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FINAL RESEARCH REPORT

June, 1974

THE IMPACT OF NEW TECHNOLOGY ON
RURAL EMPLOYMENT AND INCOME DISTRIBUTION

Contract No. AID/csd-2805

John W. Mellor, Director

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Annual Research Report

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REPORT SUMMARY

- A. 1. Project Title: "The Impact of New Technology on Rural Employment and Income Distribution"

Contract No. AID/csd-2805

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Narrative Summary of Accomplishments and Utilization

The contribution of the research lies in two quite different but complementary directions. First, the research has demonstrated the close interaction between increased employment, increased agricultural production, reduced capital intensity of industrial investment and increased foreign trade. Change in policy in any one of these areas without change in the others is likely and perhaps certain to fail to achieve its objective. These conclusions have far reaching implications to choice of development strategy and to the role and means of agricultural development within that strategy. They explain much of past failure to achieve broad participation in growth processes as well as why many of the current nostrums will fail as well. The nature of the relationships has been demonstrated with a mathematical growth model, an empirically based simulation model and a set of micro studies defined to back the simulation model and to provide independent corroboration of individual points.

Second, the research provides the basis for specific policy recommendations, within the context of an employment oriented strategy of growth, for setting priorities and sequences of agricultural production increase, for encouraging small farmers, for choosing appropriate forms of mechanization, for the setting of agricultural price policy and for fostering small scale, labor intensive industry. Each of these individual policy recommendations is, in itself, complex, the positions are spelled out in detail and empirical support provided in the various publications from the research. These are summarized in the main body of this report.

FINAL RESEARCH REPORT

"THE IMPACT OF NEW TECHNOLOGY ON RURAL EMPLOYMENT AND INCOME DISTRIBUTION"

Contract No. AID/csd-2805 John W. Mellor, Director

June 30, 1974

A.-B.-C. General Background, Statement of Project Objectives; and, Continued Relevance of Objectives

The objective of this research is to provide an understanding of the complex direct and indirect effects of technological change in agriculture on the amount and distribution of income and employment in low income countries, in order to improve the basis for public agricultural policy for meeting society's production and distribution objectives. The analysis is carried on at three different levels: growth theory, simulation models and statistical description and analysis of relationships. The emphasis on growth theory is in recognition of the potentially major role agriculture may play in determining the broad outlines of a nation's approach to economic growth: the immense direct and indirect effects which agricultural technology may have on the pace of production growth and the distribution of that product; the interrelationships which require a broad set of strategic changes if accelerated growth in employment is to be achieved; and, perhaps most important, the role current dominant theories of growth have played in directing policy towards low employment, narrow participation alternatives to growth which give little emphasis to the agricultural sector. The development of a simulation model is a further recognition of the complex interactions in both growth and distribution and the dual role of agriculture in providing to other sectors of the economy both wages goods and the income and demand for employment creating production. The collection and statistical analysis of data recognizes the paucity of information on crucial relationships and the importance of data from the operational level to understanding growth and distributive policies.

D. Accomplishments

The contribution of the research lies in two quite different but complementary directions. First the research has demonstrated the close interaction between increased employment, increased agricultural production, reduced capital intensity of industrial investment and increased foreign trade. Change in policy in any one of these areas without change in the others is likely and perhaps certain to fail to achieve its objective. These conclusions have far reaching implications to choice of development strategy and to the role and means of agricultural development within that strategy. They explain much of past failure to achieve broad participation in growth processes as well as why many of the current nostrums will fail as well.

Second, the research provides the basis for specific policy recommendations, within the context of an employment oriented strategy of growth, for setting priorities and sequences of agricultural production increase, for encouraging small farmers, for choosing appropriate forms of mechanization, for setting of agricultural price policy and for fostering small scale, labor intensive industry. This report is thus presented in two parts. The first states the integrated view of growth which arises from critical analysis of theory and empirical data. The second states empirical findings in the context of current policy problems

1. The Interrelations in Employment Oriented Growth

An intensive exploration was undertaken of theories of economic growth, with emphasis on comparison of those theories which have little place for

^{1/}The material in this section is presented more fully as follows: (a) an intensive, analytic review of economic growth models (Occasional Paper No. 58); (b) presentation of a growth model incorporating biased technical change in agriculture (Occasional Paper No. 43); (c) empirical exploration of growth linkages of new foodgrain technologies (Occasional Paper No. 50); (d) a popular presentation of the employment oriented theory of growth (Occasional Paper No. 42).

agriculture in the dynamics of growth with those that do contain such a place. Through this exploration it is shown that growth patterns with little role for agriculture are bound to have a low employment content and that technical change of a land augmenting type (the "green revolution") is key to agriculture's playing a positive role in an employment oriented pattern of growth.^{2/}

Two crucial aspects of agriculture's role were delineated, first, as a provider of wages goods as the real resources to back increased employment; second, as a source of real demand for the output of goods and services which provide added employment. The first sets the key role of increased agricultural production in a high employment strategy. The second recognizes that increased agricultural production itself may not directly provide adequate employment growth but that it provides the basis for indirect increases in employment which are potentially powerful, but which may also require a well designed public policy if they are to be realized. In this work it was noted that theories of growth which have little place for agriculture are much more fully developed than those that have a role for agriculture. This has been both cause and effect of the important role of such growth theory in the planning models of most low income countries with a central plan for development.

Much of the currently ascendant theories of economic growth in low income countries and the mainstream of the multi-sectoral planning models which have been so important in planning, derives from the Harrod-Domar type growth

^{2/} Throughout, this discussion abstracts from the potential to meet growth in food needs through imports. It is assumed that for reasons of aggregate world supply, food imports cannot be relied upon to support a high employment growth strategy by single large low income countries or by the collectivity of small countries, even though individual small countries may do so. Occasional Paper No. 58 discusses the potentials and limitations of the trade approach.

models developed for analysis of growth in high income countries and the Feldman-Mahalanobis models for autarchic growth of the Soviet type. These models depict growth as a function of increase in the capital stock and thus emphasize allocation of resources to capital goods industries at the expense of consumer goods industries such as agriculture, and in effect, minimization of employment because of the demand which increased employment creates for expansion of consumer goods industries in competition for resources with capital goods industries. It is shown how such theories and consequent policy have merit if agriculture offers little opportunity for efficiency increasing technological change. Conversely, the analysis of theory emphasized the importance, to an employment oriented strategy, of technical change in agriculture of a type which reduces costs per unit of output and thereby provides a basis for a massive net addition to national income. It is from this that much of the potential arises for growth linkages between agriculture and other sectors of the economy, and it is this which gives such a crucial role to the research institutions which develop and refine new technologies for agricultural production.

The analysis of growth theory indicated three key areas of relationships, between technological change in agriculture and employment growth, which required empirical analysis: (a) the direct effects of new agricultural technology on employment; (b) the expenditure patterns incident to the increased incomes from new technology and, (c) the employment content in producing the goods experiencing increased demand. A series of studies developed data in each of these areas.

Direct Effects of Agricultural Technology on Employment

With respect to the direct effects of new agricultural technology on employment, a large number of studies, including coverage of India, Bangladesh

and the Philippines, were analyzed in terms of the proportion of increased output from new technology attributable to and paid to labor as a result of increased employment as compared to the proportion received by higher income groups such as landowners (see Occasional Paper No. 50). It was found that there is great variability among new agricultural technologies in the proportion of added output paid to labor - a topic which merits considerably more intensive study than was possible in this project - but that in general the very technologies so essential to provide the food to back wages goods payments, themselves provide only a small proportion of the increased income to labor through increased employment.

Typically, only five to fifteen percent of increased income from new technologies was represented by payment for increased labor (Table 1). Although widespread adoption of new agricultural technology might allow such small proportions to represent a significant aggregate increase in employment, nevertheless substantial additional sources of employment are needed not only to meet employment and welfare objectives but also to provide equilibrium between the increased output of agricultural commodities from these new technologies and the increased demand needed to maintain incentive prices for agricultural production. Put simply, if the added income from increased food-grains production goes largely to the more well-to-do who are already eating well, output prices may decline for lack of offsetting demand and production incentives may thereby be lost. The requisite increase in demand for food may come from growth of employment in other sectors of the economy and consequent increase in incomes of laborers who unlike landowners spend a high proportion of increased income on food. Thus, one of the key findings of this research is the virtual necessity of increased employment to sustenance of the "green revolution" and the concurrent necessity of the "green

revolution" to sustenance of a high employment policy (see Occasional Paper No. 42 for an elaboration of this argument).

The Expenditure Patterns from Increased Rural Incomes

The expenditure patterns incident to the increased incomes from new technology and the consequent patterns of consumption were analyzed to see what types of production would be stimulated through secondary effects (see Occasional Paper No. 54) for the basic analysis and Occasional Paper No. 50 for application). Emphasis was given to the effect of different distributions of incomes on expenditure patterns. This analysis was in recognition of the massive effects on national income which follows widespread application of efficiency increasing technological change in the economically dominant agricultural sector and the considerable variation in the distribution of that expenditure. The analysis of expenditure patterns confirmed the position that increased employment and incomes of the laboring classes are to a large extent spent on agricultural products. In India, for the lower two deciles in total expenditure, 60 percent of increments to income were spent on food-grains alone and 85 percent on all agricultural commodities (Table 2). Thus a high employment policy must be backed by a commensurate and massive increase in agricultural production, while demand for increased agricultural production is readily generated by increased employment. Thus, increased employment and increased food production are essentially inseparable in low income countries.

A striking finding of analysis of expenditure patterns was the major role for nonfoodgrain agricultural commodities. Across nearly all income classes, on the order of 30 percent of added income was spent on these commodities, of which a major component is livestock products and vegetables. For example in India, in all but the lowest income decile, milk and dairy

TABLE I. Division of Increased "Payments" Between Labor and Other Inputs. Various High-Yielding Varieties and Areas.

Area	Increase in gross value of output		Increase in labor "payments" of		Percent increased output to labor ^a	Percent increased output to other inputs ^b
	Rupees per acre	Percent increase	Rupees per acre	Percent increase		
----- Wheat -----						
Aligarh, U.P. (7)	462	71	46	58	10	90
Varanasi, U.P. (24)	620	65	11	15	2	98
Udaipur, Rajasthan (1)	343	43	18	13	5	95
Punjab (14)	450	100	56	42	12	88
----- Kharif paddy -----						
West Godavari, Andhra Pradesh (2)	269	38	32	17	12	88
East Godavari, Andhra Pradesh (2)	216	33	20	13	10	90
Uttar Pradesh (24)	1100	200	67	92	6	94
Tamil Nadu (13)	550	100	33	20	6	94
Laguna, Philippines (4)	374	72	3	3	1	99
Sambalpur, Orissa (28)	404	95	36	28	11	89
----- Rabi paddy -----						
West Godavari, Andhra Pradesh (2)	562	86	39	16	7	93
East Godavari, Andhra Pradesh (2)	761	153	39	30	5	95
Tamil Nadu (13)	625	100	46	21	7	93
Gumai Bil, Bangladesh (18)	948	208	302	125	32	68
----- Bajra -----						
Kaira, Gujarat (5)	300	85	39	27	13	87

^a Labor "payment" is defined as physical labor input (family and hired) in man-days at a constant wage.

^b Other inputs "payments" defined as gross value of output minus share to labor.

Source: Mellor, John W. and Uma J.: Lele, "Growth Linkages of the New Foodgrain Technologies," Indian Journal of Agricultural Economics, Vol. XXVIII, No. 1, January-March 1973, Table II, p. 39.

TA 2.. Division of Incremental Expenditure Among Expenditure Categories, by Rural Expenditure Class
India, 1964-65.

	Bottom deciles (mainly, landless ag. & nonag. laborers)	3rd decile (laborers with less than 1 acre)	4th & 5th deciles (1-5 acres)	6th, 7th & 8th deciles (5-10 acres)	9th decile (10-15 acres)	Lower $\frac{1}{2}$ of 10th decile (15-30 acres)	Upper $\frac{1}{2}$ of 10th decile (30+ acres)
<u>Mean Per Capita Monthly Expenditure</u>	8.93	13.14	17.80	24.13	30.71	41.89	85.84
<u>Allocation of an Additional Rupee of Expenditure</u>							
A. Agricultural Commodities	.79	0.69	0.59	0.52	0.46	0.40	0.33
(a) Food grains	.59	0.38	0.25	0.16	0.11	0.06	0.02
(b) Nonfoodgrains	.20	0.31	0.34	0.36	0.35	0.34	0.31
(i) Milk & milk products	.07	0.11	0.12	0.13	0.13	0.12	0.09
(ii) Meat, eggs & fish	.02	0.03	0.03	0.03	0.03	0.03	0.02
(iii) Other foods (a)	.01	0.05	0.07	0.09	0.10	0.12	0.16
(iv) Tobacco	.01	0.01	0.01	0.01	0.01	0.01	0.01
(v) Vanaspati	-	0.01	0.02	0.02	0.02	0.02	0.01
(vi) Other oils	.05	0.05	0.04	0.04	0.03	0.02	0.01
(vii) Sweetners	.04	0.05	0.05	0.04	0.03	0.02	0.01
B. Nonagricultural Commodities	.21	0.31	0.41	0.48	0.54	0.60	0.67
(a) Textiles	.09	0.08	0.07	0.08	0.07	0.06	0.07
(i) Cotton textiles	.09	0.08	0.07	0.06	0.06	0.05	0.03
(ii) Woolen textiles	-	-	-	0.01	0.01	0.01	0.02
(iii) Other textiles	-	-	-	0.01	-	-	0.02
(b) Nontextiles	0.12	0.23	0.34	0.40	0.47	0.54	0.60
(i) Footwear	-	0.01	0.01	0.01	0.01	0.01	0.01
(ii) Durables & semidurables (b)	0.01	0.01	0.01	0.02	0.02	0.03	0.05
(iii) Conveyance (c)	0.01	0.01	0.02	0.02	0.03	0.05	0.10
(iv) Consumer services (d)	0.02	0.02	0.02	0.03	0.03	0.04	0.06
(v) Education (e)	0.01	0.01	0.02	0.03	0.03	0.05	0.11
(vi) Fuel & light	0.07	0.07	0.06	0.05	0.05	0.04	0.03
(vii) House rent (f)	-	0.01	0.01	0.02	0.03	0.04	0.08
(viii) Miscellaneous (g)	-	0.09	0.16	0.22	0.27	0.28	0.16
TOTAL	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Source: Mellor and Lele, op. cit., Table III, p. 41; original data estimated from the functions fitted to data from NCAER, "All-India Consumer Expenditure Survey," 1964-65, Vol. II, New Delhi, 1967; computations made by Bhupat Desai, for which see Occasional Paper No. 54.

products are about 50 percent more important than textiles in incremental expenditure patterns. In general, the nonfoodgrain agricultural commodities are labor intensive in production (see Occasional Papers No. 68 and No. 71 by Donovan). Thus, in the context of rising rural incomes and appropriate development policy, these commodities offer potential for massive increase in employment within the rural sector. It follows that agriculture itself may through these secondary effects play a major role in providing increased employment but that conversely, efforts to expand employment in agriculture through intensification in nonfoodgrain agricultural commodities must be supported by increased demand from higher consumer incomes. Thus, an important relationship between consumption, use of labor and growth is established and hence it can be seen that employment policies need to be coordinated over a broad range of effort.

A clear potential was also shown for rising rural incomes to generate increased demand for relatively labor intensive manufactured goods, and from that a potential is established for development of industries which previously lacked either a demand or production rational for location in rural areas. From this it is shown how increased rural incomes can provide the demand and capital requirements for such growth (see Occasional Paper No. 42).

Table 3 illustrates through two cases how aggregate expenditure of Rs. 2400 million varies substantially according to the distribution of income. The Rs. 2400 million is roughly equivalent to a five percent addition to foodgrain production in India at the price levels of the late 1960's.

In one case, consistent with many of the new high-yielding foodgrain varieties, we assume 10 percent of the Rs. 2400 is expended by the laboring classes (the lower three deciles in expenditure patterns) and 90 percent is expended by the owner-cultivator class (the sixth, seventh and eighth deciles).

TABLE 3. Distribution of Rupees 2400 Million Expenditure Assuming Two Different Distributions of Income.

Items	10% of expenditure by landless labor and 90% by owner-cultivator ^{a/}			80% of expenditure by landless laborers and 20% by owner-cultivator ^{a/}		
	Laborers expenditure (million rupees)	Cultivators expenditure (million rupees)	Total expenditure (million rupees)	Laborers expenditure (million rupees)	Cultivators expenditure (million rupees)	Total expenditure (million rupees)
1. Food grains	101	324	425	806	72	878
2. Milk & milk products	24	281	305	192	62	254
3. Meat, eggs & fish	8	65	72	58	14	72
4. Tobacco	2	43	45	19	10	29
5. Vanaspati	2	43	45	19	10	29
6. Other edible oils	12	64	77	96	14	110
7. Sweeteners	12	86	98	96	19	115
8. Other foods	12	194	206	96	43	139
9. Cotton textiles	22	151	173	173	34	206
10. Woolen textiles	-	22	22	-	5	5
11. Other textiles	-	22	22	-	5	5
12. Footwear	-	22	22	-	5	5
13. Conveyance	2	43	46	19	10	29
14. Consumer services	5	65	70	39	14	53
15. Education	2	65	67	19	14	34
16. Fuel & light	17	130	146	135	29	163
17. House rent	-	43	43	-	10	10
18. Durables & semi-durables	2	43	46	19	9	29
19. Miscellaneous	17	154	470	134	101	235
TOTAL	240	2160	2400	1920	480	400

^{a/} Landless laborers defined as the lowest three expenditure deciles and owner-cultivator as the sixth, seventh and eighth expenditure deciles.

Source: Mellor and Lele, *op. cit.*, Table V, p. 45.

As an alternative, we assume that 80 percent of the income is expended by the laboring classes and 20 percent by the owner-cultivator class. The latter is analagous to the probable division of expenditure in the case of traditional labor intensive increases in production.

In the first case, while all the income is assumed to be derived from increased foodgrain production, only 13 percent of the added "expenditure" is allocated to food grains and hence is not sold out of the foodgrains sector. In the second case, 37 percent is allocated to foodgrains. Presumably in both cases all the food grains produced will be consumed. The first involves much more complex production and trading relations.

The increment in demand for nonfoodgrain agricultural commodities has a somewhat different composition depending on the distribution of income. The increment in demand for milk and milk products is about 20 percent greater in the distribution that favors the upper income groups than that which favors the lower income groups. The increment in demand for "other" foods, which includes fruits and vegetables, is 50 percent greater in the distribution toward the landowning classes than for that toward the laboring classes. In contrast, in the distribution toward the laboring classes, the demand is relatively larger for other edible oils and sweeteners.

Striking differences occur in demand for nonagricultural commodities. While the increment in demand for cotton textiles actually is 15 percent less in the distribution toward the rich as compared to the distribution toward the poor, the increment in demand for woolen and "other" textiles is more than four times larger in the "rich" case compared to the "poor." The increment in demand for miscellaneous goods, largely consumer nondurables is nearly twice as great in the "rich" case as compared to the "poor."

These are of course the consumption patterns that would occur if the underlying demand functions did not change and if adequate planning allowed the desired quantities to be produced and supplied without change in relative prices. Effective and appropriate policy needs to be based on knowledge of these potentials for changes in expenditure pattern and of the institutional and other policies needed to facilitate or inhibit particular changes.

Simulation of Demand Effects of Increased Rural Income

The complex relationships delineated by the analysis of income distribution and employment effects are examined in the context of a simulation model to explore the equilibrium positions, between supply of wages goods from agriculture, the increase in employment, the growth in income and demand for various commodities and the employment so generated. The initial purpose of the model is to check consistency between production of foodgrains, employment and demand for foodgrains and to examine the division of direct and indirect employment effects between sectors, with emphasis on the potential for employment expansion in the nonfoodgrain agriculture sector. The simulation model is based on the mathematical model stated in Occasional Paper No. 43 and is presented in two forthcoming Occasional Papers dealing with the technical nature of the model and the findings. The analysis confirmed the critical role of increased food production to provide the wages goods to support increased employment; the potential for agriculture itself to provide a substantial portion of that increase in employment; and the extent to which the increase in employment in agriculture is dependent on increased consumer expenditures which will themselves stimulate considerable growth in the nonagricultural sectors as well.

The simulation model raises the question, with a given rate of growth of foodgrain production, what rate of growth in employment can be sustained

and what will be the division among production sectors of that employment increase. That determination requires knowledge of the relationship between per capita consumption of foodgrains by the laboring classes and the level of their incomes -- as income rises, per capita consumption rises and a given increment of foodgrain production will support a lesser increment of employment than previously. It is also necessary to know the characteristics of the technology for increasing foodgrain production and the labor productivity in the other sectors. The former determines the labor used directly in foodgrains production, as well as the distribution of income among income classes, thereby determining the potential direct increase in employment.

The model, as currently formulated, concentrates on the foodgrain and nonfoodgrains agricultural sectors and calculates nonagricultural employment as a residual. Using base line data closely related to India, assumption of a technology system heavily influenced by the new high-yielding crop varieties applied at a rate to provide growth of foodgrains production of approximately 3.9 percent per year and the consumption relationships shown in Table 2, we find that total employment grows at a rate slightly higher than four percent per year (see forthcoming Occasional Paper). With a labor force growth rate of two and a half percent, such a rate of growth employment would allow absorption of all labor force growth plus an additional equivalent of 30 percent of the base period active labor force in a period of 12 years. Although the supply of labor in low income countries is highly elastic it still seems likely that that order of employment growth would result in rising real wage rates in addition to increasing average employment per person and per family. With the given technical assumptions the rate of growth of employment in foodgrains production is about three percent per year; and, in the initial years, 22 percent of the added employment is in that sector, despite the

relatively low employment content of the new agricultural technology. The rising incomes stimulate a rapid growth in demand of employment in that sector of initially 5.7 percent, increasing gradually to 6.1 percent per year, absorbing approximately 22 percent of the added employment. Thus, the two agricultural sectors initially absorb about 44 percent of the added employment, about equally divided between foodgrains and the rest of agriculture -- the first determined by technology and the second by the indirect effects of increased consumer income and expenditure.

The residual employment allows a four percent rate of growth of employment in the nonagricultural sector. That is a rate slower than that actually achieved within the Indian Third Plan period. But in this case, employment growth in agriculture is faster and there is consistency with the foodgrain supply. The rate of output growth in the nonagricultural sector would depend on the rate of investment in that sector, and the consequent increase in labor productivity. It would perhaps be reasonable to expect output to rise at a rate of eight percent per year if employment were rising at four percent. All these growth rates seem feasible with reinvestment of the bulk of returns to capital or industrial profits at a rate of return on capital of eight percent or higher. Hence, in this context, it seems unlikely that capital would be limiting to employment growth -- assuming no excessive leakage into public sector consumption and a potential to trade for capital intensive products. These rates would provide an overall rate of growth of output of about 5.4 percent per year and a rate of growth of per capita income of 3.4 percent per year.^{3/}

^{3/} The overall growth rate is a weighted average of the three sectoral growth rates and the per capita rate is adjusted by subtracting the population growth rate.

The rate of growth of per capita laboring class incomes and expenditure is a function of the employment growth rate minus the labor force growth rate, until "full employment" is reached -- or in this case about 1.5 percent per year. Thus, income of other classes are growing significantly faster than laborers' incomes. However, that is a vast improvement for the laboring class over the capital intensive pattern of growth, which has historically given them no increase in per capita real income. Also, the extent to which expenditure patterns among income classes diverge depends on the extent to which increased incomes of the nonlaboring classes are reinvested. Among the peasant farming and small business classes such reinvestment is likely to be high in the growth climate portrayed.

The growth system is shown to be quite sensitive to change in the rate of growth of foodgrains production. Thus, a decline of the agricultural production growth rate to 3.3 percent, other assumptions approximately the same, reduces the rate of growth of employment to about 3.4 percent per year with about 30 percent of the increase in employment in the foodgrains sector itself. Production of nonfoodgrains agricultural commodities grows at a rate of about four percent per year. The rate of growth of per capita income of the laboring classes reduces to one percent per year.

trikingly, if the technology of foodgrains production swings more heavily away from traditional techniques so that a slightly higher than four percent rate of growth of foodgrains output is achieved but with the bulk of the growth from modern, high-yielding variety technology, then the overall rate of growth of employment is of course the same, but 30 percent of this is initially in the foodgrains agricultural sector and the rate of growth of nonagricultural employment is initially 6.2 percent, declining gradually to 4.5 percent per year.

Thus we see clearly that consistency between growth rates of foodgrain production, employment and capital supplies and requirements are quite interdependent and sensitive to each other at approximately current levels of production. A cohesive program of expanding the various sectors of the economy is needed and because of the varying nature of the sectors, call for different supportive efforts in those various sectors.

Employment Implications of Increased Rural Expenditure

Change in the level and distribution of income and expenditure has a potential to increase the labor intensity of production processes. It may do so by increasing the relative importance of goods and services produced by labor intensive processes, that is by changing the structure of industrial production as well as by contributing to an environment conducive to growth of small scale industry of a generally labor intensive nature. Rapid growth in agricultural production through technical change places heavy demands on a nation's capital resources both directly in the large capital requirements of technical change itself and indirectly by releasing the wages goods constraint on employment and thereby requiring the capital for creating many more jobs.

The research explores the capital problem as it interacts with technical change in agriculture from three points of view. First, secondary data were analyzed to test whether variation in income distribution and hence patterns of consumption affected labor intensity. Second, the characteristics and needs of small scale industry were studied. Third, a general exploration of capital intensity of industry was undertaken to ascertain if changes in structure related to broad strategies of growth do indeed have a substantial effect on employment.

Even though the secondary data available for this purpose were meager and difficult to interpret, two reassuring points are apparent from comparative data on capital-labor ratios. First, the capital-labor ratios are relatively low in the consumer goods industries experiencing the largest increase in demand from increased rural incomes associated with technical change in a peasant agriculture (Table 4). Thus, food processing, textiles, footwear and furniture manufacture are amongst the least capital intensive industries (Table 4).

Second, while there is considerable variation within these industries, important industries with high capital-labor ratios are primarily those catering to demand from urban consumers (Table 5). For example, the capital-labor ratio for milk and milk processing is high and comparable to that of the chemical industry. Similarly, the ratio for the cigarette industry is somewhat lower than for milk and milk products but much higher than that for several other major consumer goods industries and greatly higher than that for traditional forms of tobacco products. Under small town and rural conditions these products or their close substitutes are consumed in a form requiring much less capital intensity in their production. This point is made dramatically in Nightingale's illustration of potential for reducing capital intensity through small-scale operations in providing milk marketing and processing services: (see Occasional Paper No. 17). Thus, the structure of demand may influence the choice of techniques as well as influencing the scale of production of many of these consumer goods. Through both of these factors, the structure of demand associated with rising rural incomes may encourage a more decentralized and labor-using pattern of industrialization. That pattern may, however, require considerable facilitative action with respect to the rural infrastructure.

Table 4. Capital-Labor Ratios and Value Added, by Industrial Sector, India, 1960-1964

Industry	Productive capital per employee (Rupees)	Plant mach. & tools per employee (Rupees)	Percent of total value added	
			1960	1964
Tobacco Mfrs.	3,856	399	2.0	1.3
Mfr. of Footwear, Other Wearing Apparel & Made-up Textile Goods	4,182	774	0.1	0.2
Textile Mfrs.	4,877	2,219	31.8	6.0
Mfr. of Leather & Fur Products Except Footwear & other Wearing Apparel	6,011	947	0.3	0.2
Mfr. of Wood & Cork; Mfr. of Furniture & Fixtures	6,095	1,648	0.8	0.7
Miscellaneous Mfg. Industries	6,823	2,599	1.1	1.2
Food Mfg. Industries, Except Beverage Industries	8,077	3,029	12.0	8.1
Mfr. of Transport Equipment	8,551	2,949	10.2	9.7
Mfr. of Nonmetallic Mineral Products Except Products of Petroleum & Coal	9,054	4,053	4.4	3.7
Mfr. of Metal Products except Machinery & Transport Equipment	9,185	3,048	2.1	2.3
Mfr. of Paper & Paper Products; Printing, Publishing & Allied Industries	11,308	6,181	4.4	4.1
Mfr. of Machinery except Electrical Machinery	11,453	4,685	3.2	5.3
Mfr. of Rubber Products	13,076	4,643	2.6	1.9
Mfr. of Elec. Mach., Apparatus, Appliances & Supplies	13,921	4,399	3.3	4.2
Beverage Industries	15,578	5,487	0.3	0.4
Mfr. of Chemicals & Chemical Products	26,436	11,123	8.3	8.4
Basic Metal Industries	35,035	22,109	8.7	2.8
Electricity, Gas & Steam	52,171	38,882	2.6	8.2
Mfr. of Products of Petroleum & Coal	126,056	57,793	1.8	1.3
Total			100.0	100.0

Source: Government of India, Annual Survey of Industries, Vol. 1, 1964.

TABLE 5. Capital-Labor Ratios and Value Added for Various Consumer Goods Industries, India, 1960-1964.

	Productive capital per employee	Plant mach. & tools per employee	% of all industrial value added	
			1960	1964
<u>Milk Foods & Malt Foods</u>	26,446	12,949	0.1	0.1
<u>Other Foods</u>				
Processed Fish & Seafood	6,498	4,249	-	-
Processed Fruits & Vegetables	5,871	1,678	-	0.1
<u>Tobacco</u>				
Biri	816	33	0.2	0.0
Cigarette	17,798	2,056	1.2	1.2
Snuff	10,754	1,267	-	-
Jerda	3,658	476	0.1	-
Other Tobacco	1,653	135	(not comparable)	
<u>Edible Oils</u>	7,635	2,380	0.6	0.4
<u>Other Oils</u>				
Vanaspati	14,010	4,299	0.9	0.4
<u>Sweeteners</u>				
Sugar	12,107	6,113	4.4	3.0
Gur	1,961	976	-	-
<u>Cotton Textiles</u>	4,843	2,382	23.7	17.7
<u>Other Textiles</u>				
Wool	9,259	2,729	0.7	0.8
Art Silk	11,427	5,274	1.3	2.2
<u>Footwear</u>	4,821	610	-	0.1

Source: Government of India, Annual Survey of Industries. Vol. 1. 1964.

Tables 4 and 5 also present data for proportion of value added in manufacturing contributed by each of the industry categories for India in 1960 and 1964. In this period the industries which would experience sharp increase in demand from increased rural incomes, actually experienced a relative decline in importance. Particularly, large relative declines occurred in the low capital-labor ratio agricultural processing and textile industries. As a consequence average capital-labor ratios increased markedly and the employment content of growth decreased. Thus, for India, the effect of change in industrial structure alone was sufficient to increase the average capital-labor ratio by 20 percent from 1957 to 1964, and by an additional 22 percent from 1960 to 1964 (data from Annual Survey of Industry). The change in average capital-labor ratio was calculated by assuming the capital-labor ratio for each industry constant at its 1964 level and then weighting that ratio by the proportion of value added contributed by each industry for each of the years measured. Thus change in the ratio by this calculation is entirely due to change in the proportion of value added by each industry. Major increases in rural incomes through increased output of new foodgrain varieties may reverse this tendency and change the structure of demand and output growth toward more labor intensive industries.

More intensive analysis of change in industrial structure in India confirmed that the employment content of past industrial growth has been strongly skewed towards large scale capital intensive industry; that this was the result of the strategy of growth; and, that the trend could be reversed in complement with a rural development strategy which raises incomes through efficiency increasing technological change in agricultural production (see forthcoming Occasional Paper by U. Dabholkar)

Because of the interrelation of food production with demand for food and employment it is crucial to the agricultural strategy that substantial employment growth occur in other sectors of the economy.

Small scale industry represents an important potential source of employment growth which itself may be located more readily in rural areas experiencing rapid increase in incomes and consumer demand. The analysis of small scale industry confirmed its potential for labor intensive operation and showed a heavy dependence on capital intensive large scale industry for inputs. It is this latter which, on the one hand, limits the employment potential for small scale industry in the autarchic growth strategies of the formal type, with consequent loss of opportunities for rural industries as well as employment growth, but which, on the other hand, argues for increased foreign trade as a means of importing capital intensive intermediate products to facilitate growth of small scale industries and for exports of labor intensive products in payment. Thus, we document a further interdependence between policies for agricultural employment, industry and trade (see Occasional Paper No. 74 by Mellor and Lele).

In summary, the research shows the need for major change in strategy of growth if employment is to increase more rapidly and how technical change in agriculture can play a key role in that change, not only by providing wages goods and direct increases in employment, but also through changes in demand structure which foster a decrease in capital intensity a major portion of which is due to growth in labor intensive products in agriculture for which demand increases rapidly with rising incomes. From this follow a series of policy needs and recommendations.

2. Policies for Employment Oriented Growth^{4/}

The growth relationships of a rural and employment oriented growth strategy suggest a wide range of policy issues and actions upon which the research has shed light of varying intensity. Ten such issues are treated below. The treatment is in each case brief, and pulls the essence from a larger treatment in the cited Occasional Papers.

a. Priorities and Sequencing for Agricultural Production Increase

Increased production of basic food commodities was established in the theoretical analysis as essential to a high employment policy for the simple reason that low income consumers spend the bulk of increments to their income on basic caloric sources such as grain.

Similarly, technological change of yield increasing types was established as crucial not only as a means of increasing production, but unlike higher prices, as a means of providing a net increase in national income which stimulates growth in other sectors of the economy, with consequent profound implications to employment policy. Thus pursuit of the "green revolution," much critical literature to the contrary, is for most countries a necessary condition to increased employment and welfare of the poor. Thus the production policies of agricultural research, education, input supply, etc. are the first policies for an employment oriented pattern of growth. The potentials inherent in the green revolution, however, do not flow automatically. They must be supported with complementary policies.

Judiciously selected mechanization may be necessary to both the increase in agricultural production as well as to direct increases in employment. This

^{4/} Much of the research on this contract was designed to provide the basis for an employment oriented strategy of growth and to indicate the broad policy requisites of such a strategy. However, because the approach to the broader problem has been through selected micro studies, it has been possible through additional analysis of those data to shed light on a number of policy issues of current importance, particularly in the context of dynamic rural development.

is because labor bottlenecks at certain seasons may prevent acceptance of new crop varieties or cropping patterns which would not only increase production and income, supporting employment in other sectors of the economy, but which would directly increase employment at other seasons as well. (For a full discussion and programming examples see Occasional Paper No. 71 by Donovan). Of course the full distributional implications of such mechanization also depends on the underlying structure with respect to such matters as land tenure and power. Thus, mechanization policy is particularly complex, requiring knowledge of labor supply and its seasonality as well as technical requirements for crops. In the long run considerably more research is needed to facilitate sound policy. In the short run, the complexity of the situation may require emphasis on the market mechanism and prices to regulate the growth of mechanization.

Increased production of nonfoodgrain agricultural commodities such as vegetables and livestock products becomes an early priority in an employment oriented strategy. This is because they are labor intensive in their production, providing a major potential for increased employment as incomes rise and a high proportion of increments to income are spent on these commodities (see Occasional Paper No. 50). In simulation analysis of high employment growth patterns, approximately half the increase in agricultural employment occurred in this sector. Several important policy implications follow. Realization of the potential in the nonfoodgrains agricultural sector requires growth in consumer expenditures, as it is a demand led growth, dominated by commodities with elastic demand patterns. That same characteristic implies growth in demand for nonagricultural commodities as well, providing a joint stimulus to several sectors of the economy. Because of the nature of demand, rising relative prices will shift consumption to

other commodities, thereby losing the employment potential of this sector. Thus, it is important that agricultural policy remove the production and marketing bottlenecks in these sectors. Since breakthroughs in the basic food commodities may occur rapidly, a forward looking rural development strategy will give early attention to livestock and vegetable production and marketing problems. Further, in a rural oriented strategy much of the growth in demand for such commodities will be in the rural areas themselves, with further implications to marketing institutions and policy

b. Fostering the Small Farmer

Improving the conditions of the small farmer is important in its own welfare context and in order to prevent his falling into the even poorer landless labor class. The small farmer problem interacts closely with both technical change in agriculture and with various aspects of employment policy. For these reasons this research gave substantial attention to small farmer problems (this work is reported in Occasional Papers Nos. 47, 53, 57, 61, 64 and 68).

Increasing participation of the small farmer in growth requires two major thrusts. First, facilitating his application of high yielding technology; and second, fostering production of labor intensive commodities. The first requires recognition of the special problems of the small farmer and consequent micro policy and the second additionally requires an adequate macro policy environment.

The small farmer faces problems of access to capital necessary to application of high yielding technology; but, even more important, he faces serious problems of risk and uncertainty aversion which make him reluctant to borrow or to innovate even when other conditions are favorable (see detailed

analysis of risk and uncertainty vis-a-vis the small farmer in Occasional Paper No. 68 by Schluter). Thus, small farmers are constantly forced to choose lower income but more stable crop combinations and technologies. The policy implications are several: orientation of research to reduce risk and uncertainty; providing small farmers access to credit on terms which reduce risk and uncertainty; development and provision of income stabilization schemes. The important point for policy is that simply providing access to credit may not be a sufficient condition for widespread small farmer participation in income increasing technology. In addition, the small farmer may lack access to critical inputs such as fertilizer due to their general scarcity and consequent control of distribution by larger farmers. The solution to this problem lies primarily with eliminating scarcity of such critical inputs.

The small farmer earns his income more from the labor of his family than from his small piece of land -- he is thus a cross between a landless laborer and a landlord, but weighted towards the laborer. It is for this reason that the labor intensity of farming is so important to the small farmer and it is here that important interactions occur with other elements of development strategy. The farm enterprises which offer the greatest opportunity for increased labor intensity -- livestock products such as milk, vegetables and some types of fruits, have highly elastic demand. Unless consumer expenditure generally is rising there will not be a favorable demand and price context for major increases in production of such commodities. Thus, in our simulation model we show a substantial proportion of increased employment in agriculture generally and livestock production and vegetables particularly. However, expanding consumer expenditure for demand elastic agricultural commodities will be accompanied by commensurately large, or larger, increase in demand for nonagricultural consumer goods, which also have elastic demand.

and which also have a potential for substantial labor absorptive capacity. Thus, we see a crucial set of interactions. Large increases in productivity in foodgrains production are required to provide both the most basic wages goods to back increased employment and a portion of the increased income to purchase nonfoodgrain agricultural commodities, while growth must also occur in the nonagricultural sectors to reinforce the demand growth and to provide complementary consumer goods. Thus, much can be done to increase employment in agriculture and particularly employment and incomes of small farmers -- but only in the context of a set of major developments in other sectors of the economy.

In the context of a general strategy for economic growth favorable to nonfoodgrains agricultural production it is necessary to give attention to the same factors requisite to spread of new technology to small farmers -- reduction of risk and uncertainty and provision of capital. Labor intensive activities are normally intensive in requirements of working capital and the risk and uncertainty from weather and pest effects on yields and price instability may be especially high. It is for these reasons that small farmers tend to avoid the labor intensive enterprise combinations which on the surface seem best suited to them (see Schluter, No. 68). The policy needs are several. First, a research emphasis to reduce yield uncertainty of labor intensive enterprises through greater pest resistance and control and tolerance to weather fluctuations. Second, improved credit facilities to meet the high risk conditions of such enterprises. Third, improved marketing and processing facilities to reduce price fluctuations and risks.

c. Fostering Small Scale Industry

Expansion of small scale industry offers potentials closely related to those in nonfoodgrains agriculture and can be seen as highly complementary

to employment oriented policies for agriculture. Rising income in rural areas may itself create a favorable demand environment as well as a source of savings and investment (for a fuller treatment of small scale industries, see Occasional Papers Nos. 56 and 65). Concurrently, small scale industry may tap sources of savings not otherwise available for industrial expansion. Our investigation showed the following policy related characteristics of small scale industry: (1) they tend to be labor intensive; (2) they have large working capital requirements relative to their fixed capital requirements (while leading systems tend to be more oriented to providing loans on security of fixed capital); (3) they use large quantities of raw materials relative to fixed capital, requiring finance and making them vulnerable to price fluctuations in raw material markets, the latter, in turn, placing emphasis on trading acumen and favoring the trader as entrepreneur in small scale industry; (4) the raw materials required such as steel, plastics and fibres may be capital intensive, requiring imports if the labor intensive advantages of small scale industry is not to be substantially lost.

Thus, growth of small scale industry complements vigorous agricultural development policy by providing employment and hence increased incomes and demand for food and other agricultural commodities and by providing demand for food and other agricultural commodities and by providing a potential investment outlet. It requires supporting policy of improved infrastructure for better working markets, imports of capital intensive raw materials and intermediate products, ready supply of working capital, and rising consumer income. From this it is clear why small scale industry has fared badly in capital intensive strategy of growth.

d. The Potentials and Role of Integrated Rural Development

Integrated rural development becomes a desirable and feasible proposition in the context of income increasing technological change in basic agriculture and the market town concept as a development unit then becomes an important conceptual approach. It is through such a set of integrated developments that major increases in rural employment may occur. However, these changes hinge very much on the initial technological breakthroughs in basic food production -- the 'green revolution.' It is the increased incomes from the initial technological breakthrough which provide increased demand for transport, for increased agricultural output, for producer goods such as fertilizer and for consumer goods; for electrification for both production and consumption purposes; as well as other elements of rural infrastructure. Increased rural incomes and demand, greater potential for rural investment and improved rural infrastructure then create an environment favorable for small scale industry which, in turn, fosters employment and resources to help pay for rural infrastructure. Therefore, we see agricultural production, consumption and rural industry providing a basis to support rural infrastructure which no one factor alone could support. The implications of this set of relationships to total development strategy are profound. Given the massive initial size of the rural sector, widespread success in integrated rural development will require a high proportion of the economy's physical and financial resources. Thus, a major reorientation of development strategy is required for the total approach to succeed; success is not likely with a partial commitment to an employment oriented strategy.

The basic policy needs are a commitment to technological change in agriculture as the engine of growth; to investment in rural infrastructure,

including roads and electrification, on a massive scale; and to fostering small scale rural industry, as indicated above.

e. The Role of Rural Public Works

The foregoing analysis facilitates placing the role of rural public works in perspective. It can be seen that without major ancillary efforts at rural development, public works programs cannot fulfill a function of providing a major source of employment and real income for the low income laboring classes. With vigorous rural development, rural public works will be needed for productive purposes and generally need fill no more than a residual role in providing employment. (For a full discussion of rural public works in the larger context of rural development, see Occasional Papers Nos. 60 and 71 by Donovan.)

Rural public works programs may provide a major source of employment in pilot project areas without affecting aggregate demand for food significantly. But, if a public works program is national in character and affects a major portion of the laboring class and the employment problem, then it necessarily has a substantial impact on the demand for food and for grain in particular. It is the high marginal propensity of poor people to consume food that creates this relationship and makes vigorous growth in food supplies a necessary condition of a vigorous employment program. But, that very growth in food output, increases employment directly, and provides income flows which indirectly increase employment and through this set of processes creates an effective demand for increased rural infrastructure. In this context, rural public works are properly viewed first in their productive capacity of providing the infrastructure of rural development and secondarily as dealing with a small scale, hard core problem of unemployment and poverty within a generally expansionary employment context. It is the necessarily supplemental

role of rural public works which has been missed in much of current policy discussion.

f. Regional Development Problems and Prospects

Regional development in a rural oriented growth pattern, remains the most intractable problem of employment and growth. A region which is unable to apply new agricultural technology and to experience vigorous rural growth suffers a dual disadvantage in mitigating problems of employment and poverty. First, agriculture itself does not serve as a major direct and indirect source of expanded employment; second, the area itself can provide neither the resources nor the effective demand for the infrastructure created by rural public works. Conversely, such infrastructure is in heavy demand and can be paid for in an advancing area. Thus rural oriented growth is likely to establish and greatly widen regional income disparities.

The dilemma arises as to whether investment is better placed initially in the areas with production potential, relying on growth in demand for labor in such areas to provide employment for the lagging area through migration or to eventually provide large funds for infusion into the lagging area. Our programming analyses suggest substantial potential for increased employment by concentration of investment in more responsive areas and using labor migration to break labor bottlenecks and to relieve poverty in the backward areas (see Occasional Paper No. 71 by Donovan). The dilemma of the social welfare implication of such regional disparities remains.

g. Agricultural Price Policy

Agricultural price policy becomes, in the strategy set forth, a relatively passive tool of policy, consistent with the intensive analysis of our previous AID research project on, "Agricultural Prices in Economic Development: Their Role, Function and Operation" (see Occasional Papers Nos. 39 and 51).

Relative agricultural prices play a major role in indicating the balance between employment policy and food production policy. Rising relative agricultural prices indicate that employment and real incomes of the low income people with elastic demand is increasing faster than food production and that failure to accelerate food production growth will require slowing of employment growth. Conversely, declining relative food prices suggest potential for accelerating employment growth and an indication that the pressure of direct and indirect stimulation of employment may require a facilitative public policy. Attempts to control prices without dealing with the underlying supply and demand relationships are likely to create lost opportunities for increasing long run employment.

Rising relative prices of potentially employment intensive commodities, such as livestock products and vegetables, indicate that production or marketing constraints are inhibiting growth and provision of employment.

Special price problems arise with respect to the small farmer. His particular vulnerability to risk and uncertainty argue for programs to shield him from fluctuations in output prices. However, it must be remembered that for the small farmer with a major element of subsistence production, stabilization of prices tends to destabilize income (see Occasional Paper No. 6). For the income elastic commodities such as livestock and vegetables, the small farmer may well sell as large or a larger proportion of production than the large farmer, but stabilization of prices of perishable commodities may be exceedingly expensive except through programs of improved marketing, including storage and transportation.

Thus, the farmer's and politician's emphasis on prices is well considered given their major direct effect on income and incentives. But sound policies will focus on those price effects as important indicators of underlying

problems which must receive attention if objectives of growth and distribution are to be met.

Public policy may inadvertently add to price distortions which interfere with social objectives. Subsidies for labor saving mechanization, for example, not only encourage uneconomic mechanization but may divert attention and allocate resources away from the types of mechanization which break employment bottlenecks and increase total employment. Similarly, attempts to reduce farm prices are likely to result in distortion of production patterns towards unaffected products or to distortion of marketing channels in less efficient directions. These problems are of consequence and must be analyzed.

h. Land Reform and Multiplier Effects

Land reform and a relatively even size distribution of land ownership is crucial to obtaining the favorable indirect, linkage effects of technological change in agriculture upon employment growth. Although this research did not deal directly with the land reform question, the favorable relationships discovered occurred in situations of relatively broadly diffused land ownership patterns (see Occasional Paper No. 54). It seems likely that where land ownership is highly concentrated the consumption patterns of the land owners would tend towards high import content and high capital intensity. Thus, the linkage or multiplier effects emanating from the new agricultural technologies would not stimulate employment growth, nor consequently, growth in demand for the increased agricultural production. The consequence is likely to be programs of subsidized storage or export, or price declines which may remove incentives for increased production. Preferable for both growth and income distribution would be change in consumption patterns by redistribution of land or, through taxes, the income from land.

These brief comments on land tenure add not only an additional dimension to considerations of land tenure but serve to emphasize a key feature of growth processes related to agriculture -- the role of income distribution, the patterns of consumption expenditure and consequent employment intensity on the structure of growth.

i. Social Welfare Programs in Perspective

Social welfare programs, including health and nutrition, are unlikely to be successful except in a context of vigorous growth of the agricultural sector and in that context, offer considerable scope as ancillary programs. The reasons for this lie with the nature of health deficiencies and the patterns of income distribution of the poor.

It is becoming increasingly clear that the poor in low income countries suffer a lack of basic calorie sources, and that they spend a high proportion of increments to income on these basic calorie sources (see Occasional Papers Nos. 48 and 50). The first requisites of improved diet and health are increased agricultural production and increased income of the poor. If these requisites are met by aggressive rural development, then the food supplies become available as does the potential for employment to increase incomes of the poor. Further, the environment becomes improved for rural infrastructure of transport and electrification, which further improves the conditions for building and staffing institutions for supplementary programs of education and direct delivery to target groups of special vulnerability to health and nutrition problems.

j. Rural Education

Rural education, as is true for health and nutrition, has greater potentials for success in a context of vigorous rural development. The children of the rural poor tend not to attend school in the context of a stagnant

rural economy. Under such conditions the returns to education are low (see Occasional Paper No. 69 by Shortlidge). Vigorous rural development provides growth in rural employment opportunities for low levels of education (see Occasional Paper No. 67 by Shortlidge). These opportunities arise not only in firms servicing the production aspects of agriculture but also in firms and sales outlets for the higher quality consumer goods demanded from the higher incomes. Thus investment in rural education may attract lower income participants in a context of expanding employment opportunities and not in a stagnant rural and employment growth situation

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App. 1

Appendix 1. [D.1.]

July, 1974

PUBLICATIONS LIST

Cornell University - USAID

Prices, Employment and Income Distribution Research Project

Department of Agricultural Economics

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PUBLICATIONS LIST

Cornell University - USAID

Prices, Employment and Income Distribution Research Projects

Department of Agricultural Economics

Cornell University

<u>Paper No.</u>	<u>Date</u>	<u>Title</u>	<u>Author</u>
1.	Oct. 1967	"Change in Relative prices of Agricultural Commodities, India, 1952-53 to 1964-65" (Out of print)	John W. Mellor and Ashok Dar
2.	Oct. 1967	"Notes on Foodgrains Prices, India, 1967-68 to 1968-69"	John W. Mellor
3.	Dec. 1967	"Determinants and Development Implications of Foodgrains Prices, India, 1949-50 to 1963-64" (Published in <u>The American Journal of Agricultural Economics</u> , Vol. 50, No. 4, Nov. 1968) (Out of print)	John W. Mellor and Ashok Dar
4.	Nov. 1967	"Domestic Terms of Trade and Economic Development in India, 1952-53 to 1964-65" (Cornell International Agricultural Development Bulletin No. 12)	Ashok Dar
5.	Jan. 1968	"Note on Agricultural Price Policy - 1968 Indian Wheat Price Support" (Out of print)	John W. Mellor
6.	Jan.-March 1968	"The Functions of Agricultural Prices in Economic Development" (Published in the <u>Indian Journal of Agricultural Economics</u> , Vol. XXIII, No. 1, Jan.-March, 1968)	John W. Mellor
7.	Jan. 1968 revised July 1969	"Three Reviews of Indian Agriculture: a) agricultural production trends, b) marketing, c) village studies"	John W. Mellor
8.	Jan. 1968	"Farm Management Extension in a Modernizing Agriculture" (Published in <u>Netherlands Journal of Agricultural Science</u> , 16, No. 4, 1968)	John W. Mellor
9.	Apr. 1968	"Opportunities and Problems Associated with Wheat Production, Marketing and Pricing in the Kathmandu Valley"	John W. Mellor
10.	Apr. 1968	"Wheat Production and Utilization as a Leading Edge for Development in the Kathmandu Valley"	John W. Mellor

<u>Paper No.</u>	<u>Date</u>	<u>Title</u>	<u>Author</u>
11.	Sept. 1968	"Statistical Tables, Methodology, Data Sources and Conclusions regarding Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960" (Out of print. This material is now in the following book: <u>Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960</u> , Cornell University Press, 1971.)	Teng-hui Lee
12.	Dec. 1968	"Working of Grain Markets in Selected States, India, 1955-56 to 1964-65" (Out of print. This material is now in the following book: <u>Food Grain Marketing in India</u> , Cornell University Press, 1971.)	Uma J. Lele
13.	June 1968	"A Study of Movement in Prices of Selected Items of Foodgrains and Industrial Raw Materials in India, 1939 to 1967-68" (Out of print)	M. B. Mathur
14.	Jan. 1969	"Increasing Fertilizer Use in Indian Agriculture" (out of print)	Gunvant M. Des
15.	Jan. 1969	"A Note on the Distribution Effects of Chilean Agricultural Price Policies" (Out of print)	Roberto Echeverria
16.	Jan. 1969	"Economic Analysis of Well Irrigation, Aligarh District, India"	T. V. Moorti
17.	Apr. 1969	"The Modernization Decision in India Urban Fluid Milk Markets" (Cornell International Agricultural Development Bulletin No. 15.)	Ray W. Nightingale
18. thru 23.	Mar. 1969	Summary Tables for Study of Diffusion of Innovation, Central Plains, Thailand (Out of print, see Paper No. 41.)	Brook A. Green & Jerachone Sriswasdilek
24.	July 1969	"Growth of Fertilizer Use in Indian Agriculture" (Cornell International Agricultural Development Bulletin No. 18.)	Gunvant M. Des
25.	Aug. 1969	"The Relationship Between Agricultural Production and Industrial Capital Formation in India, 1951-52 to 1964-65" (Cornell International Agricultural Development Bulletin No. 17.)	U. S. Bawa
26.	Oct. 1969	"An Economic Analysis of Resource Use in Farming, Jabalpur District, Madhya Pradesh, India, 1967-68" (Cornell International Agricultural Development Bulletin No. 20.)	V. P. Shukla
27.	Aug. 1969	"Agricultural Price Policy in the Context of Economic Development" (Published in <u>The American Journal of Agricultural Economics</u> , Proceedings Issue, Vol. 51, No. 5, December, 1969.)	John W. Mellor

<u>Paper No.</u>	<u>Date</u>	<u>Title</u>	<u>Author</u>
28.	Sept. 1969	"Stability for Primary Products: Means to What Ends?"	W. G. Tomek
29.	March 1970	"A Comparative Study of Well Irrigation in Aligarh District, India" (Cornell International Agricultural Development Bulletin No. 19.)	T. V. Moorti
30.	June 1970	"The Effect of Agricultural Price Policies on Intersectoral Income Transfers" (out of print)	Roberto Echeverri
31.	June 1970	"The Structure and Performance of the Rice Marketing System in East Pakistan," (Cornell International Agricultural Development Bulletin No. 23.)	M. O. Farruk
32.	June 1970	"The Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal," (Cornell International Agricultural Development Bulletin No. 14.)	Mark C. W. Schroeder & Daniel G. Sisler
33.	June 1970	"Agricultural Resource Transfers and Agricultural Development: A Brief Review of Experience in Japan, England, and France"	Uma J. Lele
34.	June 1970	"Technological Change in Agriculture and Intersectoral Resource Flows," Revised Jan. 1972 & reissued as "Accelerated Growth in Agricultural Production and the Intersectoral Transfer of Resources" (Published in <u>Economic Development and Cultural Change</u> , Vol. 22, No. 1, October, 1973)	John W. Mellor
35.	May 1970	"A Brief Bibliographical Sketch on Intersectoral Capital Transfers in Japan" (Out of print)	Shigemochi Hirashima
36.	June 1970	"Fertilizer Adoption and Use in Amphoe Manorom, Thailand, 1967-69"	Brook. A. Greene
37.	June 1970	"An Analysis of Modernization of the Rice Milling Industry in India"	Uma J. Lele
38.	June 1970	"Elements of a Food Marketing Policy for Low Income Countries" (Published in <u>The Marketing Challenge: Distributing Increased Production in Developing Nations</u> , Foreign Economic Development Report 7, December, 1970)	John W. Mellor
39.	June 1970	"Agricultural Prices in Economic Development - Their Role, Function and Operation" (Out of print, for summarization of points in this paper, see No. 51.)	John W. Mellor
40.	July 1970	"Modernization of the Rice Milling Industry" (Published in <u>Economic & Political Weekly</u> , Vol. V, No. 28, July 11, 1970)	Uma J. Lele

<u>paper No.</u>	<u>Date</u>	<u>Title</u>	<u>Author</u>
41.	Nov. 1970	"Rate of Adoption of New Farm Practices in the Central Plains, Thailand" (Cornell International Development Bulletin No. 24.)	Brook A. Green
42.	June 1971	"The Political Economy of Employment Oriented Development." Now available as a reprint entitled, "Jobs, Poverty and the "Green Revolution," (Published in <u>International Affairs</u> , Vol. 48, No. 1, January, 1972.)	Uma J. Lele and John W. Mellor
43.	June 1971	"A Labor Supply Theory of Economic Development" (Out of print; to be replaced by revised, "Technological Change and Distributive Bias in a Dual Economy," by Uma J. Lele and John W. Mellor.)	John W. Mellor
44.	Feb. 1971	"Capital-Labor Ratios, Capital-Output Ratios, and Rates of Profit in Indian Industry"	Grace Horowitz
45.	June 1971	"A Note on Dualistic Models"	Uma J. Lele
46.	June 1971	"Dilemma of State Tube Wells" (Published in <u>Economic & Political Weekly</u> , Vol. VI, No. 13, March 27, 1971.)	John W. Mellor & T. V. Moorti
47.	Aug. 1971	"Differential Rates of Adoption of the New Seed Varieties in India: The Problem of the Small Farm"	Michael Schluter
48.	Sept. 1971	"The Green Revolution Income Distribution and Nutrition" (Published in Philip L. White (Ed.), <u>Proceedings - Western Hemisphere Nutrition Congress III</u> , Mount Kisco, N.Y. Futura Publishing Co., Inc. 1972)	Uma J. Lele
49.	Dec. 1971	"The Modern Rice Mill in India"	Uma J. Lele
50.	Dec. 1971	"Growth Linkages of the New Foodgrain Technologies" (Published in <u>Indian Journal of Agricultural Economics</u> , Vol. XXVIII, No. 1. Jan.-Mar. 1973)	John W. Mellor & Uma J. Lele
51.	Oct. 1970	"The Basis for Agricultural Price Policy" (Published in <u>War on Hunger</u> , Vol. IV, No. 10, Oct. 1970)	John W. Mellor
52.	Feb. 1972	"Preliminary Observations on the Production of New High Yielding Rice Varieties and Traditional Rice Varieties in Suphan Buri, Thailand"	William R. Burton & Tongruay Chungtes
53.	Mar. 1972	"New Seed Varieties and the Small Farm" (Published in <u>Economic & Political Weekly</u> , Vol. VII, No. 13, Mar. 27, 1972)	M. Schluter & John W. Mellor

<u>Paper No.</u>	<u>Date</u>	<u>Title</u>	<u>Author</u>
54.	Aug. 1972	"Analysis of Consumption Expenditure Patterns in India"	B. M. Desai
55.		"Nitrogen Use and Foodgrain Production, India, 1972-73, 1978-79 and 1983-84" (Forthcoming)	B. M. Desai
56.	July 1972	"Capital Intensity, Absolute Size and Growth Rate of the Small Industries Sector in India: A Critique of Official Estimates"	Jan H. van der Veen
57.	Oct. 1972	"Some Aspects of the Suitability of High Yielding Rice and Bajara Varieties for the Small Farm, Thanjavur and Mehsana Districts, India"	Michael G. G. Schluter & Richard W. Longhurst
58.	Dec. 1972	"Models of Economic Growth and Land Augmenting Technological Change in Foodgrain Production," in Nurul Islam (Ed.) <u>Agricultural Policy in Developing Countries</u> , The Macmillan Press, Ltd., London, 1974. Pp. 3-30.	John W. Mellor
59.	Mar. 1973	"Dynamic Models of Agricultural Development with Demand Linkages"	Mohinder S. Mudahar
60.	April 1973	"Rural Works and Employment Description and Preliminary Analysis of a Land Army Project in Mysore State, India" (Condensed version entitled, "A Preliminary Analysis of a Land Army Project in Karnataka, India," published in <u>Development Digest</u> , Vol. XI, No. 4, Oct. 1973)	W. Graeme Donovan
61.	July 1974	"Expansion of Co-operative Credit to Small Farmers for Adoption of New Cereal Varieties in Gujarat: A Demand or Supply Constraint?" (Published in <u>Artha-Vikas</u> , July 1974)	Michael G. G. Schluter & Gokul O. Parikh
62.		"Generating Employment in Bangladesh: Some Special Problems and Their Possible Solutions" (Forthcoming)	John W. Mellor & M. Raquibuz Zaman
63.	April 1973	"Developing Science and Technology Systems -- Experience and Lessons from Agriculture"	John W. Mellor
64.	May 1973	"The Role of Co-operative Credit in Small Farmer Adoption of the New Cereal Varieties in India"	Michael G. G. Schluter
65.	May 1973	"A Study of Small Industries in Gujarat State, India"	Jan H. van der Veen
66.	Dec. 1973	"Marketing of Selected Agricultural Commodities in the Baco Area, Ethiopia"	Winfried Manig

<u>Paper No.</u>	<u>Date</u>	<u>Title</u>	<u>AUTHOR</u>
67.	Jan. 1974	"University Training for Gramsevakhs in India: An Example of Recurrent Education in a Low Income Country"	Richard L. Shortlidge, Jr.
68.	Feb. 1974	"Interaction of Credit & Uncertainty in Determining Resource Allocation and Incomes on Small Farms, Surat District, India"	Michael G. G. Schluter
69.	Apr. 1974	"The Labor Market for Agricultural Graduates in India: A Benefit-Cost Case Study of G. B. Pant University of Agriculture and Technology"	Richard L. Shortlidge, Jr.
70.	Apr. 1974	"Economics of Resource Use on Sample Farms of Central Gujarat," (Published in <u>Indian Journal of Agricultural Economics</u> , Vol. XXVIII, No. 1, Jan.-Mar. 1973)	B. M. Desai
71.	June 1974	"Employment Generation in Agriculture: A Study in Mandya District, S. India"	W. Graeme Donovan
72.	June 1974	"Hicks Co-Efficient to Depict the Direction of Movements in Relative Shares in Agricultural Production"	C. G. Ranade
73.	June 1974	"Generating Employment in Rural Areas," (Published in <u>Seminar on Rural Development for the Weaker Sections</u> , Indian Society of Agricultural Economics, Bombay, 1973)	Gunvant M. Desai & Michael G. G. Schluter
74.	June 1974	"The Interaction of Growth Strategy, Agriculture and Foreign Trade -- The Case of India," in G. S. Tolley (Ed.) <u>Trade, Agriculture and Development</u> , Ballinger Publishing Company, Cambridge (Forthcoming 1974)	John W. Mellor & Uma Iele
75.	June 1974	"Modernizing Agriculture, Employment and Economic Growth: A Simulation Model"	John W. Mellor & Mohinder S. Mudahar
76.	June 1974	"Simulating a Developing Economy with Modernizing Agricultural Sector: Implications for Employment and Economic Growth"	John W. Mellor & Mohinder S. Mudahar
77.	July 1974	"Population, Resources and Jobs - A Summary Statement"	John W. Mellor
78.	July 1974	"Management Objectives of the Peasant Farmer: An Analysis of Risk Aversion in the Choice of Cropping Pattern, Surat District, India"	Michael G. G. Schluter & Timothy D. Mount

BULLETINS REPORTING RESEARCH ON THE ECONOMICS OF ASIAN AGRICULTURE

Cornell International Agricultural Development Series

1. Lele, Uma J. and John W. Mellor, "Estimates of Change and Causes of Change in Foodgrains Production, India, 1949-50 to 1960-61" Bulletin No. 2.
2. Mellor, John W. and Bruno de Ponteves, "Estimates and Projections of Milk Production and Use of Concentrate Feeds India, 1951-1976" Bulletin No. 6.
3. Weaver, Thomas F., "Irrigation Evaluation under Monsoon Rainfall Patterns -- A Case Study for Raipur District, Madhya Pradesh, India" Bulletin No. 10.
4. Dar, Ashok K., "Domestic Terms of Trade and Economic Development of India, 1952-53 to 1964-65" Bulletin No. 12.
5. Schroeder, Mark C. W. and Daniel G. Sisler, "Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal" Bulletin No. 14.
6. Nightingale, Ray W., "The Modernization Decision in Indian Urban Fluid Milk Markets" Bulletin No. 15.
7. Bawa, Ujagar S., "Agricultural Production and Industrial Capital Formation, India, 1951-52 to 1964-65" Bulletin No. 17.
8. Desai, Gunvant M., "Growth of Fertilizer Use in Indian Agriculture -- Past Trends and Future Demand" Bulletin No. 18.
9. Moorti, T. V., "A Comparative Study of Well Irrigation in Aligarh District, India" Bulletin No. 19.
10. Shukla, V. P., "Interaction of Technological Change and Irrigation in Determining Farm Resource Use, Jabalpur District, India, 1967-1968" Bulletin No. 20.
11. Farruk, M. O., "The Structure and Performance of the Rice Marketing System in East Pakistan" Bulletin No. 23.
12. Greene, Brook A., "Rate of Adoption of New Farm Practices in the Central Plains, Thailand" Bulletin No. 24.

These studies are part of a continuing series being carried on in the Department of Agricultural Economics at Cornell University. See, also, list of Occasional Papers.

APP. 2

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Appendix D.2

Interpretation of Data and Supporting Evidence
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Appendix 2 (D.2.a.)

UEAID Research Progress Report

Researcher: Uttam Dabholkar

Period covered by report: January 1, 1973 - June 30, 197

1. Subject of Research

Aspects of industrialisation and labour absorption in industry in India. The research investigation has three aspects, namely, economic, quantitative and methodological and has two major objectives:

A. Performing comprehensive economic analyses of the evolving pattern of industrialisation and industrial employment in India since the onset of central economic planning in that country in 1951.

B. development of a new analytical approach, supplemented by empirical evidence from Indian industries, that may be a useful tool in the formulation of an industrial policy that is designed to generate large scale additional employment over the planning period.

2. Progress Made

(i) Collection and systematization of raw data on capital, employment, output, prices and costs for industries embracing the entire organised Indian industrial sector for important years since 1951.

(ii) Economic statistical and econometric studies of the behaviour of key economic variables like capital, employment, output, prices and costs over time and their evolving relationships to one another, in individual industries and in the industrial sector generally.

(iii) Inferences by way of economic explanations of the evolving pattern of the relative magnitudes and inter-relationships of key economic variables observed since 1951.

(iv) Proposition of a revealed output input relation called the Posterior Industry Aggregate Output Input Relation in place of the traditional technological concept of the production function, as an aid in the formulation of a new industrial policy and estimation and economic explanation of the estimated PIAOIR for twenty-five Indian industries.

3. Some Important Conclusions

(i) The structure of Indian industries by way of the composition of fixed capital in industry and industrial output, changed significantly over the period 1951-67, in favour of industries that have a low employment component per unit of fixed capital and also per unit of output.

(ii) Within given industry groups there was evidence of labour saving in relation to capital over time generally which in turn can be

Appendix 2 (D.2.a.) (Cont.)

ascribed to the changing importance by way of share of fixed capital of sub-industries within given industry groups or to a tendency towards progressive substitution of capital for labour in processes of production generally or to both.

(iii) It is possible and also eminently desirable, given the prevailing economic conditions in India, and in view of the performance to date of the industrial sector, to adopt a strategy of industrialisation that is capable of generating very sizable additional productive employment over the plan period. This can be achieved in part by consciously facilitating the growth of industries that have a high employment potential in the short and in the medium run. An economic tool that may be valuable in this context is the Posterior Industry Aggregate Output Input Relation which enables the planner to discriminate quantitatively between industries with regard to their labour absorption potential.

4. Work to be done

(i) Some amplificatory and supplementary computation is yet to be done both with regard to satisfactory achievement of objectives (A) and (B).

(ii) A small portion dealing with investigation of objective (B) is yet to be written.

Appendix a (D.2.b.)

USAID Research Progress Report

Researcher: Bhupendra M. Desai

Period covered by report: January 1, 1973 - December 31, 1973

Currently input-output data of each crop of the sample farmers of Surat and Muzaffarnagar districts are being compiled. Simultaneously drafting of the report is also in progress. The introduction and an appendix on assumptions and procedures of compiling complete input data for banana and sugarcane are already drafted. Also a micro-economic model of interrelationships of crop-farming, dairy-farming and consumption is being conceptualized to explain a farmer's decision to change his technology.

Technology is defined to include new seed varieties and new cropping pattern that is particularly influenced by the release of a key production resource, viz., irrigation, constraint. Both the Surat and Muzaffarnagar samples provide an evidence to this definition of technology. A significant number of sample farmers of both the districts have invested in well irrigation even though they have access to the canal irrigation -- a resource for which these districts have been traditionally known.

Some specific although tentative findings supporting the above for the Surat sample are given below:

As many as 43 percent of the sugarcane growers have either exclusively or partially irrigated this crop by well irrigation. The corresponding percentages are 86 for banana growers, 50 for vegetable growers, 26 for wheat and 21 for paddy. One third of the sample farmers who have neither grown banana nor sugarcane have the least irrigation resource available to them. All of these farmers do have canal irrigation facilities. Also these farmers' yields and net returns per acre on their paddy and wheat crops are almost identical to those of the remaining two-thirds of the sample farmers.

One of the objectives of this research is to find out the changes in net income and in input requirements as a result of changes in cropping pattern (including new seed variety). All the sample farmers of Surat district have exclusively grown the new variety of paddy which yields about 73 percent more than the traditional varieties. However, none has grown the high-yielding variety of wheat. This is due to the environmental unsuitability of the new wheat varieties available in the reference year, 1969-70. Some tentative results on increment in net income and in input requirements per acre per annum for alternative crop-combinations are tabulated.

Until more suitable and profitable new varieties of wheat and paddy are found sugarcane will continue to occupy the land it has claimed. Indeed, the paddy-wheat acreage may even get replaced by sugarcane,

Appendix 2 (D.2.b.) (Cont.)

particularly when the marketing and irrigation facilities would expand. In such an event, maximum demand (in absolute terms) would rise for irrigation, followed by groundnut and castor oil cakes, human labor and fertilizers in that order of importance. Against this, a shift in acreage from bajra-wheat to banana would raise the demand maximum for fertilizers, followed by oil cakes, irrigation and human labor in that order of importance. A substantial rise in demand for oil cakes due to a shift in acreage to sugarcane and banana indicates a potential for inducing inter-regional growth linkages through the expansion of groundnut cultivation in unirrigated areas, which are richly endowed with a resource viz., labor most needed for this crop (Table 1.).

Table 1. Per Acre Per Annum Incremental Net Income and Demand for Working Capital Inputs

Alternative Crop Combinations	Increment in Per Acre Per Annum						
	Net Income	Fertilizer	Oil Cakes	Irrigation	Human Labor	Tractor Services	Total Working Capital
	(in Rupees)						
1. Sugarcane vs. Paddy (HYV) Wheat (Improved)	357 (40)	30 (15)	80 (190)	94 (104)	72 (23)	-15 (-75)	213 ^{1/} (21)
2. Banana vs. Bajra ^{2/} (Desi)- Wheat (Improved)	194 (43)	223 (216)	217 (425)	152 (304)	107 (58)	20 (143)	746 (132)
3. Banana vs. Bajra ^{2/} (Hybrid) Wheat (Improved)	33 (5)	198 (155)	193 (257)	152 (304)	60 (26)	3 (10)	619 (90)
4. Banana vs. Groundnut- Wheat (Improved)	33 (5)	204 (167)	141 (362)	150 (288)	24 (5)	28 (467)	625 (91)

Figures in parentheses are percentages of increment to the alternative crop-combination.

^{1/} Increase in demand for total working capital is lower because the incremental demand for FYM and bullock labor is negative. In other words, FYM and bullock labor per acre for paddy-wheat are much higher than that for sugarcane.

^{2/} Since bajra is never grown in Surat district the data on bajra are obtained from other studies. Hence this alternative is more hypothetical than real. Bajra is never grown perhaps because it is not consumed by the people in the district.

^{3/} Wheat is occasionally grown in the soil suitable to banana.

Appendix 2 (D.2.b.) (Cont.)

It also indicates a potential for inducing employment and growth in the decentralized rural industrial units manufacturing groundnut and castor oils.

A shift in acreage from groundnut-wheat to banana will raise the demand maximum for fertilizers and minimum for labor. But a shift from either bajra (hybrid) - wheat (improved) or groundnut-wheat to banana does not appear very profitable. Profitability of banana in relation to two vegetable crops (which seem to be the most appropriate alternative for the soil in which banana is grown) may even turn out unfavorable for banana. We do not, however, have enough data to examine this.

The earlier referred to micro economic model is finalized and empirically tested. The model is being currently exploited to predict changes in input requirements, incomes and its distribution, consumption and its pattern by varying resource endowments of farm families in equal as well as unequal amounts.

USAID Research Progress Report

Researcher: W. Graeme Donovan

Period covered by report: January 1, 1973 - June 30, 1974.

This study begins from the premise that the agricultural sector in India must provide employment opportunities for a high proportion of persons entering the potential labor force in the next two decades. Concentrating on demand for labor, possibilities for employment generation in the agricultural sector are explored, and major issues and relationships in expanding employment opportunities are analyzed. It is argued that a dynamic in agriculture associated with spread of high yielding cereal varieties promises employment increases in foodgrain production, as well as producing a flow of wage goods to sustain employment generation in other agricultural activities, and in public works providing productive rural infrastructure.

This study focuses on a four-village region of canal-irrigated rice and sugar cane agriculture in Mandya District of the State of Kanartaka, where employment opportunities arising from adoption of high-yielding cereal varieties, multiple cropping, vegetable and sugar cane production and dairying are evaluated, and power tiller mechanization relationships explored. A second, six-village region of dryland agriculture, 80 miles north in Tumkur District, also enters the analysis. This is the site for a Land Army rural works project, and in addition, hypothetical labor links are set up between this region and the irrigated region to simulate migration possibilities.

Analysis for the irrigated region uses a single-period, comparative statics linear programming model, which treats the villages as one large farm. The objective function to be maximized is regional net income to cultivators. An employment maximization objective function is used in some runs to explore upper limits on labor absorption (with the same technologies, and subject to the same constraints as with income-maximization), to study tradeoffs between employment and income, and to suggest product price changes which might induce cultivators to favor more labor-intensive activities. Major constraints on the model are land, labor (in monthly periods throughout the year), short and long-term credit, irrigation water, a 'factory capacity' induced upper limit on sugar cane area, and a fodder linkage between crops and dairy livestock. Extensive parameterization of elements of the model tests sensitivity of solutions, and simulates effects of factors which would be introduced endogenously in a multi-period, dynamic framework.

The analysis demonstrates a scope for considerable intensification of agriculture in the irrigated region, which could expand employment by between 75 and 100 percent over current levels, and increase regional income by between 150 and 190 percent. The most important factors underpinning

this intensification are considered to be localized research which ensures availability of flexible, short-duration cereal varieties, a substantial program of extension, demonstration and farmer training, and provision of short-term credit to support farm cash operating costs, which could rise by from 170 to 230 percent above present levels. The crucial importance, for expanding multiple cropping, of finding ways to loosen labor constraints at peak periods of the cropping year, is demonstrated. As a means of achieving this, power tiller mechanization is shown to be very profitable. It is argued, however, that breaking labor bottlenecks by seasonal importation of labor is a preferred solution, and that specific steps should be taken to facilitate such labor exchange between unirrigated and irrigated regions.

The irrigated region is likely to become a heavy net exporter of cereal foodgrains and vegetables, a net importer of pulses, and possibly of dairy products. Sugar cane production may diminish in importance over time under competition from triple cropping.

In the dryland region, rural public works effectively raised incomes of lower-income families. The importance of stimulating continuing employment for these persons, and the need for research on improved dryland crop varieties, is emphasized.

USAID Research Progress Report

Researcher: Gillian P. Hart

Period covered by report: January 1, 1973 to June 30, 1974

My research activities have been concentrated in the following areas:

(1) Preparation for field research in Bangladesh:* This project is concerned with the supply of labor in the agricultural sector. An extensive review of the literature on labor supply has been completed which emphasizes the shortcomings inherent to concepts of disguised unemployment and surplus labor. In this study an attempt will be made to analyze the interactions between economic and welfare factors in labor supply. Particular attention will be focused on --

- (a) interseasonal differences in labor allocation
- (b) the dispersion of activities among family members
- (c) the trade-off between economic and welfare factors

An attempt will be made to analyze the implications for both employment policy and social services programs.

(2) An analysis of the relationship between the supply of family labor and the demand for hired labor. Using data from a group of irrigated and unirrigated farms in Surat District, Gujarat, it was found that the degree of substitutability between family and hired labor differs substantially between operations. This difference was most marked in the unirrigated area, where the results tend to suggest that an increase in the supply of family labor for planting would result in a far higher degree of hired labor displacement than in the case of weeding.

(3) An examination of rural public works projects in Bangladesh.

(4) A conceptual and empirical analysis of the relationship between welfare and economic factors in labor supply using data from the Philippines.

(5) A survey of the literature on national and rural development planning.

* Because of problems associated with field research, the project has recently been shifted from Bangladesh to Indonesia (see the revised research proposal which follows).

Title: An Analysis of the Interaction between Economic and Welfare Factors in Labor Supply Decisions

Location: Ithaca, New York and Bogor, Java

Leader: Gillian Hart, leader of sub-project

Cooperators: It is proposed to do this research under the joint sponsorship of the Indonesian Agro-Economic Survey and the Department of Agricultural Economics, Cornell University.

Justification: Experience during the past decade in a number of Asian countries has demonstrated that relatively high rates of growth have done very little to improve the lot of the poor. A number of studies have suggested that that position of the lowest income groups in both rural and urban areas has probably declined;^{1/} Collier et. al., for example, comment that "The adoption of the high yielding rice varieties has not helped solve the problems of unemployment and income distribution in Java. Rather, the HYV's have probably exacerbated these problems." (Collier et. al. 1974: 42)

In response to the pressing need to raise the real incomes of the poor, increasing attention is being devoted to improving employment opportunities for landless laborers and small farmers on the margin of subsistence. The employment problem consists of three separate but interacting elements:

- (a) the supply of labor which is to be absorbed;
- (b) the availability of jobs which could absorb that labor;
- (c) the supply of consumer goods (particularly foodgrains) to back wages for expanded employment.

Major emphasis is usually placed on (b) - i.e. expanding the demand for labor. With respect to open urban unemployment this is obviously the most relevant issue. In the case of Java, however, where 70 percent of the population live in rural areas, urban unemployment probably constitutes a relatively small proportion of the total extent of poverty and tends to be indicative of worsening rural conditions. It is therefore suggested that basic research should be directed towards problems of rural unemployment and underemployment.

1/

For evidence from India and Bangladesh, see Bardhan (1971), Dandekar and Rath (1970) and Bose (1968).

Within this context, questions relating to the supply of labor and its relationship to the supply of wages goods assumes major importance. Arguments will be outlined below which indicate that rural unemployment and underemployment are extremely complex problems, and that even in very densely populated areas simplistic views of "disguised unemployment" and "surplus labor" might be dangerously misleading and are unlikely to provide a useful basis for policy. This is largely because of problems of seasonality, longer hours worked by lower income groups and relatively high labor force participation rates by women and children. These factors are likely to have important implications for family welfare in terms of health and nutritional status. Thus the basic assumption upon which this study is based is the necessity of understanding the manner in which economic and welfare factors interact with one another in determining the family's allocation of labor both within the household and in income earning activities.

The rationale underlying this assumption is that in the context of increasing unemployment and income distribution, such as exists in Java, the expansion of output together with the creation and/or maintenance of acceptable levels of income and welfare will require a complex set of coordinated policies. From the viewpoint of employment programs it is essential that jobs be tailored to the needs of the poor with respect to job conditions, timing and location, as well as wage rates; thus optimum employment policy must take account of the determinants of labor supply behavior. Closely related to this is the question of the formulation of health and nutritional programs. Mellor, for example, points out that

"Many of the public programs for health improvement assume available time on the part of the participants. Children must be free to attend activities where feeding is provided; women must be free to grow kitchen gardens to add to vitamin supplies; men must have access to ponds and time to fish to add protein; women must have time to prepare more laborious, but nutrition-conserving foods. All such programs have more potential in families of leisure than families of poverty. Thus, unless time, for example through child care centres or foregone income, are provided to the poor, such programs probably to serve to widen rather than to lessen human welfare disparities." (Mellor, forthcoming)

On the basis of these and similar considerations, this project will be concerned particularly with issues pertaining to the supply of labor in rural areas; more specifically, it will involve an attempt to formulate an approach which might be useful in delineating the magnitude and nature of the employment and welfare problem, and in providing guidelines for policy.

Objectives:

The broad objectives of this study are:

- (a) To formulate a conceptual framework, the aim being to identify some of the major determinants of labor supply, and examine their interrelationships in such a way as to be able to predict the effect of changes in these determinants on patterns of labor supply;
- (b) To subject these hypotheses to empirical testing and review the theoretical framework in the light of empirical findings;
- (c) To analyze some of the policy implications arising from this analysis which might be relevant in the formulation of employment and welfare policy in Java.

The conceptual framework which will provide the basis for empirical analysis has been outlined in some detail in a paper by Hart and Popkin (forthcoming).^{2/} Very briefly, we argue that the vast majority of studies of labor utilization in low income countries which have attempted to estimate the existence or otherwise of "surplus labor" are based on a set of restrictive, static and largely irrelevant assumptions.^{3/} Further, most of the estimates of labor supply schedules in high income countries are severely limited in their usefulness.

A more relevant perspective on the question of labor supply is that formulated by Myrdal (1967):

"In dynamic policy terms, the labor supply and the labor input, and the duration and efficiency of work are themselves functions of the policy measures intended to be carried into effect. Indeed, even when the planner moves to mobilize the readily available labor surplus, or part of it, by simply increasing labor demand and work opportunities, he is setting in motion forces that induce change..."

^{2/} The hypotheses developed in this paper were tested using data from the Philippines.

^{3/} Furthermore, Schluter and Hart (1973) demonstrate that the methodologies employed in many of these studies tend to ignore a number of crucial factors.

labor reserve) cannot be defined - and thereafter measured - in an 'objective' way as merely related to facts and independent of policy assumptions." (Myrdal, 1967: 1002)

Similarly Krishna (1973) has shown that unemployment can be defined in terms of various criteria (such as time, income/productivity and willingness) and that each will yield estimates relevant to different important policy questions.

We argue that whether one views policy from a time, willingness or income perspective, it is likely to operate via two closely related sets of interactions:

- a) Those endogenous to the household: This includes two sets of factors - economic (including permanent income, transitory income, wealth, qualifications, cropping pattern in the case of landowning families, access to credit etc.) and welfare (mortality, morbidity, physical productivity, mental performance etc.). Through a complex process of interaction, these factors are closely related to one another and to consumption, household size and composition, and potential labor supply in terms of market labor and non-market household activities such as food preparation, home gardening, child care etc.
- b) The way in which each household member's time is allocated between market and non-market activities will be determined by interactions among these endogenous factors and those which are exogenous to the household. These would include, for example:
 - (i) The characteristics of available employment with respect to wage rates, job conditions, timing and location;
 - (ii) The nature, availability and prices of goods;
 - (iii) The accessibility and quality of social services - e.g. clinics, child care facilities, drinking water supply, nutrition programs etc.
 - (iv) Ecological factors such as climate and seasonality which are likely to be partly related to job availability.

4/ Including wage labor and self employment.

The precise mechanisms of interaction are likely to be heavily influenced by cultural patterns, as well as the socio-political environment insofar as it affects factors such as accessibility to jobs, social services and so forth. The major distinguishing feature of exogenous factors is that they are more readily amenable to policy manipulation.

Among the major hypotheses which emerge from this analysis are:

- a) That the labor force behavior of women is crucial to understanding both the intrafamily allocation of labor and levels of welfare. Particularly in poorer households we hypothesize that women will be more likely to enter the market force if family income is at a relatively low level, and that this might involve a trade-off in terms of income and welfare;
- b) Related to this, to the extent that the woman is the major producer of welfare commodities^{5/} within the household her labor force participation and duration is likely to be affected by the age and size composition of the family;
- c) The amount of time spent by the woman in the market labor force is likely to be inversely related to levels of family welfare and hence the intensity of work of other family members. However the greater the availability of goods and social services which substitute for the mother's time in the household and/or increase the quality of household consumption, the less crucial will be the trade-off between income and welfare;
- d) Related to (a), the greater the extent of seasonality the higher the probability that women will enter the labor force at seasonal peak periods. Conversely in a more long-term and productivity-oriented perspective, questions arise concerning (i) a more even pattern of

^{5/} Welfare commodities are defined as the combination of goods and non-market labor and include food preparation, child care etc.

labor demand throughout the year via technological changes and (ii) a permanent withdrawal of a segment of the agricultural labor force to stable, year-round employment in the non-agricultural sector. These issues raise a number of extremely complex questions, a comprehensive analysis of which would require detailed knowledge of shifts in labor demand induced by different types of technological innovations, in addition to possible labor supply responses. Although a detailed examination of the nature and extent of changes in labor demand lie beyond the scope of this study, an attempt will be made to develop hypotheses concerning certain patterns of labor supply responses and subject them to empirical testing as far as is possible. One of the most important of these patterns relates to the supply responses of larger farmers: The heavy labor requirements at the seasonal peak suggest that permanent removal of a portion of the agricultural labor force might require some form of reorganization to prevent a fall in output.

This could be achieved by greater participation by women and children, increased overtime work or some form of mechanization. It is unlikely that the first two alternatives would be viable in the long run, particularly insofar as they carry fairly severe implications for welfare. For these, and a number of other reasons relating to the technical requirements of high yielding seed varieties, it seems likely that mechanization will be extremely important. If, however, certain forms of mechanization (e.g. thrashers) are given consideration as a means of relieving peak labor requirements and spreading labor demand more evenly throughout the year, it will be crucial to take cognizance of the possible labor supply responses of larger farmers. It has been shown that the labor input of larger farmers tends to be relatively small, and it is possible that a change in the nature of work brought about by mechanization, as well as the increase in labor productivity and wages, might induce larger farmers to increase their own labor input. Thus aggregate data which show constant labor requirements with increased intensity and mechanization may mask the displacement of lower income, hired laborers by higher income farmers.

Having examined these empirical relationships, it is hoped to evaluate the relative impact of the following policies (both singly and in combination) on the intrafamily allocation of time between market and non-market activities:

- a) Expanding the availability of various types of employment;
- b) Stabilizing incomes and increasing productivity;
- c) Changing the cropping pattern;
- d) Expanding the availability of various types of goods;
- e) Increasing the availability of different types of social services, with particular reference to organizational forms.

Methodology:

Final decisions as to research design and methodology will be made so as to make the project as consistent as possible with the Agro-Economic Survey. Thus the methodological issues raised in this proposal are intended to provide broad guidelines so as to maintain maximum flexibility.

a) The Model

Ideally, the final form of the model will be such as to permit the pooling of time series and cross sectional data; the extent to which this will be possible is largely dependent on the time series data available through the Agro-Economic Survey. This, in turn, will partly determine the choice among (i) a single multi-equation model, (ii) several multi-equation models, or (iii) a series of single equation models.

Although at this stage it is not possible to specify the model/s precisely, particular attention will be focused on the following variables:

- i) Dependent variables: the allocation of time of household members between market and non-market labor; the size and composition of consumption; the health and nutritional status of each household member, particularly children.^{6/}
- ii) Explanatory variables: various combinations of the

^{6/} This variable is likely to present problems of measurement. In the absence of more direct measures, an attempt will be made to use a proxy such as dietary intake.

above variables according to the equation; wealth; income of each family member; education of mother and father; family size and age/sex composition; wage rates; acreage cropping pattern, and volume of hired labor in landowning households.

b) Sampling Design

In this project there is likely to be a particularly important trade-off between sample size and the quality and comprehensiveness of data, mainly because of the need for detailed data on time allocation and consumption which might require relatively long periods of direct observation. In order to arrive at a reasonable compromise, great care will be exercised in the selection of sample villages so as to control for environmental factors as far as possible, and concentrate on mechanisms of interaction among factors endogenous to the household. Obviously final decisions in this area will have to be made in the field, but an attempt will be made to adhere to the following broad guidelines:

- i) To study two basic village situations, selected according to whether or not irrigation allows for multiple cropping. This should reflect major differences in the labor market situation;
- ii) To compare four villages, two in each of the village situations. If possible, it would be useful to control for the availability or otherwise of social services, which would give the following overall sample design:

	Multiple Cropping	No Multiple Cropping
Relatively high availability of social services	Village A	Village C
Relatively low availability of social services	Village B	Village D

An attempt will be made as far as possible to control for other environmental factors, such as distance from urban areas, which would influence the labor market.

- iii) The sampling within each village will follow as closely as possible to the Agro-Economic Survey sample. An approach to which serious consideration is being given is to commence with an extensive survey in each village, and then use this as a basis for selecting a small, carefully stratified sub-sample. The major criteria for stratification will be income (if satisfactory data are

available) and acreage for landowning households. The sub-sample will be interviewed more or less continuously throughout the year, whereas the whole sample will be interviewed at less frequent intervals which will coincide with discernable changes in the labor market. It is hoped that this type of approach will provide adequate detailed information, while at the same time allowing for sufficient variation to make the econometric analysis meaningful.

c) Data Collection

The precise data requirements will be largely dictated by the final form of the model; in general however they will be more or less along the lines of the variables outlined on p. 7 above. As mentioned earlier, the major problems in data collection are likely to be encountered in:

- i) Collecting precise information on time allocation, and
- ii) Obtaining acceptable measures of welfare factors.

In commenting on the frequent-visit procedure, Collinson notes that

"The required planning components - operational sequence, operation timing, and rates of work - can all be synthesized from this kind of list. A good deal of other planning information is also enumerated in the course of this listing; the lengths of day worked by different groups and at various parts of the season are important qualifications of labor supply constraints for planning. Various approaches have been used for detailed collection. The method recommended by (several authors) requires a listing of all activities of each individual during daylight hours. This is probably the best technique, allowing a full enumeration of other non-farm activities undertaken by family members. It may, however, be precluded by cost conditions, for it adds significantly to both enumerator and respondent burdens." (Collinson, 1972: 225)

Thus it will probably be necessary to conduct a series of pilot studies to assess the costs and benefits of various types of interviewing and questionnaires. In general it is my intention to seek as much advice as possible from those concerned with the Agro-Economic Survey, and to achieve the closest possible acquaintance with people in the villages.

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For the welfare measures, simple and useful parameters such as height and weight of each child are useful, but are unlikely to allow enough sensitivity to seasonal fluctuations in family income and intrafamily time allocation. Consequently measures more sensitive to these changes such as dietary intake (24-hour recall or 3-day weighing and measuring) will be needed.

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Appendix 2. (D.2.c.)

USAID Research Progress Report

Researcher: Chandrashekar G. Ranade

Period covered by report: January 1, 1973 to June 30, 1974

Since last reporting, work was done in two areas, (1) dualistic models and (2) production functions.

1. Dualistic model: Professor Henry Wan, Jr. gave substantial comments on the Lele-Mellor model. This led to some revisions in the model, especially with respect to the analysis related to technological change in agriculture. The next task was to incorporate intersectoral allocation of capital in the Lele-Mellor model. In view of this, time was spent on formulating the basic conceptual framework. The conceptual framework for this extended Lele-Mellor model and posed some questions regarding how the relative factor shares move in agriculture when the supply of more than two inputs changes. This problem resulted in extensive work on the production functions, as described below.

2. Production Function: Review of all important theoretical work done in this area since 1932. The research was mainly confined to building a conceptual framework to analyze income distribution and resource substitution in agriculture. The conceptual framework was tested by doing some analytical work on the input-output data for the Muzaffarnagar District, India. The results indicate that the conceptual framework is statistically feasible and has economic relevance.

The above two efforts are now taking final shape. We are finalizing the extended Lele-Mellor model and also extending the empirical work for production functions for some other input-output data for Andhra Pradesh and Surat District, India.

USAID Research Progress Report

Researcher: Michael G. G. Schluter

Period covered by report: January 1, 1973 to June 30, 1974

This study has been completed and an Occasional Paper is in the process of being issued.

The study has examined factors constraining small farmers from intensifying production through adoption of new cereal varieties, increasing fertilizer use, dairying, and changes in cropping combination. The primary data source is a cross-section survey of 120 farmers in Surat district, for 1971-72. The sample is drawn equally from high, middle and low income villages, but is stratified so that the proportion of small farmers is similar to that in India as a whole.

The chief problem of the small farmer on irrigated land is identified as a shortage of working capital. This arises from a lack of collateral against which to borrow, and unwillingness to use available credit owing to income uncertainty. On unirrigated small farms, uncertainty is the main constraint because inadequate assets, and funds to finance consumption, make farmers unable to sustain the large income fluctuations of high-income crop combinations.

Small farmers' incomes may be divided conceptually between returns to land and returns to family labor. Estimated family labor supply functions for irrigated farms indicate that intensification of cropping combinations will not increase the family labor input significantly, so both small and large irrigated farms are concerned primarily about returns to land. Only in dairying, is the family labor input substantial. On unirrigated farms, intensification will significantly increase the family labor input, increasing returns to land and family labor. In this framework, we identify factors constraining small farmers from intensifying production.

Adoption of new varieties is determined primarily by the profitability of the variety. Availability of working capital is shown to be a factor influencing small farmer adoption primarily in situations of relatively high uncertainty, and late in the diffusion process, when small farmers are willing to adopt.

Increased fertilizer use is constrained primarily by a shortage of working capital on irrigated farms; on unirrigated farms, uncertainty probably accounts for the large difference between the marginal value product of nitrogen, in the estimated production functions, and the price of nitrogen.

The chief constraints on expanding size of dairy herd on small farms are identified as shortage of land for green and dry fodder, and shortage of female family labor. This makes it difficult to increase

Appendix 2. (D.2.f.) (Cont.)

herd size, so increasing buffalo productivity is required. Some scope exists to increase feed levels, but purchase of improved breeds is identified as the most profitable means to raise productivity. However, improved breeds are disease prone, increasing uncertainty, so that a buffalo insurance scheme may be appropriate.

The influence of uncertainty in determining cropping pattern on unirrigated farms is analyzed by estimating EV frontiers for 33 farms, using a parametric linear programming model based on time-series data for 1966/67 - 1971/72. Farmers are shown to operate close to their EV frontier, indicating that minimizing uncertainty is part of their objective function. Since the source of uncertainty is yield variability, which is offset rather than compounded by price variation, price stabilization policies are inappropriate in this context. For irrigated farms, the increase in capital requirement relative to uncertainty for cropping combinations along the EV frontier is illustrated. The analysis indicates that shortage of working capital prevents small farms growing the high-income crop, sugarcane.

The study concludes that expanding co-operative credit availability would increase fertilizer use, and encourage a shift to higher income crops (new varieties and sugarcane) on irrigated small farms. Greater flexibility of loan repayment would make small farmers more willing to use available credit.

On unirrigated farms, research must play a vital role both to increase yield levels, and to develop varieties or cultivation practices which will minimize yield losses in years of low rainfall.

Appendix 2. (D.2.g.)

USAID Research Progress Report

Researcher: Richard L. Shortlidge, Jr.

Period covered by report: January 1, 1973 to June 30, 1974.

Work on the survey of agricultural graduates from G. B. Pant University of Agriculture and Technology, Pantnagar, U.P., India, is completed. The survey of agricultural graduates has been issued as an Occasional Paper under the title, "The Labor Market for Agricultural Graduates in India: A Benefit-Cost Case Study of G. B. Pant College of Agriculture and Technology."

Two topics have been abstracted from this study and serve as the subject of two papers. Both of these papers are to appear in the Occasional Paper series.

1. "University Training for Gramsevaks in India: An Example of Recurrent Education in a Low Income Country," has been accepted for publication in a forthcoming issue of Economic Development and Cultural Change.

Summary of paper: Although Gramsevaks, or Village Level Workers, come to the university at an age significantly older than regular agricultural undergraduates and tend to have weaker academic backgrounds, their performance at the university suggest that they do better than regular undergraduates. Using the earnings data supplied from a mailed questionnaire, the earnings functions of both regular graduates and Gramsevaks are estimated. Using the cost data supplied by the university for each graduate in the sample, it was possible to generate internal rates of return for both cohorts. The conclusion of the study is that the reduction in the academic program for Gramsevaks by one year more than offsets the loss in years in the labor force (Gramsevaks are ten years older than other students). The estimated internal social rates of return suggest that the Gramsevak program is at least as efficient as the regular undergraduate program in agriculture. Furthermore, since the program allows the participation of a group of individuals from a lower socio-economic group in India, the program is advantageous from the standpoint of equity.

2. "Occupational Choice and Labor Force Experience: The Case of Agricultural University Graduates in India."

Summary of paper: The paper utilizes the theoretical model of Eli Ginzberg to explore the occupational or career development of agricultural graduates in India. The major findings of the study are (a) student employment preference is not related to the occupation of fathers, and (b) choice of an occupation for agricultural graduates is a function of long run employment expectations as opposed to short run employment.

Appendix 2. (D.2.g.) (Cont.)

The major reason for the rejection of a relationship between student employment preference and the distribution of parental occupations lies in the lack of preference for agriculture or farming. This conclusion is supported by evidence from other agricultural universities in India. The author shows that although students are not employed in agriculture directly, they are likely to be employed in areas serving agriculture. It is hypothesized that this is a more efficient use of their training than farming. Second, the initial jobs of agricultural graduates are often at the university as research and extension personnel. These jobs tend to be short term. The long run finds a shift of graduates from university research and extension to private business and Government of India corporations. Student employment preference is related to the distribution of jobs after at least two years in the labor force.

3. The survey of 300 households in 14 villages in Nainital and Badaun districts is still in the process of analysis. The discovery of coding errors during the early summer necessitated the recoding and punching of the data. This has delayed the completion of the study several months. The study will address itself to two questions. First, the decision to send children to school will be analyzed within the framework of Probit analysis. The dependent variable in the analysis will be a zero-one variable. Second, for those children in school or who have been to school, the analysis will utilize a regression to explain the number of years of schooling likely for different socio-economic groups in India. In order to ascertain which variables are important explanatory variables, an AID-RTI search will be run to determine interactions.

4. The analysis of the employees in 15 categories of firms in four small and medium size urban areas has been completed. The results will be forthcoming in a study entitled, "The Employment of the Educated in Small Businesses in India: Fact or Fiction." The analysis is of employees of over 250 firms in the cities of Badaun, Rudrapur, Bisauli and Wazirganj in Badaun and Nainital districts. Monthly take home pay of employees is regressed against variables measuring educational background, experience, location of employment, occupation, and firm classification. A brief review of these results indicates (1) level of education is positively correlated with earnings; (2) educational level of employer is also positively correlated with the earnings of employees; (3) employment in firms such as agricultural equipment sales, shoe stores, grain agents, and consumer goods (radios, bicycles, etc.) are positively related to earnings; (4) employment as technician, mechanic or supervisory personnel is positively related to earnings. Some of the factors negatively related to earnings of workers were (1) apprenticeship, (2) employment in Badaun district. The study indicates that employers do pay and value workers with education and that employment in a rapidly growing area such as Rudrapur results in higher wages. In addition, the positive relationship between firm classification and earnings suggest that an increase in consumer demand for radios, bicycles, etc., as well as an increase in agricultural equipment demand will result in higher earnings for workers through an expansion in employment in this area.

Appendix 3.

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Appendix E.1.(1)

BIBLIOGRAPHIC LIST AND ABSTRACTS

Contract Period -- January 1, 1973 to June 30, 1974

- a. Desai, B. M., "Changes in Consumption and Investment Under the Old and New Food Grains Technology in India -- A Conceptual Framework," paper prepared for the International Conference of Agricultural Economists, Sao Paulo, Brazil, August 20-29, 1973.
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Appendix 3. (Appendix E.1.(1)) (cont.)

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(A folder of these publications for AID only will be included,
any of these publications will be given to others upon request.)

ABSTRACT

"Changes in Consumption and Investment Under the Old and New Food Grains
Technology in India -- A Conceptual Framework"

This paper develops an overall framework for research on implications of new food grain technologies to changes in consumption and investment patterns. It identifies different factors of new technologies that would cause an increase in production and incomes of farmers. It further shows that under new technological conditions the skewness in income distribution among farmers of varied farm size would increase. This is because of differences in access to new inputs and new cropping patterns, and also in the ability of various farmers to bear risk and uncertainty associated with the change. The skewness in income distribution between farmers and landless laborers would also increase, although the absolute levels of incomes of the latter class would also rise. This is because new technology being land saving the marginal productivity of land and capital relative to that of labor would increase. Given a factor-price ratio, this would cause a substitution of land and capital for labor. However, this substitution being imperfect would be quite low in the initial stages. Hence, the rise in capital-labor ratio would be quite modest.

The rise in returns to land and capital would induce demand for the yield increasing inputs as well as the farm assets. The marginal propensity to consume food grains would be positive but declining. Against this, the corresponding MPC for such goods as dairy products, edible oils, sugar, vegetables and fruit, footwear, bicycles, etc. would be increasing. This is because the absolute levels of incomes are rising and also because the distribution of income is skewed further. Finally, the paper notes that the growth linkages induced by different consumption and investment goods differ in three respects. One, the extent of stimulus each can provide to the domestic economy. Two, the magnitude of employment and capital use each can induce in various sectors. And three, the type of industries, whether small or large, regionally dispersed or concentrated, each encourages.

ABSTRACT

"Economics of Resource Use on Sample Farms of Central Gujarat"

This paper considers whether or not the returns on the resource use for a sample of farms located in two distinct parts of central Gujarat, India, given their respective production functions, are maximized and if not, why not. This question is studied using econometric methodology. The second objective is therefore to analyze the economic and statistical implications of selection of (a) functional forms, and (b) variables for estimating production functions for a cross-section of farms.

The production functions on the sample farms in the two regions are different. The cause was found to lie in the underlying uncertainty with respect to the irrigation resource in the two regions. This very factor pervades so deeply that it seems to have also caused an uneconomic use of labor and sub-optimum use of fertilizers and manures in the less developed region.

ABSTRACT

"Rural Works and Employment Description and Preliminary Analysis
of a Land Army Project in Mysore State, India"

"A Land Army Project in Karnataka, India"

(Note: Mysore state was renamed Karnataka in 1972.)

The Land Army administers approximately one half of the funds allocated to Mysore State under the Crash Scheme for Rural Employment

This paper describes a Land Army project in Tumkur district, visited in August 1972, involving expenditure of Rs. 600,000 on eight inter-village roads (totalling $2\frac{1}{2}$ miles), three water supply tanks and a small forestry plantation. The roads affect 18 villages. Workers were coming from the seven villages closest to the current activities of the project. It was estimated that 18 percent of the total work force of these villages had received some employment on the project. The task force reached a peak of 560 members in the early part of August 1972. Interviews with a sample of laborers from the task force indicated that a large proportion of its workers were being drawn from lower-income families. If all Land Army work was assumed to be a net addition to work normally obtained, it had increased annual employment of task force members by 63 percent and their annual incomes by over 100 percent. The paper points up the need for projects to stimulate employment-increasing changes in the local economy so that project laborers may find opportunities for employment when the works have been completed.

Appendix 3. (E.1.(1)d.)

Winfried Manig
December, 1973

ABSTRACT

"Marketing of Selected Agricultural Commodities in the Baco Area, Ethiopia"

Based mainly on data for a specific region in Ethiopia, this study makes a further contribution towards a national discussion of the present marketing system for agricultural commodities in developing countries.

The present marketing system of agricultural commodities is examined in this study with respect to the following questions. What are the reasons for the present high price fluctuations? Do the spatial price differences exceed the shipping costs? Does the present marketing system enable the merchants to make excessive profits? The study indicates that the present marketing system for agricultural commodities works effectively, with some exception with respect to village level markets, given the environment of physical infrastructure and volume of marketings. The study does make a case for increased investment in the transportation and improved market information systems.

ABSTRACT

"Growth Linkages of the New Foodgrain Technologies"

Successful introduction of the new high-yielding foodgrain varieties makes a substantial net addition to national income and distributes that income largely to upper-income rural people. Since upper-income rural people have a low marginal propensity to consume food grains, an initial imbalance is created between increased foodgrain supply and demand. The very forces which lie behind this imbalance provide potential for growth and employment stimulating linkages with other sectors of the economy. Through these linkages, supply and demand for food grains may be balanced with only a small change in relative prices. Failure to develop these linkages may result in large changes in relative foodgrain prices which could prejudice continued growth of the foodgrains sector itself.

This paper attempts to tie together the relationship between the factor biases of technological change in agriculture, consumption patterns of different income groups, the demand which is so generated, and the implications of that to labor intensity in the nonfood grains sectors. The individual general relationships which have been dealt with have, of course, been generally understood, but widespread interest arises with respect to the interrelationships which are pointed out. The paper also focuses on the use of a log log inverse function for drawing attention to differences in elasticities and in marginal propensities to consume by income class.

Appendix 3.(E.I.(1)f.)

John W. Mellor
Uma J. Lele
1973

ABSTRACT

Summarization of paper entitled, "Domestic Markets and the Growth of Farm Cash Income," in Guy Hunter (Ed.), "The Food Research Institutes's Fiftieth Anniversary Conference, Strategies for Agricultural Development in the 1970s: A Summary and Critique"

The paper analyzes the effects of technological change in foodgrains. It is concerned with the "growth of (domestically) marketable surplus of agricultural commodities and increased capacity to support a nonagricultural labor force on the one hand, and through growth in farm cash income and hence increased effective demand for output of other sectors on the other hand." This growth will only take place if there is substantial technological change in agriculture; and the nature and operation of technological change will greatly affect its impact on domestic factor and product markets.

ABSTRACT

"Accelerated Growth in Agricultural Production and the Intersectoral
Transfer of Resources"

Accelerated growth in the agricultural production of low-income countries may sharply increase the transfer of resources between agriculture and other sectors of the economy. Such changes affect relative rates of capital formation and income growth in various sectors, the structure of growth, and overall rates of growth. Recent technological breakthroughs in agriculture give current relevance to these relationships.

This paper deals with conceptual and empirical aspects of (a) the magnitude of resource flows between the agricultural and non-agricultural sectors under various conditions of economic growth; (b) the changing role of economic and institutional devices in transferring resources among sectors; and (c) the relationship between such resource flows and technological change in the agricultural sector. Detailed comparisons are made for Taiwan and India, while brief note is taken of the experience of Japan, Britain and France. This paper summarizes a substantial amount of empirical research.

ABSTRACT

"Dynamic Models of Agricultural Development with Demand Linkages"

The general purpose of this study is to develop positive dynamic models of agricultural development with emphasis on demand linkages. These models incorporate microeconomic details of agricultural development and account for the salient features of traditional agriculture in transition. Specific attention is directed to the substitution between farm and nonfarm produced consumer goods and to exogenously versus endogenously determined prices. Recursive programming is used for this purpose. These models are tested by using real data from the agricultural sector of the Indian Punjab for the period 1951 to 1971.

These models display an inherent instability of the farm sector if demand were constant and the stabilizing effect of the growing market for agricultural produce. Seasonal labor demand patterns indicate both scarcities and surpluses. The substitution of brown sugar for refined sugar for household consumption as farm income goes up is effectively displayed. The crucial role of money capital in the agricultural sector is forcefully pinpointed.

ABSTRACT

This paper is a study of short-term co-operative credit for farmers with the necessary infrastructure to adopt new varieties. The analysis is largely based on micro data from samples of farms.

The role of co-operative credit is of the greatest importance in situations where adoption is profitable but farmers face a high degree of risk, and where their own funds are inadequate to meet the additional expenditure. Co-operative credit also becomes important in diffusion of new varieties at the point when small farmers begin to adopt and large farmers put more than a small part of their acreage under the new varieties.

Two reasons are suggested for the importance of co-operative credit in adoption. First, unwillingness or inability of traditional sources of credit and savings of small farmers to expand to meet the increased costs of cultivation. Secondly, the unwillingness of small farmers to use these sources, even if they are able to, owing to the uncertainty involved in adoption.

ABSTRACT

"The Interaction of Credit and Uncertainty in Determining
Resource Allocation and Incomes on Small Farms,
Surat District, India"

This study examines factors constraining small farmers from intensifying production through adoption of new cereal varieties, increasing fertilizer use, dairying, and changes in cropping combination. The primary data source is a cross-section survey of 120 farmers in Surat District, for 1971-72. The sample is drawn equally from high, middle and low income villages, but is stratified so that the proportion of small farmers is similar to that in India as a whole.

The study concludes that expanding co-operative credit availability would increase fertilizer use, and encourage a shift to higher income crops (new varieties and sugarcane) on irrigated small farms. Greater flexibility of loan repayment would make small farmers more willing to use available credit.

On unirrigated farms, research must play a vital role both to increase yield levels, and to develop varieties or cultivation practices which will minimize yield losses in years of low rainfall.

ABSTRACT

'Expansion of Co-operative Credit to Small Farmers for
Adoption of the New Cereal Varieties
in Gujarat: A Demand or Supply Constraint?'

This paper argues that small farmers may be unable to borrow from traditional sources for adoption owing to an inelastic supply of credit, and unwilling to borrow from these sources owing to the uncertainty of returns from the new varieties. Macro-economic data for Gujarat State show that widespread adoption of new varieties requires huge expansion in the supply of co-operative credit. Micro-economic data indicate that co-operative credit becomes important after the initial phase of the diffusion process, and under conditions where a high degree of uncertainty is involved in adoption.

The analysis suggests that co-operatives may be an especially effective policy instrument to accelerate diffusion of the new varieties to small farms under the following conditions:

- (i) Where a profitable innovation has been introduced.
- (ii) In the second phase of the diffusion process, when small farmers begin to adopt.
- (iii) In the kharif season, when crop diseases and weather variability lead to the highest levels of uncertainty, and capital available from own funds is at a minimum.

ABSTRACT

"University Training for Gramsevak in India
An Example of Recurrent Education in a
Low Income Country"

An analysis of a special two year Bachelor of Science Agriculture program for Gramsevak or Village Level Workers initiated in 1961 at the G. B. Pant University of Agriculture and Technology. The program represents a departure from the normal three year undergraduate program in agriculture: first, by lowering its admission standard with respect to previous academic work; and second, by decreasing the degree program by one year which is tantamount to substituting five years of experience in agricultural extension for one year of university course work.

The Gramsevak program has allowed the participation of a lower socio-economic group in the Pant University's agricultural program. One can speculate that the university training of Gramsevak with experience working in rural areas equips them to meet the emerging needs of rural development in India. The Gramsevak program demonstrates the effective use of a program of recurrent education both from the standpoint of efficiency and equity. The social rate of return was shown to be equal to or greater than the comparable return for the regular agricultural graduate. The higher return is dependent on the reduction of the program for Gramsevak by one year.

ABSTRACT

"The Labor Market for Agricultural Graduates in India:
A Benefit-Cost Case Study of G. B. Pant University
of Agriculture and Technology"

This study is an evaluation of the first agricultural university in India, G. B. Pant College of Agriculture and Technology, founded in 1960 on the model of land grant universities in the United States. The study evaluates the university's program in terms of the performance of its graduates in the labor force. Its primary purpose is to ascertain if investments in agricultural universities are justified using a criterion of economic efficiency. Therefore, the framework of analysis is cost benefit.

The study evaluates the university's program in terms of the performance of its graduates in the labor force. A measure of performance is the net gain in earnings resulting from having obtained an education at the university. Measured against the cost of obtaining that education it is possible to estimate the rate of return on the investment.

Of interest to public policy is the return on the investment of society's resources. Therefore, the social rate of return is estimated. However, it is useful to understand factors affecting the demand for education. For this reason, the private rate of return is estimated.

The analysis centers on five degrees awarded by the university. It provides a detailed, quantitative analysis, not only of costs and returns to education in an agricultural university in India, but also of the components of the costs and returns and from that, the bases for improved educational policy.

ABSTRACT

"A Study of Small Industries in Gujarat State, India"

This study is based on data from stratified random sample of small industrial units in Gujarat State, India. The findings support the general presumption that small industries do offer substantially more employment creation potential than do large industrial units, whether measured against capital engaged or against value added. Also, small industrial units, in general, are characterized by lower capital/value added ratios than are large industrial units. Thus, policies promoting expansion of small industries tend to improve employment opportunities while encouraging more effective use of that capital which is available for purposes of industrial development.

Due to the remarkably heavy use of material inputs in the production process and serious imperfections in most of the materials markets in which small industrialists operate, returns to entrepreneurial activities which emphasize purchasing and marketing are relatively large. Correspondingly, returns to entrepreneurial activities which emphasize the production process itself, as reflected in full capacity operations or in technological improvements, are relatively small.

The structural interdependence of small industries is explored by using an input-output model of Gujarat state, expanded explicitly to include the small industries subsector. Results suggest that urban unregistered units are strongly integrated into the state's industrial sector. Backward linkages from large and small units alike are considerable, as are forward linkages into other small units. Forward linkages into large industries are weak.

Appendix 4. (E.1.(2))

STATEMENT IDENTIFYING USE OF MATERIAL

January 1, 1973 to June 30, 1974

Desai, Bhupendra M.

- a. August 20-25, 1973. Present the work being done under Contract No. AID/csu-2805 at the International Conference of Agricultural Economists, Sao Paulo, Brazil.

Mellor, John W.

- b. January 8-9, 1973. Participate in a panel meeting on, "Program and Organization to Tackle Rural Poverty," International Bank for Reconstruction and Development, Washington, D. C.
- c. February 13-14. "Effect of Choice of Growth Strategies on Trade--Some Preliminary Thoughts," presented to the Agricultural Development Council Seminar on Trade, Agriculture and Development, Center for Continuing Education, University of Chicago, Chicago, Ill.
- d. February 28. Seminar: "An Employment Oriented Strategy of Economic Development," International Agricultural Development, Cornell University.
- e. March 6. Seminar: "Nutrition, Development and Income Distribution," Graduate School of Nutrition, Cornell University.
- f. March 6. Seminar (by telephone): "Agricultural Price Policy," Department of Agricultural Economics, University of Missouri, Columbia, Mo.
- g. March 19. Seminar: "Price Policies I: Agriculture," Economic Development Institute of International Bank for Reconstruction and Development, Washington, D. C.
- h. April 5. Seminar: "The Development of India and China, with Emphasis on Economic and Political Structure," China-India Seminar Series, Spring 1973, Cornell University.
- i. April 30. "Developing Science and Technology Systems -- Experience and Lessons from Agriculture," paper presented at Seminar entitled, "Incorporation of Scientific and Technological Considerations in Development Planning," jointly sponsored by the Office of Science and Technology, Technical Assistance Bureau and Office of Policy Development and Analysis, Bureau for Program and Policy Coordination, Agency for International Development, Washington, D. C.
- j. May 2. Seminar: "Employment Oriented Strategy for Economic Development," Program for Comparative Planning and Development, Department of Policy Planning and Regional Analysis, Cornell University.
- k. May 23-29. "Modernizing Agriculture and Theories of Economic Growth," Paper presented at the "Conference on Agriculture in Development Theory," Bellagio, Italy. (Jointly sponsored by the Rockefeller Foundation and Yale University.)

- l. June 12-14. Comprehensive review of the project, "Impact of New Technology on Rural Employment and Income," Agricultural Economics and Sector Planning Division, Office of Agriculture, Bureau for Technical Assistance, Agency for International Development, Department of State, Washington, D. C.
- m. July 2. "The Role of Agriculture in the Development Process and the Importance of and Means for Obtaining Employment Oriented Development," lecture at the Foreign Service Institute, Department of State, Washington, D. C.
- n. July 9-11. Participate in the SEADAG Rural Development Panel Seminar, "Directions in Rural Development Planning," New York, N. Y.
- o. July 12-13. Participate in the Spring Review of Small Farmer Credit Conference, Agency for International Development, Department of State, Washington, D. C.
- p. August 24. Seminar: "Research Strategies Related to Employment Generation," Bangladesh Agricultural University, Mymensingh, Bangladesh.
- q. August 27. Discuss work in the field with members of International Voluntary Services program in Bangladesh, Comilla, Bangladesh.
- r. August 28. Talk with faculty with respect to the research program of the Bangladesh Institute of Development Economics, Dacca, Bangladesh.
- s. August 29-30. How to include small and low income farmers in the development process, discussions with the Planning Commission and Secretary of Ministry of Cooperatives and Local Government, Government of Bangladesh.
- t. August 30. Discussion with respect to the research program, Dacca University, Dacca, Bangladesh.
- u. September 1-5. Various meetings with personnel of the World Bank, International Land Development Consultants, Arnhem-The Netherlands, Kasetsart and Thomasart Universities, personnel from the Ministry of Agriculture, Government of Thailand to discuss problems of equitable taxation of farmers with particular emphasis on equity relative to small and low income farmers, Bangkok, Thailand.
- v. September 6. Seminar: "Research Strategies for Employment Oriented Development," Department of Agricultural Economics, Kasetsart University, Bangkok, Thailand.
- w. October 26. Seminar, Bangladesh Team, Agency for International Development, Department of State, Washington, D. C.
- x. October 29-31. Lecture: "Agri-Business and Rural Development," U. S. Department of Agriculture Graduate School, Washington, D. C.
- y. November 13. "Rural Development and Its Problems in the Next Decade," Talk given at luncheon commemorating International Voluntary Services' Twentieth Anniversary, Washington, D. C.

- z. November 21. "Issues and Perspectives in Rural Development: A Comparative Analysis," paper presented at the seminar on rural development co-sponsored by the University of Ife and the U. S. Information Service, Ile-Ife, Nigeria.
- aa. November. Discussion on rural development, program for Voice of America in Africa.
- bb. December 9-14. Participate in seminar on agricultural development with special reference to the Taiwan experience, jointly sponsored by the Joint Commission on Rural Reconstruction and the Agricultural Development Council, Taipei, Taiwan.
- cc. December 20-21. Lecture at the Foreign Service Institute, Department of State, Washington, D. C.
- dd. March 4, 1974. Seminar on Bangladesh, Department of State, Washington, D. C.
- ee. March 8-11. Seminar: "The Politics and Economics of Choosing a Development Strategy for India," plus informal meetings with students and faculty, New College, Sarasota, Fla.
- ff. March 22-24. Chairman and Participant in the seminar on "Regional Development as it Concerns Specialization and Intensification of Agriculture in the Mekong Basin," sponsored by the Mekong Development Panel of the Southeast Asia Development Advisory Group of the Asia Society, Cornell University.
- gg. April 18. Seminar: "The Requisites and Implications of a Rural-Oriented Strategy for Economic Growth," in honor of Professor M. N. Srinivas, Department of Anthropology, Cornell University.
- hh. April 22-25. Participate in seminar on population dynamics under the auspices of the United States-Republic of China Cooperative Science Program, Research Triangle Park, N. C.
- ii. April 25-28. Seminar: "Agriculture and An Employment Oriented Strategy of Growth," Department of Economics, Iowa State University, Ames, Iowa.
- jj. May 10. Seminar: "Price Policies I: Agriculture," Economic Development Institute, International Bank for Reconstruction and Development, Washington, D. C.
- kk. June 6. Semi "Rural Development and Employment," 1974 Spring International Power Seminar, U.S. Department of Labor, Washington, D.C.
- ll. June 5-6. Lecture at the Foreign Service Institute, Department of State, Washington, D. C.
- mm. June 10-12. Lecture at the USDA Graduate School in Agro-Industrial and Industrial Development Management Training Program, Washington, D.C.

Mudhar, Mohinder S

- nn. June 12-14, 1973. "Modernizing Agriculture, Employment and Economic Growth: A Simulation Model," paper presented at the comprehensive review of the project, "Impact of New Technology on Rural Employment and Income," Agricultural Economics and Sector Planning Division, Office of Agriculture, Bureau for Technical Assistance, Agency for International Development, Department of State, Washington, D. C.
- oo. August 20-25. Attended International Conference of Agricultural Economists, Sao Paulo, Brazil, presenting comments on "New Analytical Tools in Agricultural Economics,"
- pp. February 1, 1974. Seminar: "The Dynamics of Institutional Change and Rural Development in Punjab," Rural Development Committee, Center for International Studies, Cornell University.

APPENDIX E.2.

Evidence of Findings of Research being used in IDCs and U.S.

(A brief sample follows
of the extensive cor-
respondence with respect
to this research.)

App. 5

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Dr. John W. Mellor
Director of Agricultural Econ



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Quebec, February 5, 1974

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