tools and equipments for harvesting operations. The only other operation where mechanization may be justified is the post-control operation.

12. Public resources which are being utilised for subsidizing, directly or indirectly (by tariff protection, easy access to credit, etc.), power driven machines can be better utilized in generating and extending appropriate crop raising technologies, ensuring timely

supply of biological and chemical inputs and creating physical and social infrastructure in the countryside. The last is very important. Investment in infrastructure will generate externalities which can be availed by the rich as well as the poor farmers. In the federal and state budgets in these countries one can notice a sizable allocation of funds for subsidies, both for the producers and the consumers, with the avowed objective of helping the poor. Invariably these subsidies are pre-empted by the non-poor of these countries. Subsidies and tariff protection accorded to power-driven machinery are no exception.

13. An analysis of farm mechanization at the country level can gloss over some of the vital details in large countries of South Asia with significant regional differences. Constraint to growth in different region varies. There are regions in each of the countries of South Asia where rapid growth in agriculture, and also industry, has created labour bottleneck at least during the critical operations. Migration of labour in such areas from labour abundant backward region is not a practical solution, once one recognizes the difference in language, customs, and habits. There is hardly any example of large scale labour migrations establishing an 'equilibrium wage' in a large country. However, temporary, seasonal migration do occur to a limited extent. In such labour-scarce areas (and the test is the upward movement of real wages) farmers do resort to mechanization for understandable reasons. The phenomenon of scarcity of draft animal power is also prevalent here for which even migration is not a solution. There is also the case

of the backward regions where removal of physical constraints is dependent on large scale mechanization for land shaping, irrigation, and drainage. Such activities are in the nature of infra-structure creation to which I have already made a mention. Having recognized the need for mechanization in backward regions let me also suggest that the major constraint to development of the by-passed regions is the lack of physical and social infrastructure and appropriate set of economic activities suited to the ecology and the environment of the concerned region.

14. An interesting feature of farm mechanization situation in South Asia is the existence of a relatively large number of four-wheel high power tractors, while the size distribution of agricultural holdings and would suggest a larger prevalence of two-wheel or at any rate small-power tractors. The existing situation reflects, in essence, the bi-polar agrarian structure. A fewer number of large farmers having easier access to capital resources opt for bigger machines which can be utilized for farm operations on own farms, can be hired out for similar operations on other farms, and can be used for transport purposes. It seems that small tractors and power tillers have not acquired such versatility. Besides, tractor has become a prestige symbol, and an inducement offered to the sons of the large farmers households to remain on farms rather than to migrate to cities.

15. On the other hand small farmers are investing more, on per hectare basis, for tools and equipments. This is partly because custom-hiring arrangements for smaller equipments, including power

tillers, are not in vogue. Partly, this is because mechanical equipments suitable for the small rather tiny, holdings are not developed. As a result the small farmers have to own larger number of tools and also a few (animal driven) equipments which are not quite suited to their scale of operation. The traditional form of mutual aid in farm operations is fast disappearing, which makes it necessary for each farmer household, big or small, to possess a full set of tools and equipments.

16. Finally, let me say a few words about the animal-machine interaction. The issue of draft animal power in the context of mechanization is a more complex one than what is generally realized. The fact that animals are inefficient convertors of energy, by itself, is not a decisive argument to substitute them by machines. If for no other reason, the fact that they represent vast amount of sunken capital -- on the South Asian farms, livestock ranks next only to land in investment terms -- is an important consideration for making best use of them. Besides, in several countries of the region, the livestock, particularly cattle, are dual purpose animals. The machine may take care of the draft aspect, but it cannot satisfy the demand for milk or meat. At the same time there is no justification for becoming sentimental and constantly harp on the high cost and short availability of non-renewable sources of energy to justify continuation of animal power on farms. One has to view the livestock problem in a systematic way. To make animal power comparable or superior to machine power,

improvement in traction capability as well as milk and meat yields is necessary. This would include, among other things, upgrading of feed and fodder resources, mainly by raising per hectare output. In the countries of this region, this aspect was largely neglected, and it proved to be all the more serious as the pressure of population on land brought more and more open spaces under the plough. As a result the dwindling areas under pastures and grazing meadows had to carry progressively larger number of animals, naturally, on a reduced ration. The poorer quality of livestock was sought to be compensated by larger numbers, only to continue a vicious circle.

17. In the countries of this region, the major considerations of the farmers in opting for machine power have been the paucity of draft power and its high cost of cultivation on the one hand, and the easy availability of credit for the purchase of machinery on the other. It is not surprising, therefore, that they dispensed with the animal draft power. However, this displacement of labour or the draft animal power has had no perceptible impact on farm productivity.

18. There are at least three major directions in which policy makers, agricultural scientists, engineers, and economists have to work to ensure that mechanization emerges as an aid to both the big and the small agricultural producers. In the first place, there is a need to combine the growing knowledge of biological and meteorological phenomena and the advances in crop sciences with the engineering skills; mere spread of tools and equipments which have evolved in different climatic conditions

and for different agrarian structure is not enough. This is particularly so in case of the by-passed regions where social and ecological features require application of the most sophisticated knowledge and technology to break the physical and organizational constraints. Investment in building scientific capability is as important, rather more important, as the introduction of machines. Secondly, there is a need to evolve an efficient power-pack and a whole complement of tools to perform various farming operations. The poor farmers of South Asia are not in a position to have a series of different machines and equipments. What they need is a versatile machine which, with proper adjustment, can perform all their basic operations. While evolving appropriate tools, the possibility of their being used by the animal draft power should be an over-riding concern. Thirdly, it should be recognized that there is an organizational aspect of mechanization also. A larger machine could be defended even for poorer farming communities, if there are arrangements for custom hiring or collective sharing. Different forms of organizations should be tried out to suit the genius of people with the objective of encouraging collective or cooperative ownership of machinery, tools, and equipments.

19. The South Asian agriculture, today, is at a stage when only those machines which are complementary to human labour and draft animals, can claim priority. The task is difficult because most of the machines are

developed either in land surplus or in capital surplus economies which do not have to face the complex problems of unemployment and under-employment of large army of human labour, and proper utilization of draft animals who cannot be dispensed with. This challenge can be met adequately only with the collaboration of agricultural scientists, agricultural engineers, economists, and management experts, all working closely with the ultimate user of their product, the agricultural producer.

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