July, 1976

ANNUAL RESEARCH REPORT
(Abbreviated version)

ANALYSIS OF DIRECT AND INDIRECT EFFECTS OF TECHNOLOGICAL CHANGE IN AGRICULTURE

Contract No. AID/ta-c-1131

Daniel G. Sisler, Director

List of Appendices

A. ANNUAL REPORT SUMMARY SHEET

ANALYSIS OF DIRECT AND INDIRECT EFFECTS OF TECHNOLOGICAL CHANGE IN AGRICULTURE

Contract No. AID/ta-c-1131

Project Title and Contract Number

Daniel G. Sisler — Cornell University

Principal Investigator and Contractor

Department of Agricultural Economics, Cornell University, Ithaca, N. Y. 14853

Contractor's Address

July 1, 1974 - July 1, 1976	July 1, 1975 - July 1, 1976
Contract Period (as amended) From-To	Reporting Period From-To
Total Expenditures and Obligations Through Previous Contract Year	$110,080.83
Total Expenditures and Obligations For Current Contract Year	$122,744.17

NARRATIVE SUMMARY OF ACCOMPLISHMENTS AND UTILIZATION

The major thrust of this contract involves analysis of primary data collected in the Philippines, Indonesia and India. The central objective of the research is to appraise how the adoption of agricultural technology influences income distribution and the demand and supply of agricultural labor. Work in the Philippines was conducted in collaboration with the International Rice Research Institute. At the beginning of the reporting period, primary data had been collected in the Philippine provinces of Laguna and Central Luzon. All farmers involved in this study were engaged in the production of rice. During the past year, the data has been analyzed and the results organized in preliminary manuscript form. Several practical conclusions have been reached. As technological change increased production, landlords, tenants, and landless laborers all gained in absolute terms. Interestingly, the share of gains accruing to landlords declined while that of tenants and hired labor increased. As land-holders' incomes increased because of new technology and land reforms, hired labor was substituted for family labor, resulting in greater demand for hired labor and a consequent increase in hired labor's share of rising output. The analysis also provided useful information concerning how the adoption of technology affected the demand for purchased inputs. The analytical framework developed for the Philippines makes a substantive contribution to work on the theory of production and distribution.

Field work in Indonesia has been carried on in association with the Agricultural Development Council and the Indonesian Agro-Economic Survey. At the time of this report, nine months' of detailed data has been collected

in one coastal village of Java with supplementary data from two other coastal villages. Rice cultivation is the primary income earning activity of the main village. The work in Indonesia concentrates on the identification of forces which influence the supply of agricultural labor. Factors such as age and sex composition of households greatly influence decisions concerning agricultural production practices and the adoption of technological improvements. Preliminary findings indicate that household labor allocation decisions are importantly affected by control over production assets, availability of credit, and the existence of off-farm employment opportunities. The supply of various classes of agricultural labor can be an important deterrent to the adoption of technology and hence bear directly on income distribution.

The research in India concentrates on how tractor mechanization influences the demand for agricultural labor and decisions concerning enterprise combinations. This project will synthesize the demand and supply facets of how a specific agricultural innovation affects the allocation of family and hired agricultural labor. Data collection in India began in February, 1976 in four centers in Chittoor District.

ANNUAL RESEARCH REPORT

Analysis of Direct and Indirect Effects of Technological Change in Agriculture

Contract No. AID/ta-c-1131

Daniel G. Sisler
Director

B. Project Objectives:

The broad objectives of the project are to analyze (1) input-output relationships of various technologies under differing conditions, and (2) agricultural labor supply and its interaction with changing agricultural technologies. Integrating these two objectives, the project is designed to derive implications concerning the impact technological change has on income distribution.

Our aim is to understand income distribution effects on direct participants and to derive policy implications for raising the incomes of the rural poor. Other inquiries have been made into how technology alters income distribution; however, this study provides a unique analytical mechanism for measuring returns to both participants in agricultural production and the share of increased output accruing to purchased inputs. Shares accruing to agricultural labor pose a difficult dilemma. It can be postulated that the new technologies increase demand for labor. It is also true that in most developing nations, the supply of agricultural labor has been increasing over time. The issue is simple if only averages of demand and supply of labor are considered, but becomes complex when one deals with labor input for different operations, especially at peak periods of production such as land preparation and harvesting. A further complicating factor is that technical change may place abnormal demands on labor

provided by women creating a labor bottleneck based on social rather than economic considerations. An ancillary objective of the project is to examine the interconnectivity of technical change, economic considerations, and social factors which alter the choice of enterprise combinations.

Technological change has been very rapid in rice production in the Philippines hence research there concentrated on the implications of technology on the demand for labor. In contrast, the pressure of the supply of labor is acute in India and Indonesia and therefore in these countries the research focus will be on the supply side.

This analytical procedure will be used to test two hypotheses. They are that the factors of production will receive their marginal product, and that the relative share of labor and other inputs will change according to the quantities of different inputs applied on the farm.

The research on the supply of labor examines the ways agricultural households allocate labor among three activities, i.e. agricultural production, activities within the home (e.g. child care and cottage industries) and off-farm employment. The supply of labor for agricultural production is importantly tied to the availability of farm assets notably land, draft animals and implements. Work in India specifically deals with tractor ownership and its effect on the supply of labor.

C. Accomplishments to date:

1. Findings:

During the first three months of the reporting period, detailed data collection was completed in the Philippines. Researchers at the International Rice Research Institute had conducted comprehensive surveys relating to the use of labor, technical improvements, and purchased inputs in

Laguna and Central Luzon provinces. These surveys were conducted in 1965-66 and 1970-71. The survey work conducted under this contract collected similar data during 1974-75, thereby providing a time dimension relative to changing agricultural practices on the same farms. It is felt that this data provided a unique basis for the use of production function analysis to determine how technical change increases output and in turn how this added output is divided amongst various classes of labor and what contribution each purchased input made to added output.

The major portion of the last year was spent in analysis of this data. Analysis on observed income distribution shows that as new technologies increased production, all socio-economic classes gained in absolute terms. However, the relative share of landlords declined while that of chemical inputs, tractors and hired labor increased. The relative share of total labor declined because total farm employment did not increase as rapidly as did rice production. Tractor mechanization contributed to a slower rate of increase in labor requirements but if this innovation is discounted, the relative share of total labor increased.

Production function analysis shows that changes in production elasticities and relative shares are similar. Agricultural chemicals and inputs in land preparation are paid their marginal product. Although the production elasticity and relative share of land and labor for operations differ substantially, the difference is less in modern technology than in traditional. It appears that the wage rate of laborers for harvesting operations was higher than their marginal product in traditional technology.

In general, we have found that measuring distribution of benefits of technological change among direct participants is an extremely complex

task. Imaginative use of variants of Constant Elasticity Production functions has made it possible to determine the contribution of more than two inputs to increased productivity. Doubts raised by previous researchers with respect to benefits gained by the rural poor from new technologies have been based upon fragmentary evidence and less analytical support than offered by the present research. The work definitely shows that the new technologies can contribute to increasing the absolute as well as relative incomes of rural poor who participate in agricultural production and that this can be done without a revolutionary redistribution of assets in the Philippines.

The data collection in Indonesia is still underway. Eighty-seven households in a village on the north coast of Central Java were interviewed. Sample households are being interviewed every month on labor allocation, income and consumption during the preceding 30 days and it is planned to collect a full year of data covering two rice cycles. To date it has not been possible to do any computer analyses of the household data although some simple class averages have been calculated by hand.

The work in Indonesia has emphasized that household labor allocation decisions vary according to the household's control over the production assets. The Indonesian phase of the project focuses on conceptualizing the way households allocate their labor among different activities. The analysis definitely shows that there are significant differences in labor allocation behavior among three classes defined as follows: 1. The wealthiest class which consists of those households which own and operate at least .5 hectares of wet rice fields; 2. Those which control wet rice fields between .5 and .15 hectares in size; and 3. Those who control less

than .15 hectares. Rigorous analysis on the full 12 months data are necessary before any definitive conclusions about the household allocational behavior can be stated. This analysis will be done next year. Preliminary analysis done so far helps in outlining the type of policy related issues which could be handled in this work. A preliminary report of findings was completed in June 1976 for the purpose of providing local and provincial officials with results of the project. A summary report of preliminary work is to be presented at an Agricultural Development Council conference in Singapore in August 1976.

Initial findings indicate that assets are the only policy parameter which operates directly on both the supply and demand sides of the household labor market. From the demand side, it tends to shift the opportunity curve upwards, whereas from the viewpoint of supply, access to the means of production provides the household with the minimum of security necessary to break its complete dependence on fluctuations in labor and foodgrain markets.

Policy implications of the research need to be pragmatic and acceptable within the political context of the nations being studied. In the Indonesian context, major asset redistribution is not considered a feasible policy instrument. In the absence of such measures, attention must be focused on massive increases in high productivity income earning activities, combined with minimizing fluctuations in wages and prices.

In the context of the present analysis, however, it seems relevant to argue that increases in agricultural productivity, while obviously very important, are unlikely to provide significant opportunities for the landless groups in much of rural Java. The data suggests strongly that households holding between .15 and .5 hectares of paddy land respond strongly

to the availability of high income earning opportunities within the village; thus any attempt to increase the opportunity structure of the landless group by making jobs available must take account of the possibility of a fairly high labor supply elasticity in small landowning households.

Also a point of great importance is that it is very much in the interests of the largest landowners that the landless and near-landless groups are perpetuated in a near-survival situation to insure a cheap and readily available source of hired labor. Moreover, the type of relationships which exist between rich and poor households suggest that the opportunity structure facing the poorest households is not determined only by the ecological and technological factors, but also be complex socio-political influences which must be recognized by analyses of labor allocation behavior.

No rigorous analysis is available for India, since data collection has been in process for only four months. In India, four centers have been selected for the field investigation which will provide information on the following variables: age, sex composition, and educational status and occupation of members of the family. On the production side: land utilization, enterprise combinations, sources of irrigation, employment of human labor for crop and noncrop use, wages paid to hired labor, use of mechanical inputs and draught animals for each crop, hours hired out and payment received, expenditure on seed, fertilizers and pesticides, land revenue and tax on commercial crops, sources and amount of credit available, value of assets, nonfarm income and feed for livestock and milk production.

From this detailed information, representative farms will be determined. Several analytical procedures will be used to see how a technical change alters the balance of supply and demand for household and hired labor.

The first step in analyzing these representative farms will employ simple budgeting techniques. The analysis will also utilize simulation and production function approaches. Preliminary findings indicate that the data can be collected in sufficient detail so that these analytical tools may be used.

2. Operational Significance:

Work in the Philippines further supports the findings of Mellor and Lele,[1] IRRI[2] and C. H. H. Rao[3] that the distribution of benefits of technological change is not neutral relative to participants. The work shows that the distribution of benefits varies according to the level of inputs farmers employ in production.

The findings of the overall study relate to the impact of policies for raising income of the rural poor through technological change. It has been recognized that technological breakthroughs since the mid 1960's in many areas of Asian agriculture have greatly increased production. In particular, wherever high yielding varieties of cereals are adopted, the yield per unit of land has, in general, increased. Since the potential for land expansion in much of Asia is extremely limited, increased yields offer considerable opportunities for increasing income, nutrition and employment. There also has been technological change with respect to mechanization.

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[1]John W. Mellor and Uma J. Lele, "Growth Linkages of the New Foodgrain Technologies," Indian Journal of Agricultural Economics, Vol. XXVIII, No. 1, January-March 1973, pp. 35-55.

[2]Randolph Barker, et al., Annual Report 1970, International Rice Research Institute, Manila, Philippines, pp. 173-198.

[3]C. H. Hanumantha Rao, Technological Change and Distribution of Gains in Indian Agriculture (Delhi: Macmillan Company of India, Ltd., 1975).

There is still uncertainty whether mechanization increases production per unit of land, but clearly it helps farmers perform their agricultural operations in a timely manner, and removes labor bottlenecks that might occur during the cropping period. Mechanization might be yield increasing as well as cost decreasing. New Technologies, namely, seed varieties, fertilizer and farm mechanization, have directly benefited cereal production in terms of growth and efficiency.

At the same time policymakers are increasingly aware that measures of welfare cannot be based solely upon growth in output and increases in efficiency. It is necessary to know how the gains from economic growth are distributed among different income groups. Substantial concern has been expressed that in LDC's, participation and gains in economic growth by low income groups has been poor.[1] For example, Griffin argues that in all LDC's, except Taiwan, the new technologies are landlord biased, and suggests that radical policies are needed to raise incomes of the rural poor.[2] Other studies completed in India indicate similar conclusions. The research reported here points to the fact that the issue is not as easy to define as has been previously presented. The conclusion is drawn that the distribution of benefits of the new technologies depends upon how gains are measured and defined. The work in the Philippines focused on three aspects of the distribution of benefits: 1. socio-economic distribution, 2. observed factor shares, and 3. returns to factor shares as estimated

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[1] See, for example, Robert S. McNamara's address to the Board of Governors of the International Bank for Reconstruction and Development, September 24, 1973.

[2] Keith Griffin, The Political Economy of Agrarian Change: An Essay on the Green Revolution (Cambridge, Mass.: Harvard University Press, 1974), pp. 47-91.

from production functions. Findings with respect to the first aspect clearly show that institutional arrangements among landlords, tenants and laborers for sharing costs and returns in production play a very significant role in determining who benefits most. This conclusion could not be drawn from the second technique of measurement. However, the use of observed factor shares helps in understanding returns to the factors of production while the third analytical procedure pinpoints returns within the input market.

Research findings in the Philippines suggest that the distribution of benefits of technological change should be viewed simultaneously from the three aspects outlined above. Policies based upon only one aspect could be misleading. Especially we find that in analyzing an agricultural technology it is essential to incorporate labor input along with the other major nonlabor inputs such as fertilizer and land. Techniques of analysis should be used in such a way that technical variability in agriculture as well as socio-economic structure can be handled.

Interesting conclusions can be drawn from a comparison of results based on the second and third analytical techniques. For example, the wage rate was higher than the marginal product of labor under traditional technology, especially for harvesting operations. The differential was much less under modern technology. Thus it appears that laborers did some tasks other than production activities and the payment for these tasks was included in the wage rate. This implies that policies oriented toward increasing wage rates in traditional agriculture may not result in a commensurate increase in labor productivity. In modern technologies, however, this implication does not hold.

Several other policy implications have emerged from the study. In particular, a limited redistribution of land favoring tenants, and some organization of landless laborers for ownership of mechanical inputs could benefit the rural poor. On the technical side the distribution of benefits is flexible depending upon the level of nonlabor inputs. Therefore, policies relating to input subsidies should take into account the distribution facets of new technologies.

The above conclusions are subject to qualification because it is not clear whether changes in the payments to labor over time are mainly the effect of technological change or result from changing supply of labor. Specifically, it is not certain which force is dominant. The research in India and Indonesia will provide valuable insights relative to this extremely important issue.

3. Side Effects of the Work:

Although research in the Philippines concentrated on original objectives of the project, several additional findings appear useful. For example, the work on socio-economic income distribution was not intended. Also, the work in Indonesia has expanded the original scope of the project. We expect the work in India to result in similar broadening of both scope and policy implications. This was possible at low marginal cost since it was found that while gathering data many unanticipated facets of distribution could be covered with the identical interviewing schedule.

4. Research Design:

No special problems were faced in any of the three countries with respect to data availability, sampling and data processing. The only difficulty which arose was in Indonesia where crop infestation delayed the

survey by three months. The present modes of inquiry, especially collection of primary data at the farm level appear optimal for the study design. This not only offers considerable insight into socio-economic aspects of the country under study, but also helps in having interaction with the people of those countries in their home environment. Currently there is considerable controversy concerning the frequency of farm visitations and the accuracy of farmer and household member recall. These three sub-studies appear to support the position that while frequent farm and household visitations are expensive, they yield considerable peripheral data and add greatly to the researcher's ability to interpret results. The point is that technically the data collected may be no more accurate when high frequency interviews are used, but the interpretation of this data is likely to be conducted with greater understanding and sensitivity.

D. Dissemination and Utilization of Research Results:

The major effort in disseminating research results is the distribution of the Occasional Papers. The list of papers which includes publications from earlier projects is appended to this report as Appendix I. A mailing list of approximately 600 names is used for distributing the Papers. The list has developed mainly from written requests and consists of a large number of libraries and institutions in addition to research scholars. Over half of the names on the list are from countries other than the United States and are truly representative of a worldwide audience with the major emphasis on the developing countries of Asia and Africa. In addition, a large number of requests are received each year for individual papers. Appendix V. gives a brief sample of this correspondence.

Please see the appendices for the balance of the report on the dissemination and utilization of research results.

E. Work Plan for the Coming Year:

Because of the relationship of this project to other projects this contract was terminated and has now been made part of a larger project entitled, "Poor Rural Households, Technical Change and Income Distribution in LDCs." The final summary of the work of this project will be available as part of the new project.

A financial statement is not appended because this contract has been superceded by the new larger project mentioned above.

F. Involvement of Minority Personnel and Women:

1. The sub-project in Indonesia entitled, "The Interaction between Economic and Welfare Factors in Labor Supply Decisions," has been under the supervision of Ms. Gillian P. Hart.*

2. The sub-project in the Philippines entitled, "Distribution of Benefits from New Agricultural Technologies: A Study at Farm Level," has been under the supervision of Mr. Chandrashekhar G. Ranade.*

3. The sub-project in India entitled, "Mechanisation and Its Effect on Demand and Supply of Labor," has been udner the supervision of Mr. Gorantla Doraswamy.*

4. Mrs. Alice Wells has administered the project and in addition has assisted in editing and manuscript preparation.

5. A part of the analysis has been conducted by Mrs. Judith Kramer who assisted in editing, computer work and manuscript preparation.

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*Not U. S. nationals.

LIST OF APPENDICES
(Abbreviated version)

Appendix I.

D.1. Dissemination and Utilization of Research Results:

PUBLICATIONS LIST

Cornell University - USAID

Technological Change in Agriculture Project

(and including earlier projects on Prices, Employment and Income Distribution)

Department of Agricultural Economics

Cornell University

Ithaca, New York 14853

U.S.A.

PUBLICATIONS LIST

Cornell University - USAID
Technological Change in Agriculture Project
Department of Agricultural Economics
Cornell University

Paper No.	Date	Title	Author
1.	Oct. 1967	"Change in Relative Prices of Agricultural Commodities, India, 1952-53 to 1964-65" (Out of print)	John W. Mellor & Ashok Dar
2.	Oct. 1967	"Notes on Foodgrains Prices, India, 1967-68 to 1968-69" (Out of print)	John W. Mellor
3.	Dec. 1967	"Determinants and Development Implications of Foodgrains Prices, India, 1949-50 to 1963-64" (Published in The American Journal of Agricultural Economics, Vol. 50, No. 4, Nov. 1968) (Out of print)	John W. Mellor & 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 Indian Journal of Agricultural Economics, Vol. XXIII, No. 1, Jan.-March, 1968)	John W. Mellor
7.	Jan. 1968 revised July '69.	"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 Netherlands Journal of Agricultural Science, 16, No. 4, 1968) (Out of print)	John W. Mellor
9.	April 1968	"Opportunities and Problems Associated with Wheat Production, Marketing and Pricing in the Kathmandu Valley" (Out of print)	John W. Mellor
10.	April 1968	"Wheat Production and Utilization as a Leading Edge for Development in the Kathmandu Valley" (Out of print)	John W. Mellor
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	Teng-hui Lee

Paper No.	Date	Title	Author
		following book: Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960, Cornell University Press, 1971)	
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: Food Grain Marketing in India, 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. Desai
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 Indian 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. Greene & Jerachone Sriswasdilek
24.	July 1969	"Growth of Fertilizer Use in Indian Agriculture" (Cornell International Agricultural Development Bulletin No. 18.)	Gunvant M. Desai
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 The American Journal of Agricultural Economics, Proceedings Issue, Vol. 51, No. 5, December, 1969. (Out of print)	John W. Mellor
28.	Sept. 1969	"Stability for Primary Products: Means to What Ends?"	W. G. Tomek

Paper No.	Date	Title	Author
29.	Mar. 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 Echeverria
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" (Out of print)	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 Economic Development and Cultural Change, 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" (Out of print)	Boook 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 The Marketing Challenge: Distributing Increased Production in Developing Nations, 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 papers, see No. 51.)	John W. Mellor
40.	July 1970	"Modernization of the Rice Milling Industry" (Published in Economic & Political Weekly, Vol. V, No. 28, July 11, 1970.)	Uma J. Lele

Paper No.	Date	Title	Author
41.	Nov. 1970	"Rate of Adoption of New Farm Practices in the Central Plains, Thailand" (Cornell International Development Bulletin No. 24.)	Brook A. Greene
42.	June 1971	"The Political Economy of Employment Oriented Development." Now available as a reprint entitled, "Jobs, Poverty and the 'Green Revolution'," (Published in International Affairs, Vol. 48, No. 1, January 1972).	Uma J. Lele & 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 & Uma J. Lele
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 Economic & Political Weekly, 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 G. G. Schluter
48.	Sept. 1971	"The Green Revolution: Income Distribution and Nutrition" (Published in Philip L. White (eds.), Proceedings - Western Hemisphere Nutrition Congress III, 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 Indian Journal of Agricultural Economics, Vol. XXVIII, No. 1, Jan.-Mar. 1973).	John W. Mellor & Uma J. Lele
51.	Oct. 1970	"The Basis for Agricultural Price Policy" (Published in War on Hunger, Vol. IV, No. 10, October 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 Economic & Political Weekly, Vol. VII, No. 13, March 25, 1972.)	M. Schluter & John W. Mellor

Paper No.	Date	Title	Author
54.	Aug. 1972	"Analysis of Consumption Expenditure Patterns in India"	B. M. Desai
55.	Mar. 1973	"Nitrogen Use and Foodgrain Production, India, 1972-73, 1978-79 and 1983-84"	G. 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 District, 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 (eds.) Agricultural Policy in Developing Countries, 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 Development Digest, Vol. XI, No. 4, October 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 Artha-Vikas, Vol. XI, No. 2, pp. 31-48, July 1974.)	Michael G. G. Schluter & Gokul O. Parikh
62.	Forthcoming	"Generating Employment in Bangladesh: Some Special Problems and Their Possible Solutions"	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
67.	Jan. 1974	"University Training for Gramsevaks in India: An Example of Recurrent Education in a Low Income	Richard L. Shortlidge, Jr.

Paper No.	Date	Title	Author
		Country" (Published in Economic Development and Cultural Change, Vol. 24, No. 1, October 1975. Pp. 139-153.)	
68.	Feb. 1974	"Interaction of Credit & Uncertainty in Determining Research Allocation and Incomes on Small Farms, Surat District, India"	Michael G. G. Schluter
69.	April 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.	April 1970	"Economics of Resource Use on Sample Farms of Central Gujarat," (Published in Indian Journal of Agricultural Economics, Vol. XXVIII, No. 1, Jan.-March 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 Seminar on Rural Development for the Weaker Sections, Indian Society of Agricultural Economics, Bombay, 1973.)	Gunvant M. Desai & Michael G. G. Schluter
74.	Mar. 1976	"The Interaction of Growth Strategy, Agriculture and Foreign Trade -- The Case of India," in G. S. Tolley (eds.) Trade, Agriculture and Development, Ballinger Publishing Company, Cambridge, Mass. 1975. Pp. 93-115.	John W. Mellor & Uma Lele
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
79.	Dec. 1974	"Dynamic Analysis of Direct and Indirect Implications of Technological Change in Agriculture - The Case of Punjab, India -"	Mohinder S. Mudahar

Paper No.	Date	Title	Author
80.	Feb. 1975	"Relationship of Consumption and Production in Changing Agriculture - A Study in Surat District, India"	B. M. Desai
81.	May 1975	"The Impact of New Agricultural Technology on Employment and Income Distribution - Concepts and Policy -"	John W. Mellor
82.	July 1975	"Recent Testimony to Congressional Committees on World Food Problems and Food Aid"	John W. Mellor
83.	Sept. 1975	"Estimates of Foodgrain Production and Marketings from Input Estimates, India, 1949/50 to 1973/74 and Projections to 1983/84"	John W. Mellor Uma J. Lele Debra Biamonte Arthur Goldsmith
84.	Oct. 1975	"Changes in the Composition of Capital, Employment, Value Added and Production in Various Industry Groups, India, 1951-1965"	Uttam Dabholkar Arthur Goldsmith
85.	Mar. 1976	"Is Human Capital an Important Determinant of Earnings in Small Manufacturing and Retail Firms in India?"	Richard L. Shortlidge, Jr.
86.	Jan. 1976	"A Socioeconomic Model of School Attendance in Rural India"	Richard L. Shortlidge, Jr.
87.	Dec. 1975	"Performance of Private Trade and Cooperatives"	John W. Mellor

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," 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.

Appendix II.

D.1. Dissemination and Utilization of Research Results:

BIBLIOGRAPHIC LIST AND ABSTRACTS

Contract period -- July 1, 1975 to July 1, 1976

a. Dabholkar, Uttam and Arthur Goldsmith, "Changes in the Composition of Capital, Employment, Value Added and Production in Various Industry Groups, India, 1951-1965," Occasional Paper No. 84, Department of Agricultural Economics, Cornell University-USAID Technological Change in Agriculture Project, October 1975.

b. Desai, G. M., "Nitrogen Use and Foodgrain Production, India - 1973-74, 1978-79 and 1983-84," Occasional Paper No. 55, Department of Agricultural Economics, Cornell University-USAID Employment and Income Distribution Project, March, 1973.

c. Desai, Shakuntala, S., "Farm Supply Response in India: A Case Study of Gujarat State," unpublished M.S. thesis. Cornell University, January 1976.

d. Mellor, John W., The New Economics of Growth - A Strategy for India and the Developing World, A Twentieth Century Fund Study. Ithaca: Cornell University Press, 1976.

e. _____ "An Employment Oriented Strategy of Development," in Raymond E. Dumett and Lawrence J. Brainard (eds.) Problems of Rural Development: Case Studies and Multi-Disciplinary Perspectives. Leiden, Holland: E. J. Brill Press, 1975. Pp. 131-139.

f. _____ "Food Aid and Long-Run World Food Population Balances," The Columbia Journal of World Business, Vol. X, No. 3, Fall 1975. Pp. 29-35.

g. _____ "Performance of Private Trade and Cooperatives," Occasional Paper No. 87, Department of Agricultural Economics, Cornell University-USAID Technological Change in Agriculture Project, December 1975.

h. _____ and Uma Lele, "The Interaction of Growth Strategy, Agriculture, and Foreign Trade: The Case of India," Chapter 4 in George S. Tolley and Peter A. Zadrozny (eds.), Trade, Agriculture, and Development. Cambridge, Mass.: Ballinger Publishing Company, 1975. Pp. 93-113 (Occasional Paper No. 74, reprint).

i. Mellor, John W., Uma J. Lele, Debra Biamonte and Arthur Goldsmith, "Estimates of Foodgrain Production and Marketings from Input Estimates, India, 1949/50 to 1973/74, and Projections to 1983/84," Occasional Paper No. 83, Department of Agricultural Economics, Cornell University-USAID Technological Change in Agriculture Project, September 1975.

j. Shortlidge, Richard L., Jr. "Is Human Capital an Important Determinant of Earnings in Small Manufacturing and Retail Firms in India," Occasional Paper No. 85, Department of Agricultural Economics, Cornell University-USAID Technological Change in Agriculture Project, March 1976.

k. Shortlidge, Richard L., Jr., "A Socioeconomic Model of School Attendance in Rural India," Occasional Paper No. 86, Department of Agricultural Economics, Cornell University-USAID Technological Change in Agriculture Project, January 1976.

D.1.a.

Uttam Dabholkar
Arthur Goldsmith
October 1975

ABSTRACT

"Changes in the Composition of Capital, Employment, Value Added and Production in Various Industry Groups, India, 1951-1965"

This paper presents summary tables on employment, capital, and output in 19 industry groups in India for the years 1951, 1957, 1961, and 1965. The data cover large- and medium-scale industries (the "registered" sector) and are based on Government of India surveys. The analysis reveals that between 1951 and 1965 aggregate industrial output and fixed capital grew at 6.7 percent and 13 percent per year, respectively, whereas employment grew at an annual rate of only 2 percent. The slow growth in labor input was caused by increases in capital intensity within almost all industry groups, and by an investment pattern favoring disproportionate growth of the relatively more capital-intensive groups. These technological and structural changes cost the economy several million potential jobs.

D.1.b.

G. M. Desai
March 1973

ABSTRACT

"Nitrogen Use and Foodgrain Production, India
1973-74, 1978-79 and 1983-84"

The two main objectives of this study have been to project nitrogen use on various crops in 1973-74, 1978-79 and 1983-84, and to estimate production of foodgrains in these three years. To project nitrogen use a model is developed to estimate nitrogen use on different crops. It gives very satisfactory results for 1969-70. If the right kind of policy is pursued then according to the model developed here the total level of nitrogen use would rise from 1.36 million tons in 1969-70 to 2.32 million tons in 1973-74, 3.86 million tons in 1978-79 and 6.19 million tons in 1983-84. Nearly 80 to 86 percent of this growth is accounted for by foodgrains. Among foodgrains, rice and wheat dominate. Together these two crops alone account for about 60 percent of the total increment in nitrogen use. This is because of their importance in the cropping pattern and replacement of local varieties by HYVs.

D.l.c.

Shakuntala Desai
January 1976

ABSTRACT

"Farm Supply Response in India
A Case Study of Gujarat State"

The study measures acreage responsiveness of irrigated and unirrigated wheat, rice, bajra, jowar to change in price and nonprice variables. The study uses time series data for the period 1951/52 - 1972/73. The purpose of the study is to investigate the widely discussed issues concerning the extent to which farmers respond to price and nonprice incentives, to investigate the comparative suitability of alternative econometric model formulations to the data, and to compare response differences among crops.

D.1.d.

John W. Mellor
April 1976

ABSTRACT

The New Economics of Growth
A Strategy for India and the Developing World

In recent years the dominant concern with Third World development has shifted from emphasis on economic growth alone to the problems of income distribution and rural poverty. The urgency of these problems has been underlined by the tenuous nature of world food production and the ever present threat that population growth in the less developed countries will outstrip available food supplies.

This study shows how the problems in the developing nations of slow growth in food production; inequitable distribution of income, rapid population increase, and economic stagnation are closely interconnected. The study presents an employment-oriented development strategy that offers greater potential for alleviating mass poverty and generating rapid overall economic growth than is possible under traditional, capital-intensive growth strategies. These issues are examined primarily through the post-colonial experience of India, which has been dominated by a capital-intensive development strategy. The study's conclusions however, have broad applicability to the rest of the developing world.

(A Twentieth Century Fund Study,
published by Cornell University Press)

D.1.e.

John W. Mellor
1975

ABSTRACT

"An Employment Oriented Strategy of Development"

The employment problem in low-income countries has emerged in recent years as a prime concern of development economists. Efforts to increase employment are frequently and correctly, in my view, equated with the broadening of the distribution of income. This paper confirms this relationship and a high employment strategy for growth in low income countries is presented. While the strategy draws substantially on the Indian experience, there are many similarities with the problems and relationships in other low income countries.

D.1.f.

John W. Mellor
Fall, 1975

ABSTRACT

"Food Aid and Long-Run World Food Population Balances"

It is frequently alleged that food aid contributes to a worsening of the world food problem by discouraging domestic food production in recipient nations and encouraging population growth. Dr. Mellor shows how food aid can interact with choice of growth strategy, policies for agricultural production growth and broad participation in growth, and how the latter is the only effective way of eventually containing population growth and bringing balance to the long run world food situation.

D.1.g.

John W. Mellor
December 1975

ABSTRACT

"Performance of Private Trade and Cooperatives"

Recent literature with respect to the private trade in marketing has resulted in a radically improved view of the competitiveness, the efficiency and the productivity of the private trade. Nevertheless, a limited place for cooperatives, other quasi-governmental agencies and the direct operation of the public sector itself still remains. However, new issues have arisen which keep the question of the appropriate balance among the various sectors in full view as an important policy issue. These include the effect of public policy and private agencies on the distribution of income; the effect on stability of food supplies to urban areas and the relative stability of prices for that food; and the optimal use of scarce resources in allocation of institutional and personnel resources at the command of governments.

D.l.h.

John W. Mellor
Uma Lele
June 1974

ABSTRACT

"The Interaction of Growth Strategy, Agriculture and Foreign Trade

- The Case of India -"

Exposition of a relationship among agriculture, trade, and growth in which development of the agricultural sector plays a basic role as determinant of the strategy of growth, with profound implications to overall growth rates and the pace and pattern of industrial growth, and thereby becomes a major determinant of the volume and composition of foreign trade. Strategies of growth are briefly contrasted with divergent roles for agriculture and trade, and then within that context the pattern of imports and exports for India are analyzed.

D.1.i.

John W. Mellor
Uma J. Lele
Debra Biamonte
Arthur Goldsmith
September 1975

ABSTRACT

"Estimates of Foodgrain Production and Marketings from Input Estimates, India, 1949/50 to 1973/74 and Projections to 1983/84"

An appraisal of the medium and long term trend in Indian foodgrain production in which an analysis has been made of four key inputs--irrigated land, unirrigated land, labor and inorganic fertilizer. A response coefficient, based primarily on data for 1949/50, has been attached to each input such that the sum of the four inputs and their respective response coefficients provide an estimate of total output in that year. All other inputs are assumed to move proportionately with these four key inputs. Based on the resulting production estimates, and using some additional assumptions, estimates have also been made of annual foodgrain marketings.

D.1.j.

Richard L. Shortlidge, Jr.
March 1976

ABSTRACT

"Is Human Capital an Important Determinant of Earnings in Small Manufacturing and Retail Firms in India?"

This study focuses on the role of human capital as a determinant of earnings for workers employed in small scale manufacturing, wholesale, and retail firms in India. The human capital variables are education, firm-specific experience, occupation-specific experience, and general experience. The study yields six major conclusions. First, there is a threshold minimum level of education above which education leads to increases in earnings. Second, there are strong complementarities between education and both years of firm-specific and years of general experience. Third, while there are increasing returns to education, there are diminishing returns to general experience. Fourth, the elasticity of substitution between general experience and firm-specific experience was constant for all levels of education. Fifth, rapid agricultural development appears to positively affect wages in the nonagricultural sector. Sixth, there appear to be economies of scale among firms in the retail and wholesale trades in India.

D.1.k.

Richard L. Shortlidge, Jr.
January 1976

ABSTRACT

"A Socioeconomic Model of School Attendance in Rural India"

Becker's theory of household choice serves as the conceptual framework for this analysis of school attendance in rural India. While the literature dealing with the causal relationship between school attendance and socio-economic variables in India is considerable, it is based mainly on tabular analyses of gross associations between attendance and variables such as location of residence, age, sex, and caste. The only study which attempts a more sophisticated modeling of school attendance is one recently completed by Rosenzweig and Evenson based on aggregate district level data from the 1961 Census of India. Using a system of simultaneous equations, Rosenzweig and Evenson examined the factors likely to determine jointly a family's decision with respect to fertility, school attendance, and the employment of children in agriculture. Although the study employs Becker's theory of the allocation of time, the nature of the data precludes a direct test of this paradigm. Since the theory is designed to explain household and individual decisions about how time is spent in market, nonmarket, and leisure activities, households and individuals should be the units of observation.