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"A project-oriented approach has often been a substitute for serious concern with the design of a strategy for the agricultural sector."

Bruce F. Johnston and Peter Kilby,
Agriculture and Structural Transformation, p. 130.

"Unfortunately, either we have theories which make assertions rather than provide a framework for understanding the phenomena or we have theories instantly constructed to fit the observed facts."

C.H. Hanumantha Rao, in Employment Expansion in Indian Agriculture, p. 239.

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June 1979

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I. Introduction

Why employment-intensive or labor-intensive agricultural development ? Don't people work hard enough already ? Hasen't agriculture always been very, very labor intensive ? The answer is that we are exploring alternatives for the future. Due to technological advances cumulating over the past 30 years, a broad range of choice between labor intensive and capital intensive agricultural development is available. The evidence is mounting that, even in the short run, in the early aspects of development (essentially, while a labor surplus exists on a broad scale) choices may be made of different combinations of labor and capital (factor proportions) without giving up over-all growth potential and while gaining immediate distributional benefits.

A labor surplus is said to exist when constant real wage levels in agriculture are observed over time.^{1/} Real wage levels have been constant or declining in much of rural Asia in the poorer households.^{2/}

Labor intensive production patterns in the initial stages of development appear to practically boil down to farming. However, agricultural development in even the most under-developed economies involves considerable "backward linkages" for inputs and "forward linkages" for product processing that can be an integral element in an employment strategy, yet remain as "agricultural". In small, open economies such as Taiwan or S. Korea, refinement of these linkages through international trade can rather quickly lead to the disappearance of a general labor surplus ("Lewis turning point") in complement with the rising importance of "z - goods" — non-agricultural goods produced in the rural sector.

Emphasis upon employment holds the promise of achieving a broadly distributed productivity or growth pattern that serves to provide people with food and dignity as productive members of the human family. The essential conditions for emphasizing an employment strategy are: 1. Badly concentrated and/or worsening income distribution. 2. A weak fiscal (redistributive) potential in the state. 3. A general surplus of labor. When the conditions no longer apply, industrial development continues to present the best option for sustained increase in productivity. A labor-intensive growth strategy is applicable only in early stages of development.

^{1/} J.C.H. Fei and G. Ranis. Development of the Labor Surplus Economy: Theory and Policy, 1964.

^{2/} International Labor Organisation. Poverty and Landlessness in Rural Asia, 1977.

II. Conceptual Context

Economists have emphasized the dualistic character of developing economies through placing considerable stress upon sharply differing rates of productivity of factors of production in industry and agriculture. (There is an almost irresistible urge to classify these two types of production as sectors which are "modern" and "Traditional".) Richardp and Malthus were prominent among "classical" economists in arguing that productivity of land, and the labor associated with it, was relatively low and constrained by nature. W. Arthur Lewis and Fei and Ranis updated the classical concept of the dual economy in formulations compatible with Nurkse's evaluation of the early process of capital formation in developing economies.^{3/} The crucial assumption, that labor in agriculture could be transferred to or absorbed in industrial employment and thereby, very sharply increase the economy's productivity, was paralleled by the realization that the owners of industrial capital could realize substantial surpluses by employing the labor at wages far below its' average productivity, given the "reserve army" of workers in agriculture.

Of course, this schematic of development as a process of structural transformation has become severely complicated. Capitalist surpluses, whether from industry or from plantation agriculture, are not always (or even often) reinvested in the developing economy. All too often, average worker productivity in industry comes nowhere near theoretical levels. The massive, undifferentiated labor force proves to be somewhat erratic ("backward bending" for certain wage levels and sub-groups), politically active and often with seasonal supply characteristics. Supervisory technical skill shortages are endemic. Effective demand for industrial output is found to be very sensitive to factors exogenous to the economy of concern. Effects of population increases and of technological advances in agriculture seriously undermined the classical assumptions concerning aggregate per capita food supplies and productivity of agricultural capital.

Wage goods are needed in abundance to ensure industrial-sector capitalist surpluses. At low income levels, 60% - 70% of income is spent on basic foodstuffs, and the bulk of the remainder on products derived from agriculture. Therefore, it is necessary to produce enough in agriculture to sustain capitalist surpluses, in the classical scheme. It is assumed that the agricultural labor force can feed itself and generate a surplus for sale to industry. Malthus pointed out that population increases doomed the orderly transformation of society. The classical response was to re-emphasize industrial development, noting that as incomes rose, completed family size tended to decline. Investment in agriculture was conceded grudgingly, if at all, except for opening of new lands to cultivation and as an aspect of efforts to mitigate famine. Observedly, most such investment simply was not as productive as industrial investment.

^{3/} W.A. Lewis. "Economic Development with Unlimited Supplies of Labour, "Manchester School, 1954. Fei and Ranis, op. cit. R. Nurkse. Problems of Capital Formation in Underdeveloped Countries, 1953.

In addition to recommendations derived from observable productivity differences and from requirements for capital formation, a third powerful theoretical consideration weighs on the side of industrial development. This is the effects of changing income levels upon the composition of effective demand (Engel's Law). As people's incomes rise, less of the total is spent on foodstuffs: The diversity of demand increases. Fisher and Clark hypothesized that the effects of demand changes upon output patterns would change employment patterns, sustaining the movement of labor out of agriculture and effective demand for industrial production.

In the mid-1960s it was conclusively demonstrated that the potential productivity of agricultural investment was very much greater than historically experienced in large areas of the world. Given "sufficient" water, newly-developed hybrid seed in combination with newly-mass-produced chemical fertilizer (plus pesticides in some instances) could lead to very great increases in land productivity. The role of agriculture in development was reassessed.^{4/} It has become generally accepted that agriculture should not be utilized as a passive supplier of surplus to industry. The complexities of industry-agriculture relationships, the roles of external trade and the qualifications to rigid extrapolations of effects of Engel's Law upon patterns of output and employment receive emphasis in contemporary analyses of dynamic developing economies. Economies like that of Nepal, where low-productivity agriculture predominates, draw attention to internal problems of agricultural development.

Until quite recently, agricultural analysis was focused upon aggregate output and, to a lesser extent, upon the distributional effects of the hybrid seed/fertilizer investment package. Increased output was seen in investment terms — for fertilizer plants, storage and distribution facilities, for pesticides, for water pumps and irrigation works and electric power generation capacity. Concerns about the distributional consequences of enhanced land productivity tended to be focused on access to credit. "Dryland" agricultural development was seen as a problem of technical adaptation. The attitude that rural landless peoples represented a residual best absorbed into the "modern industrial" sector persisted.

Economists working in India have led the way in arguing that selective development within agriculture holds potential for substantial alleviation of mass rural poverty, and thus for sustaining moderate over-all growth rates in the three decades or so before aggregate population growth slows.^{5/} Technical argument along these lines

^{4/} See particularly, Subsistence Agriculture and Economic Development, edited by Clifton Wharton, Jr., 1969.

^{5/} A.K. Sen. Employment, Technology and Development, 1975; John Mellor. The New Economics of Growth, 1976; C.H. Hanumantha Rao. Technological Change and Distribution of Gains in Indian Agriculture, 1975.

has become feasible because of the tremendous potential for increased productivity inherent in a new agricultural technology which, in crucial components, is technically neutral to scale (i.e., can be realized on small as well as large farms). A recent, profound increase in understanding of rural agricultural labor behavior has led to abandonment of the earlier notion that some, or even much, rural labor worked at or below zero marginal productivity.^{6/} This is a crucial break with the classical labor surplus model, implying as it does that any labor moving from agriculture to industry does so at a significant opportunity cost and, most important in the recent context, that investment in agriculture will not be merely absorbed in sustaining numerous sub-marginal agricultural "hangers-on".

Perceptions of the institutional aspects of labor supply functions that are of considerable importance to the new agricultural development strategy have been derived from analyses of experience in Japan, China, India, S. Korea and Taiwan. It appears that China (and Japan at a comparable stage in development) utilizes about three times as much labor per hectare of irrigated land over a year as does India today. Exceedingly labor intensive land development and water control investments have been undertaken on a broad scale. India and Taiwan in contemporary times, however, appear to be substituting machinery for labor about as rapidly as labor utilization increases (and very recently, Taiwan's agriculture has been displacing labor). In Taiwan, the prosperity of rural households has been maintained by non-agricultural sources of income. In addition to providing an object lesson in potential labor utilization (albeit under quite different water regimen, photo-synthesis and fertilizer conditions), China appears to have developed, in the work brigade/work points system, a way of inducing high labor effort by ensuring that local management does not expropriate an undue proportion of gain. The work brigade system strongly parallels the farm household production unit of subsistence agriculture.

The recent emphasis upon internal agricultural development appears at a most opportune moment from a political perspective. Adleman and Morris capped an impressive list of analysts who argued that the aggregate growth realized in early stages of industrial development did very little to affect the poverty of the bottom one-third of most country populations.^{7/} The "basic needs" of people has become a focal point in

^{6/} T.W.Schultz. Transforming Traditional Agriculture, 1964.

^{7/} Irma Adleman and C.T. Morris. Economic Growth and Social Equity in Developing Countries, 1973.

development planning. Most groups identified as somewhat deprived of these needs - the poorest people - are rural agriculturists.

Finally, it is apparent that internal development of agriculture is heavily energy intensive. Even traditional agriculture is surprisingly energy intensive.^{8/} Much of the employment potential of the "new" agricultural investment comes in substitution at the farm of man and/or man/animal for machine in combination with appropriate management units and practices and with technical inputs that are petrochemical - based. In international resource transfer terms, it would appear that the new agricultural strategy holds promise of efficiently combining the labor of developing countries with modern technology and petroleum wealth.

Is there a distinguishable trade-off between growth and equity? The question is posed in terms of the early development experience (e.g., the first 3-4 decades). The answer seems to be affirmative with regard to historical and nearly all recently analyzed experience. (Taiwan may have been an exception). However, the new agricultural investment potential, increased understanding of the wide range of choice of both labor intensive technology and labor using technology, and reinterpretations of implications of the goods composition of consumers' choice as incomes change has led to the general conclusion that there need not be a basic trade-off between over-all growth and equity (income distribution), even during early stages of development.^{9/}

II. Institutional Constraints

It is useful for understanding the numerous institutional constraints to widespread implementation of a labor intensive development strategy for agriculture to consider the simple proposition that, in today's traditional agriculture, there is an oversupply of labor relative to capital and therefore a low product per worker. If this is correct, who needs more workers? This perception may be shared by both private farm entrepreneurs and the public at large. However, it is irrelevant in many instances, since there already are more workers, and more are to come. To the private person, concerned about tomorrow or this year, such an observation is somebody else's problem.

^{8/} Roger Reville. "Energy Use in Rural, India "in Science, vol. 192, pps. 969-975 (6/4/76).

^{9/} Frances Stewart. Technology and Underdevelopment, 1977.

The divergence between private and public interest in the short run, underlies most institutional constraints to labor intensive agricultural development. Such constraints are: 1. Concentration of land ownership. 2. Insecurity of tenancy. 3. Inequity in water distribution. 4. Extensive mechanization. 5. Restricted access to credit. 6. The shift from payment of wages in kind to cash payment. 7. The substitution of family labor for hired labor. 8. The neglect of investment in drainage facilities. In general, these institutional practices or constraints tend to augment the relative prosperity in the short run of asset holders.

It seems apparent that traditional practices underlies most other institutional constraints noted in the literature. Prominent among these "inertial" practices are: 1. Fragmentation of holdings. 2. Low or non-existent usage of human (and some animal) wastes in fertilizers. 3. Use of inefficient farm implements. 4. Gross underutilization of land/water potential. 5. Differing workforce participation rates for female labor. 6. The fairly low (but positive) response of labor in traditional agriculture to wage-rate changes.

Three direct attacks upon the institutional patterns inhibiting a labor intensive agricultural development strategy are widely mentioned: land reform, education and credit. Comparative static investigations conclude that highly skewed land ownership is associated with reduced per area labor use, reduced female and child labor force participation, and an increase in the proportion of laborers working for wages.^{10/} Land concentration has also been found to be negatively associated with wage levels.^{11/} The argument for land reform in this context seems compelling. To this may be added the general observation that land productivity tends to decrease as size of management unit increases. There is, however, a floor, defined in locality - specific terms as that size of holding below which labor productivity drops below the average. Consolidation of very small management units should be included in land reform.

Education as a force for breaking down institutional patterns inhibiting labor intensive agricultural development needs to be differentiated by general and technical content. General education in context of traditional agriculture loses much of its potential, perhaps because the enhanced ability of the worker to acquire and interpret information about costs and new inputs is largely offset by the reality of poorly developed markets and severely restricted access to information.

^{10/} Biplab Dasgupta. Village Society and Labour Use, 1977.

^{11/} Mark R. Rosenzweig. "Rural Wages, Labor Supply, and Land Reform: A Theoretical and Empirical Analysis" in American Economic Review, vol. 68, no. 5, pps. 847-861 (12/78).

Technical education, in which the education imparted is complementary to agricultural inputs and thus increases the marginal product of labor, is an effective means of development provided the inputs are available to the workforce educated.

Widespread access to credit is very important early in the development of traditional agriculture for three reasons: 1. Provision of working capital to farm households. 2. Partial absorption by the creditor of the risk of innovation. 3. Reduction of income concentration. The first two functions performed via credit extension are doubly important in development that pursues labor intensive objectives because of distributional and demand effects.

IV. Effective Demand and Marketing

As noted in section II, the goods composition of final demand varies with level of income in ways that can be exploited to benefit a labor bias in agricultural development. Basic needs of people can be expressed in terms of goods and (some) services which can be decomposed into quality characteristics expressed in terms of labor intensity of production. While the sophisticated application of this concept requires statistically sensitive estimation of a number of parameters — income elasticities of demand, elasticities of factor substitution, consumer preference substitutability — some basic ideas provide useful guidance.

Fundamentally, the poorest people spend 60% - 70% of increments to income on foodgrains. Therefore, a labor intensive development strategy must concentrate upon foodgrains supply in the early stages. Furthermore, unless export markets are assured, increased employment (increased effective demand) is a necessity to widespread agricultural development. "Increasing foodgrain production through labor-using methods is substantially a self-balancing process."^{12/} A fundamental "basic human need", that for food, is met. Generally, the productivity increases which sustain an employment strategy (significantly enhanced by workers' increased nutritional condition) are realized in nonfoodgrain agricultural commodities (including sericulture, livestock products, vegetables), z - goods (including cottage industry products) and pre-production and post-production inputs to/outputs from the actual farm production site. It should be relatively easy to induce a dynamic peasant agriculture to purchase from domestic industries with relatively low capital/labor ratios (footwear, simple housewares, textiles, food processing). Provided they are competitive, local industries (in particular, metal-working) can receive powerful stimulus from a labor intensive development strategy, as the types and sequencing of introduction of farm equipment which can be managed to complement the emphasis upon labor intensity, is compatible with local production and repair of simple implements. Urban consumers tend to spend their incomes on more capital-intensive products than do rural consumers.

^{12/} John Mellor. The New Economics of Growth, 1976, p. 164.

The goods composition of effective demand in agriculture must be treated as a major policy variable in order to realize full benefit to the economy from growth in the agricultural sector. The most effective way to influence the composition of the "basket" of goods demanded, in the medium term, is to develop a growth strategy targeted towards certain income classes, given that the goods composition of expenditure of increments to income can be predicted fairly well by income class. The relatively wealthy tend to spend additions to purchasing power on non-foodgrain agricultural commodities and, to a greater extent upon commodities with a high capital/labor ratio. To the extent that this is so, the employment inducing effects of the former expenditure pattern are offset (in the first instance) by the latter. To the extent that the relatively wealthy spend incremental income on imported consumers goods, the potential employment multiplier effects are lost (employment effects of backward and forward linkages).^{13/} The marginal propensity to import/^{or} the relatively wealthy (especially of recently-acquired wealth) is comparatively high.

Theoretical models developed from much systematic observation indicate that the characteristics of effective demand realized from a labor intensive development of agriculture help to sustain and deepen the initial growth impetus (which is based upon innumerable small increments to marginal productivity of agricultural labor). As a general principle, an agricultural growth path is needed that generates a broad demand for relatively simple inputs and consumers goods. Of course, this implies that increments to effective demand should be primarily realized by the lower income groups. And this implies a fairly even size distribution of land holdings.

As noted above (quotation for footnote number 12 et. seq.), marketing under a labor intensive agricultural development strategy does not essentially mean a problem of moving large quantities of foodgrains. For quite a time, most production is consumed autonomously (on the farm) or goes into farm inventories (storage containers are a labor intensive commodity).

How, then, do farm enterprises realize the cash incomes necessary to procure the technical inputs and to obtain the technical knowledge necessary to initiate and sustain increased agricultural labor productivity? Marketing plays a crucial role. So does off-farm employment -- reversable migration. So do exports. In a country as overwhelmingly subsistence agricultural as Nepal, so must external resource flows, if at all possible used as leverage on the domestic agricultural credit system.

Ideally, in the initial stage of labor intensive agricultural development, farm enterprises should spend the greatest proportion of available cash balances on current inputs of labor, seeds, fertilizers, simple implements and insecticides. Initially, markets must be assumed to be very inefficient in transmitting either technical inputs or technical knowledge. Furthermore, the great majority of farm enterprises will be unwilling to

^{13/} I bid, p. 181.

accept the risk associated with new production techniques and new factor inputs.

A "classic" approach to the problem of how to initiate change in traditional agriculture is to rely upon "diffusion" of knowledge using the relatively wealthy farm enterprises as intermediaries. This approach has very recently been reemphasized by a prominent economist, with an added recommendation that permanent migrants also be relied upon as innovators, risk takers and, therefore, agents of change.^{14/} Relevance of the latter emphasis to development of agriculture in Nepal's terai seems apparent. (However, movement of Tharu family groups within the western terai does not appear to be migration in the sense used here, but rather shifting cultivation.) Observation suggests that the diffusion process has been quite inefficient in rural Nepal, probably because of traditional caste and ethnic divisions.^{15/}

Other possible means of initiating a process of agricultural development in Nepal based upon labor intensive production techniques do not appear to be inhibited by tradition or custom. Indeed, the very fact that most production increments would be consumed/stored autonomously is a tremendous advantage in a country with Nepal's topography and thin basic infrastructure.

The growth impetus under a labor intensive agricultural development plan is derived from small increments to the marginal productivity of great many agricultural laborers, in the first instance. It is essential that the technical inputs and knowledge which complement relatively abundant labor resources be made available in small, divisible units. Initially, financial requirements of individual farm enterprises, or even areas, cannot be substantial.

Agricultural and forestry exports from Nepal either do not comprise a substantial proportion of regional markets (e.g., jute, rice, timber) or are highly specialized (musk, ayurvedic drug materials). In these circumstances a considerable expansion in Nepal's agricultural exports may reasonably be planned for. However, as indicated in an earlier paper, it appears quite unlikely that an export-led growth strategy could be sustained in Nepal, because of severe (if not insuperable) internal distributional difficulties and because of the unusual migration dynamics of the area.^{16/} In the present context, development of labor intensive export crops that can be economically grown in and exported from a wide area (e.g., ayurvedic herbs, ghee, sisal) certainly should be encouraged, while receipts from exports of jute, rice, timber and the like should be utilized to support the broad-based, extensive development of agriculture implicit in a labor intensive approach. Over time, public investment derived from exports and other sources may be expected to shift from financing of basic agricultural inputs to agriculture-linked, labor intensive light industries geared to the domestic market.

^{14/} John K. Galbraith. The Nature of Mass Poverty, 1979.

^{15/} Ram P. Yadav. "Case Study of Small Farmers in Naktajhijh, Dhanukha, Nepal"(mimeo), 1977 (?). ARTEP/ILO. Nepal Rural Household Survey, 1976.

^{16/} John Babylon. "A Commentary on the Nepalese Economy". USAID/Nepal, 6/79, 21 pages.

Farm enterprise receipts derived from off-farm employment would appear to represent the largest, most widespread resource upon which to initiate a labor intensive employment strategy in Nepal. As noted in section II, the reported very widespread occurrence of such receipts implies that Nepalese farm labor cannot be diverted towards intensive development within the "home" farm enterprise except at significant opportunity cost. For this reason, it is important that initial design of a labor intensive development strategy in Nepal be skewed towards implementation on operational units large enough to employ laborers from either landless families or from extremely small farms. Although very small holdings in the hills produce more per area than larger, they are too small in absolute terms to produce enough for the survival of the farm enterprise without off-farm employment. It does not appear that this remark is applicable to the terai, where few very small holdings exist and where land productivity on smaller holdings is comparatively low.^{17/} Migration of agricultural labor from the hills to established terai farm enterprises is indicated.

Foreign assistance to Nepal designed to support a labor intensive strategy of agricultural development could be utilized to support efforts to: 1. Adapt agricultural technologies to Nepal's varied conditions; 2. Develop estimates of optimal cropping patterns; 3. Develop estimates of optimal utilization of livestock as both energy source and source of cash sales; 4. Develop estimates (often by crop and by region or by income class) of income elasticities of demand, elasticities of factor substitution, internal terms of trade and other basic information needed for refined application of a labor intensive agricultural development strategy. Activities 1 - 3 above are being undertaken. However, it is not clear that a deliberate bias towards enhancing marginal labor productivity underlies the work.

Of course, the major short-term part that external resource transfers can play in facilitating initiation of a labor intensive development of agriculture is in making available technical inputs, knowledge and implements in complementary and timely fashion over a very broad area. Involved are capital costs for inputs, recurring costs for highly selective (complementary) technical education (extension), transport subsidies, recurring input costs and recurring operational expenses.

There is no compelling reason to initiate a labor intensive agricultural development program by distributing inputs, etc. without financial cost to the user. It is important that inputs complementary to labor be distributed widely and that most of the initial risk (to all but the wealthy) be absorbed by the state. It appears that the formal credit system provides a means of facilitating both objectives. Furthermore, using a matching grant system or something similar, it would be possible for foreign assistance inputs to the credit system to lever significant domestic resources.

^{17/} ARTEP/ILO, op. cit., pps. 67-93.

Inefficient, archaic marketing structures will need to handle both inputs to and high-value-added outputs from many small farm enterprises. There is no evidence that public sector distribution beyond rail/truck depots should be established to compete with private markets. In fact, in a sense Nepal has some elements of an efficient private sector marketing system in operation, in that representatives of farm enterprises bring their own produce to intermediate markets (often in co-operative groups) where larger lots are assembled for shipment to final demand centers. The problem, of course, is that transport is extremely costly and communications are slow and unreliable. Nepalese authorities are attempting to move trucking depots up into the hills (e.g., Surkhet and Ghorahi). Another, interim, measure to facilitate distribution of inputs complementary to labor could be to pay porters (particularly self-account porters) a flat rate based on days travelled, to help defer transport costs. Another public measure which could have very great pay-off would be establishment of small radio stations at major markets (e.g., Nepalgunj, Bhairawa, Janakpur) to broadcast market information. An interim measure could be to sharply increase broadcasts from Kathmandu of regional market price data and other market information, including labor market conditions.

V. The Promise of Technology

Empirical economic research over the past twenty years has established that, at the early stages of development, astute combinations of output and of technology which employ increasing volumes of abundant, unskilled labor can enable the economy to avoid the classic trade-off between growth and equity.^{18/} Labor-intensive, capital-saving techniques can absorb an increasing labor force productively, even though the underlying man/land ratio is unfavorable.^{19/} To these observations may be added the Asian perception that very labor intensive investment in land-cum-water development and preparation have been efficiently employed in agriculture in some countries of the continent, and apparently could be utilized in other areas.

In the context of this paper, technology means information, recurring inputs and methods of land/water improvement which is/are complementary to unspecialized agricultural labor. Technology, when applied, must have as one consequence an increase in the marginal product of the agricultural labor force. Technology should not substitute for labor in the initial stage of a labor-intensive agricultural development strategy.^{20/}

^{18/} Gustav Ranis. "Technology Choice and Employment in Developing Countries: A Synthesis of Economic Growth Center Research" (memo), 1978.

^{19/} B.F. Johnston. "Agriculture and Structural Transformation in Developing Countries: A Survey of Research", 1970.

^{20/} Willis Peterson and Y. Hayami. "Technical Change in Agriculture" in A Survey of Agricultural Economics Literature, vol. 1, 1977.

Emphasis upon the role of labor-complementing technological innovation in agricultural development derives from the observed relatively low level of present agricultural activity in South and South-East Asia. This is expressed in terms of present very wide spread:

- cultivation of low value crops,
- low cropping intensities,
- low levels of development of land and water resources in complement,
- low levels of management of land and of rain, surface and ground water resources.^{21/}

Given that appropriate technologies for small farmers are those that tend to stabilize yields and minimize risk, that the new technologies of high-yielding seeds-plus-fertilizer are neutral to scale, and that there is evidence that tight multiple cropping may be practical under certain soil and water conditions on farms up to three acres in size with nominal mechanization, it is apparent that the underdeveloped state of agriculture in the region represents a tremendous opportunity for broadly distributed development. Considering the additional, considerable potential represented in development of forward and backward linkages, it is realistic to plan in terms of technologically-derived development of the entire agricultural sector.

In the literature the following kinds of technological information are identified as crucial for dissemination to farmers:

- I. Land management
 - A. Land leveling
 - B. Multiple cropping
 - C. Intercropping
 - D. Weeding
 - E. Drainage
- II. Water management
 - A. Timing and amounts
 - B. Pumps - types/uses
 - C. Drainage
- III. Inputs
 - A. High-yielding varieties
 - B. Fertilizer combinations
 - C. Implements

The role of entrepreneurs in the process of knowledge diffusion has been found to be quite important.^{22/} Local innovators and risk takers (not necessarily the largest farmers) also play a crucial part in the process of local adaptation of technological information and input

^{21/} ARTEP/ILO. Employment Expansion in Indian Agriculture, 1979.

^{22/} Gustav Ranis, cp. cit., p.37.

"packages". In Nepal, the central government clearly cannot hope to fulfill the requirement for local adaptation without assisting local entrepreneurs.

It is crucial to success of a labor intensive agricultural development strategy that recurring inputs be utilized in labor complementing ways in accordance with each area's particular factor endowments (especially, water resources and soil types). There are some general principles identified in the literature from wide-spread observation. These are summarized below.

First, although the combinations and intensities of inputs to be used in combination with (assumed) abundant labor are quite sensitive to whether the farm production unit is irrigated or unirrigated, this distinction in practice is quite difficult to establish in Asian conditions. The line is not easily drawn between "irrigated" and "unirrigated". Commonly, farm production units are fragmented into many plots, some of which are irrigated and some of which are not. Irrigation which is supplementary only and designed to serve only the given cropping pattern, and no more, is quite common. Indeed, differing water regimes are a major element in difficulties encountered in attempting to transfer knowledge from research farms to farmers' fields. "For the extent to which irrigation increases cropping intensity depends on how far it increases the assurance of water supply and modifies the seasonal availability of water for crops from natural rainfall".^{23/}

Second, mechanization of farming operations which facilitates increased cropping intensity generally has the net effect of increasing labor intensity of production. The use of tractors and power tillers, therefore, should be confined to land preparation when increased cropping intensity is the objective, and to haulage.

Third, mechanized threshing of crops other than rice is bad for labor utilization. If reduced threshing losses are sought, labor intensive methods should be devised.

Fourth, herbicides are "disastrous" for a labor intensive employment strategy.^{24/} Weeding is a highly labor intensive activity that can significantly increase yields.

Fifth, proper drainage of land is essential to optimal land/water usage. The construction and maintenance of drainage facilities can be a highly labor intensive activity.

Sixth, farm implements should be simple (highly differentiated) and introduced in careful complementarity to labor. They should be such that local workshops can undertake both their manufacture and repair.

^{23/} A. Vaidyanathan and A.V. Jose. "Absorption of Human Labor in Agriculture" quoted in Labor Absorption in Indian Agriculture, 1978, pps. 171-172.

^{24/} Edward J. Clay. "Institutional Change and Agricultural Wages in Bangladesh", 1976, p. 86.

Seventh, technology should be adapted to the main energy source. In a labor intensive development path, the source should be either animal or human, not mechanical (e.g., tractors). A "bullock package" detailed by Johnston and Kilby includes the following: moldboard plow, disc harrow, comb-harrow, seed-fertilizer drill, oldpad thresher, leveling plank, cart, harness, chaff cutter, rotary hand weeder, stationary thresher, knapsack sprayer, 20 horsepower pump on a well down 120 feet, and accessories.^{25/}

Eighth, mechanized harvesting equipment should not be used. There may be exceptional circumstances when a shortened harvest period facilitates more intensive cropping and labor is temporarily quite scarce, in which case use of machinery is warranted.

Ninth, the hulling of threshed output should be done by labor intensive methods.

Tenth, mechanized bagging equipment should be avoided.

Eleventh, as a general principle chemical fertilizer is labor using in comparison with organic fertilizers.

Twelfth, the more complex organic fertilizers become (e.g., inclusion of human wastes) the more labor intensive they are per unit.

Thirteenth, raising of water can be extremely labor intensive. Dug well and creek irrigation should not be mechanized in conditions of great labor surplus. Use of animal power to raise water (e.g., Persian wheels) is quite labor intensive in over-all effect. As in other technical combinations, if mechanical pumping eases a bottleneck in the way of increased cropping intensity, it may be appropriately utilized. However, it should be clear that manual/animal pumping could not achieve the same result. Again, these observations were developed in context of pumping from shallow wells and surface water sources only.

Fourteenth, mechanical drying can facilitate increased cropping intensity and reduce post-harvest losses considerably, offsetting any immediate adverse effects on labor utilization.

It should be apparent that a number of things can be done that will increase the labor intensity of agricultural operations independent of the use of high-yielding varieties and fertilizers. However, the basic objective is to increase the labor input per land area unit without decreasing the marginal productivity of labor. This condition is essential, particularly when the average productivity of labor is very low (near subsistence). It is in this context that the crucial

^{25/} Bruce F. Johnston and Peter Kilby. Agriculture and Structural Transformation, 1975, chapter 8.

role played by the technology embodied in the new seeds and fertilizers becomes apparent. The new technology very sharply increases land productivity. In absence of the mechanization of the basic farm operations (threshing, tilling and reaping) the new technology demonstrably increases labor utilization by 30-50 percent, in and of itself.^{26/}

However, when mechanization is broadly introduced along with high-yielding varieties and fertilizers, an absolute decrease in labor utilization of up to 25 percent is observed.^{27/} This can be offset by increased cropping intensity, with a net result of roughly no increase in labor intensity yet much higher land utilization. This general pattern apparently typifies "modern" Indian agriculture today.^{28/}

As noted in section III, the size distribution of operational units is a key variable determining the types of technology adopted and the speed and extent of innovation.^{29/} Labor force participation and labor intensity of cultivation decrease as concentration of land ownership increases.^{30/} Where land ownership is concentrated, as in Nepal, a major innovation increasing labor intensity would be land reform.

Many labor-using technical innovations may be derived from the fifteen observations set out above. Other labor-using labor practices observed to be both productive and widely applicable are:

- land leveling by work brigade (requires skilled surveyor input)
- construction/maintenance of field irrigation networks
- construction/maintenance of catchment ponds (widely used in China, Requires fairly evenly distributed rainfall.)
- construction/utilization of compost pits
- seedling bed preparation, for rice
- straight line transplanting of rice (facilitates intercropping).

As a general rule, broadcast sowing is less labor intensive than partially mechanized row sowing and is not conducive to intercropping. Therefore, this practice should be abandoned in a labor intensive development program.

Backward and forward technical innovations should be induced (as a significant consequence of a labor intensive production strategy) that are themselves labor intensive. Backward (pre-production) innovations in uses and characteristics of implements have been referred to several times. Implements should become increasingly specialized, to complement most effectively certain labor roles. Their manufacture should be labor intensive. Induced innovation should be expected to affect the mix of fertilizers demanded by wholesalers and public procurement

^{26/} ILO. Poverty and Landlessness in Rural Asia, pps. 90-91.

^{27/} Ibid., pps. 92-95.

^{28/} Ishikawa, op. cit., pps. 67-69.

^{29/} Johnston and Kilby, op. cit., p.160.

^{30/} Dasgupta, op. cit., pps. 77 and 141.

agencies. Forward (post-production) linkages probably would affect most immediately the storage of crops. Household containers and fumigants would appear obvious targets.

The third basic energy source in agriculture, that of animal power, appears to be utilized in inverse proportion to human labor in the first approximation.^{31/} However, animals often are retained in the farm enterprise as production units (of manure, milk, meat, eggs, etc.) and for reasons of security (alternate energy source, a food source in case of famine) as well as for their energy input. An investigation of the entire complex of animal/human labor interactions does not appear to have been completed. However, it seems clear that animals should not be retained in the farm enterprise as direct competitors to human labor exclusively. For example, where the ground becomes too difficult to work with human labor, then bullocks should be retained. The use of bullock-drawn implements in harvesting and of bullock-powered threshers displaces human labor.^{32/} Bullocks and complementary inputs probably should be considered as an intermediate technology in context of a labor intensive agricultural development strategy. Opportunity costs of using land for fodder crops should be included in considerations of animal power costs/benefits.

VI. Phasing and Public Works

Predictions of distinct phases of activity which are likely to occur under a strategy of labor intensive agricultural development are derived from theory and from observations of what occurred in Japan, Taiwan and other countries of East Asia. There is no contemporary "model" economy from which analysts could develop a neat staging model. Therefore, discussion of phasing will be confined to a set of very general observations.

The theory of comparative advantage is quite relevant to analysis of Nepal's development prospects. The mountains, hills and terai appear to constitute distinctive natural resource zones. The mountains may not be characterized by a general labor surplus. The basic man/land ratio in the hills and mountains is similar, and very much higher than in the terai. In spite of this factor, agricultural technology in judicious combination with surplus labor in viable farm operational units could lead to substantial increases in labor productivity in the hills and mountains. It is pertinent, therefore, to consider the

^{31/} William H. Bartsch. Employment and Technology Choice in Asian Agriculture, 1977.

ILO. Labour Absorption in Indian Agriculture, 1978.

^{32/} Bartsch, op. cit.

theory of comparative advantage as applied to poor, labor surplus economies: "The combination of a general advantage relative to labor costs with specific natural endowments should result in the narrow specialization of poor countries."^{33/}

The multiple,, subtle effects of Engel's Law undoubtedly are useful in predicting the gross parameters of productive activity as agricultural development using labor intensive methods proceeds. The changing composition of output and employment as incomes change, considered in context of an economy's regional natural resource and geographic attributes, underly the assumption that what occurred in Japan or Taiwan is pertinent to consideration of what may happen in Nepal. These two principles are basic to the contemporary theory of structural transformation.

Before briefly discussing what studies show to have happened to labor as agricultural development proceeds, it seems useful to mention briefly two other general, theoretical considerations pertinent to the question of phasing under a labor intensive development strategy. First, the Yale University Economic Growth Center research on the role of entrepreneurs has led to the hypothesis that labor surplus entrepreneurs are more technically based (on their own experience) rather than formally educated, and that early - on innovations are more likely to be derived from information generated within the enterprise (as opposed to via trade contacts, reading, technical education) and to be cost conscious (as opposed to technology or process conscious.)^{34/} Second, gainful employment has significant psychological, social and political benefits, which may be ranked by planners higher than output and growth objectives. Even in the long run, reductions in tensions derived from inequality, enlargement of the status quo interest, restrained urban in-migration and the enlarged market for cheap consumers goods may cause intangible employment objectives to be ranked very highly.

As labour intensive agricultural development proceeds the composition of effective demand changes and exploitation of comparative advantage becomes increasingly sophisticated. Output and employment patterns change and farm enterprise aggregate incomes rise. The proportion of total enterprise income derived directly from agriculture probably will decline, especially in smaller households.^{35/} Income inequality between farm household enterprises declines as non-farm income sources increase in importance.

A gradual shift away from production of basic cereals and staples such as sugar to high value/low capital intensive/high labor intensive crops such as vegetables, mushrooms and animal products occurs. Sericulture may become quite important (as in Japan). Net farming incomes may decline while net incomes of farm household enterprises increase with

^{33/} Charles Ragin and Jacques Delacroix. "Comparative Advantage, the World Division of Labor and Underdevelopment", Indiana University, 1974(?), 49 pages.

^{34/} Gustav Ranis. *op. cit.*, pps. 24-26.

^{35/} Dennis L. Chinn. "Rural Poverty and the Structure of Farm Household Income in Developing Countries: Evidence From Taiwan", January 1979.

non-farm - derived receipts. Purchased inputs replace family labor, so that land per worker eventually becomes a severe constraint to further farm productivity increases.^{36/} Machinery which facilitates greater cropping intensity, and chemical fertilizers, assume increasing importance in the farm production function.

Comparative static analyses such as recall interviewing across different income classes, farm sizes or village typologies or partial budgeting analysis yield a great deal of information about opportunities and constraints in development of peasant agriculture. They do not trace the progress of implementation of a labor intensive agricultural development strategy, but rather record what has happened over the past 20 years as differing blends of mechanization, animal power, water management and land management and inputs were used across the villages of Asia and Africa. For reference, see in particular Village Society and Labour Use, the major product of the ILO/Sussex University village studies programme. Among other publications of interest are E.J. Clay's study cited earlier ("Institutional Change and Agricultural Wages in Bangladesh") in which it is reported that labor captured about one-third of the increased value of output realized from the new varieties/fertilizer technology, and Kanta Ahuja's book, Idle Labour in Village India, a very careful investigation of agricultural labor supply conditions in Rajasthan.

Public sector (including aid donor) interest in the potentialities of a labor intensive agricultural development strategy appears to include, without exception, considerable attention to the role of public works. Economists, on the other hand, emphasize the crucial importance of complementary inputs to many, many private farm households and the crucial role of responsive markets and innovative, small-scale entrepreneurs. Erik Thorbecke contends that aid donor regulations which restrict the use of funds to donor economies unintentionally bias assistance programs towards capital intensity. He argues that, in a country (such as Nepal) with chronic budget deficits, local cost financing by aid donors could encourage labor intensive activities.^{37/}

Activities suitable for a public works approach have played a significant part in the labor intensive development of agricultural potential in parts of Japan and China, particularly in:

- land leveling
- water management
- transportation
- rural electrification.

^{36/} Y. Hayami and V.W. Ruttan. Agricultural Development: An International Perspective, 1971, p. 101.

^{37/} E. Thorbecke. "Unemployment and Underemployment in the Developing World", 1970, p. 25.

These kinds of capital improvements are singled out by Mellor as possible candidates for public works projects.^{38/} Mellor emphasizes that public works activities are supplemental to the basic labor intensive agricultural development strategy. The appropriate functions of a public works program are to create essential infrastructure when it cannot be done by private interests on private lands, and to provide employment to "hard core" unemployed.^{39/}

Ideally, public works - type projects should be small scale, so as to be able to induce local investment and the participation of (paid) local manpower. Public works activities need to be carefully articulated, engineered and implemented, always keeping in mind the potential of important trade-offs surfacing between (political and welfare) employment objectives and output objectives.^{40/}

The principal utility of public works in context of a labor intensive development of agriculture is in the early stages of the push towards structural transformation, when the public works investment clearly complements labor in increasing productivity of land and farm enterprise labor. There is a second role, relating to the inherent tendency of a labor intensive agricultural development strategy to widen regional disparities.

Initially, technical complements to labor and land are perceived and exploited rapidly in areas that are most dynamic or "advanced". Regional disparities widen sharply, almost in a one-time jump. The exploitation of regional comparative advantage may reinforce this early tendency for "those that have to get", or it may not, depending on how each area's resource base responds to shifts in the goods composition of consumer demand. The early widening of regional disparities will tend to be exacerbated if inevitable shortages of public sector funds and personnel lead authorities to concentrate upon areas where the highest returns can be expected. This is not an "inevitable" development, however. Public authorities could choose to do whatever was required to strengthen the markets in relatively - advanced areas, and concentrate efforts on relatively disadvantaged areas. Such public effort should take the form of public works of the kind noted above, with food and other simple wage goods brought in from the more prosperous areas only when absolutely essential. Public works should be implemented in or near areas of some food surplus. Public investment in transport would be an ideal way to implement a policy of spreading the areas of influence of the complementary inputs making up labor intensive agricultural development. (At present in Nepal, most transport investment appears to be oriented towards export and import trade, a sure way of vitiating the spread of agricultural development.)

^{38/} J. Mellor. op. cit., p. 101.

^{39/} Mellor, "The Impact of New Agricultural Technology on Employment and Income Distribution: Concept and Policy", 1975, p. 22.

^{40/} Bruce F. Johnston, op. cit., p. 393.

Three characteristics of the strategy work to enforce the spread of development. First, the basic elements of the complementary technical inputs, implements and knowledge are neutral to scale. Second, the early stage of the process is largely autonomous and non-inflationary, so that requirements for traded inputs are relatively small for each producing farm enterprise while the most basic of human needs, food, is the output. Third, relatively abundant, surplus labor resources may be expected to migrate to areas of relative prosperity, thus easing the situation in those relatively poor areas of their origin.

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