

CLASSIFICATION

PROJECT EVALUATION SUMMARY (PES) - PART I

Report Symbol U-447

1. PROJECT TITLE Consequences of Agricultural Mechanization	2. PROJECT NUMBER 931-1026	3. MISSION/AID/W OFFICE S&T/AGR/EPP
	4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) Terminal <input checked="" type="checkbox"/> REGULAR EVALUATION <input type="checkbox"/> SPECIAL EVALUATION	

5. KEY PROJECT IMPLEMENTATION DATES	6. ESTIMATED PROJECT FUNDING	7. PERIOD COVERED BY EVALUATION
A. First PRO-AG or Equivalent FY 1977	A. Total \$ 917,459	From (month/yr.) 1978
B. Final Obligation Expected FY 1983	B. U.S. \$ 917,459	To (month/yr.) 1983
C. Final Input Delivery FY 1983		Date of Evaluation Review February 1985

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
Final Evaluation	None	

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS	10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT
<input type="checkbox"/> Project Paper <input type="checkbox"/> Implementation Plan e.g., CPI Network <input type="checkbox"/> Financial Plan <input type="checkbox"/> PIO/T <input type="checkbox"/> Logical Framework <input type="checkbox"/> PIO/C <input type="checkbox"/> Project Agreement <input type="checkbox"/> PIO/P	<input checked="" type="checkbox"/> Other (Specify) N/A <input type="checkbox"/> Other (Specify) _____ A. <input type="checkbox"/> Continue Project Without Change B. <input type="checkbox"/> Change Project Design and/or <input type="checkbox"/> Change Implementation Plan C. <input type="checkbox"/> Discontinue Project N/A

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)	12. Mission/Aid/W Office Director Approval
Clearances: S&T/AGR/EPP: WMorse <u>WEM</u> Date <u>1/31/86</u> Project Manager S&T/AGR/EPP: RCurtis <u>RC</u> Date <u>1/21/86</u> S&T/AGR: FLi <u>FL</u> Date <u>2/12/86</u> S&T/PO: EROche <u>ER</u> Date <u>2/21/86</u>	Signature <u>Anson R. Bertrand</u> Typed Name Anson R. Bertrand Date <u>2/13/86</u>

FINAL EVALUATION: CONSEQUENCES OF
AGRICULTURAL MECHANIZATION

13. SUMMARY

The "Consequences of Agricultural Mechanization" is a \$917,459 research project funded over a five-year period, from 1978 to 1983. It was implemented by the International Rice Research Institute (IRRI) and the Agricultural Development Council (ADC). The objectives of the project are (1) to provide a better understanding of the effects of mechanization on production, employment and income, (2) to encourage more applied research on the effects of mechanization, and (3) to improve the capacity of Asian scientists and institutions to undertake research.

All of the objectives have been met. For example, studies in the five participating countries, including the Philippines, Indonesia, Thailand, Bangladesh and Pakistan resulted in better understanding of the production, employment, income and social consequences of agricultural mechanization. These are briefly summarized below:

- Mini-tractors and power tillers do not increase production. Rather, they increase the productivity of companion inputs such as land, labor, water and fertilizer. Grain threshers and dryers do not increase production, but decrease post-harvest losses and improve the quality and lengthen the storage life of grains. Low-lift pumps and tubewells, on the other hand, increase production through increased yields and increased cropping intensity.
- Mini-tractors, power tillers, mechanical threshers and dryers are labor displacing. They increase seasonal unemployment in some areas and even-out the seasonal demand for labor in others. Tubewells and low-lift pumps increase employment through increased production, particularly during the dry season or in areas where there is no irrigation.
- Mini-tractors and power tillers yield marginal returns on capital investment. They are profitable only in places where custom work is practiced and where landholdings are relatively large. Threshing machines, dryers, low-lift pumps and tubewells are generally profitable.
- In general, mechanization widens the income gap between rural and urban population. In some cases, it promotes unequal distribution of land ownership and hastens the transition of some farmers from tenancy to hired labor status.

The project has encouraged awareness of the negative as well as positive effects of mechanization. Over 100 studies have been completed under this project, examining various aspects of agricultural mechanization. Similar studies are likely to follow as countries develop and refine their policies regarding the development, utilization and dissemination of agricultural mechanization.

Finally, the capacity of Asian scientists and institutions to conduct research on agricultural mechanization has been improved substantially as a result of this project. About 79 LDC scientists and economists have participated in this project, 36 have obtained the M.Sc. degree, 5 obtained the Ph.D. degree and 4 received grants for postdoctoral fellowships.

Equally important is the introduction of agricultural mechanization policies resulting from the studies. In the Philippines, a government agency is being created to develop guidelines on the manufacture, utilization and dissemination of agricultural machinery. In Indonesia, the government has changed its anti-mechanization policy to selective mechanization, and in Thailand, specific provision regarding the development and utilization of agricultural machinery was incorporated in the Five Year Development Plan.

14. EVALUATION METHODOLOGY

This is a final performance evaluation. It focuses on the efficiency with which inputs were delivered and the degree to which outputs, purposes and goals have been achieved. It does not evaluate the research design of specific studies, the methodologies in collecting and analyzing the data, nor the results and conclusions obtained in the individual studies. These will be reported in a separate paper.

The evaluation is conducted internally within the Office of Agriculture, Division of Policy and Planning, Bureau for Science and Technology, using data from project files and comments of the project directors from IRRI and ADC. No attempt was made to visit the project sites, nor to contact the participants or beneficiaries of the project.

15. EXTERNAL FACTORS

There are three external factors that have affected the performance of the project. First is the delay in funding which caused a one-year delay in project start-up. This in turn caused renegotiation of agreements with participating LDC governments, re-staffing the project, and rescheduling project activities. Second is the loss of Pakistan as a research site. Studies in Pakistan were allowed only in relation to students funded research supervised by ADC which may or may not be consistent with the research design for the Philippines, Indonesia and Thailand administered by IRRI. Third is the introduction of agricultural mechanization policies. For example, the Philippines Council for Agricultural Mechanization (PICAM) was established to provide guidance in the development, utilization and dissemination of agricultural mechanization technology. In Indonesia, the government reversed its policy of anti-agricultural mechanization to that of selective mechanization. In Thailand, the development, use and dissemination of agricultural mechanization was incorporated in its Five Year Development Plan.

16. INPUTS

The project was initially funded for \$715,000 over a period of three years, 1978-1980. However, as a result of the delay in the first year funding and an anticipated cost over-run, the 1979 Evaluation Team recommended an extension of the project to 1982 with additional funding to a total of \$917,549. In line with the extension of the life of the project and increase in funding, the magnitude of inputs has increased by the same proportion. Professional staff has increased from 6 to 8 person years, and support staff from 20 to 35 person years. The scope of research and training activities have also increased by more than the proportional increase in funding.

Project implementation procedures have been revised according to recommendations of the 1979 Evaluation Team. The changes include:

- closer monitoring of activities and increased staffing in the project site in South Sulanesi,
- improved communication between AID/W and IRRI and between IRRI and the project sites,
- regional modeling was abandoned for national modeling of alternative policy options,
- request for two-year extension with additional funding, and
- continued independence of the project manager in managing the ADC component of the project.

17. OUTPUTS

The table below summarizes the difference between the planned and actual outputs of the project.

Table 1: Comparison Between Planned and Actual Outputs by Category

Categories of Output	Outputs	
	Planned	Actual
1. Reports and Publication	2	103 working papers 43 publications 2 presented in professional conferences 2 monographs 7 conference proceedings 4 country summaries 3 operations manual 4 code manuals 3 survey data sets
2. Seminars and Workshops	2	8 workshops 1 conference
3. Methodologies Developed	0	Judicious use of standard mathematical and statistical procedures in isolating the impact of mechanization and the consequences of alternative policy options.
4. Agricultural Mechanization Policies Developed	3	3 (Philippines, Indonesia and Thailand)
5. Trained LDC Research Personnel	10 M.Sc. 4 Ph.D.	36 M.Sc. 5 Ph.D. 79 LDC scientists 7 ADC associates

18. PURPOSES

The purposes of the project are (1) to assess the impact of mechanization on foodgrain production, (2) to determine the effects of government programs and policies on the type of mechanical technology utilized in agriculture, and (3) to forecast the level and characteristics of mechanization required in the future.

All of the above purposes have been attained. First, the production, employment, income, equity and financial impact of mechanization have been thoroughly documented in the 103 reports. Second, alternative agricultural policies and institutions are being developed in the Philippines, Indonesia and Thailand. Third, the countries that participated in the project have benefited from the graduate degree training and the experience gained by their scientists and economists in the research efforts.

19. GOALS

The goals of the project are (1) to increase employment and income of the rural poor, and (2) to increase foodgrain production.

Although it is safe to hypothesize that this project will, in the long run, contribute to increased foodgrain production and employment, it is difficult to ascertain whether this research project, during its period of performance, has in fact contributed to increased foodgrain production, employment and income. This is because there are so many factors that interact with agricultural mechanization at the national level that it is virtually impossible to determine its effect independent of physical and biological factors as well as other policies relating to pricing, credit, land reform and special government programs.

20. BENEFICIARIES

The direct beneficiaries are the 41 students who obtained their advanced degrees and the 79 LDC scientists, economists and technicians who participated and gained experience in the research process. The second echelon of beneficiaries are the participating government agencies which gained research capability in evaluating the impact of mechanization and developing alternative policy options. The third beneficiaries are machinery manufacturers and small farmers who benefit from studies regarding the design, application and use of appropriate machines under different physical, economic and social environments. In the long run, consumers and producers may eventually benefit as improved mechanical technologies are adopted and appropriate policies become operational.

21. UNPLANNED EFFECTS: NONE

20. LESSONS LEARNED

The contractor recognized the problems involved in launching a full-blown research enterprise employing identical methodologies under different physical, social, cultural and institutional environments characteristic of the participating countries. In hindsight, the contractor reported that it would have been better had the project started on a pilot basis, followed by an interim evaluation and midterm corrections as the researchers gained experience and learned from past mistakes. Regarding evaluation methodology, it would have been better if funds and time allowed for a final evaluation conducted on project sites rather than in-house evaluation based primarily on project files and discussions with the project managers.

23. SPECIAL COMMENTS AND REMARKS

Despite the initial delay in disbursing the initial fund and the implementational snags that subsequently developed, the project exceeded its planned outputs and attained all of its purposes and objectives.

The remarkable success of the project is perhaps due more to the personal factor, the management style, the sensitivity to culture and institutions, patience and hard work of all the principal actors, from the support technicians in the field to the professional staff in IRRI, ADC and AID/W, rather than the design or the strategy of the project.

ANNEX A: List of Operation Manuals, Reports, and Publications

Operation Manuals

1. Moran, P. and D. Unson. Farm Survey and Recordkeeping Procedures for Consequences of Small Rice Farm Mechanization Project. Revised May 1980.
2. Wicks, J. A. Procedures for Constructing Two-Way Tables for Consequences of Small Rice Farm Mechanization Project. January 1980.
3. Wicks, J. A. Specification of Variables to be Included in Data Files for Consequences of Small Rice Farm Mechanization Project. October 1980.
4. Lucas A. A. Variable Identification and Data Codes for the Philippines. Consequences of Small Rice Farm Mechanization Project. 1984.
5. Lucas, A. A. Variable Identification and Data Codes for Thailand. Consequences of Small Rice Farm Mechanization Project. 1984.
6. Lucas, A. A. Variable Identification and Data Codes for South Sulawesi, Indonesia. Consequences of Small Rice Farm Mechanization Project. 1984.
7. Lucas, A. A. Variable Identification and Data Codes for West Java, Indonesia. Consequences of Small Rice Farm Mechanization Project. 1984.

Workshop Reports and Publication

1. The International Rice Research Institute. The Consequences of Small Rice Farm Mechanization on Production, Incomes and Rural Employment in Selected Countries of Asia. A workshop report and project proposal. February 1978.
 2. The International Rice Research Institute. The Consequences of Small Farm Mechanization on Rural Employment, Incomes and Production in Selected Countries of Asia. A workshop report. Department of Agricultural Engineering. September 11-13, 1978.
 3. The International Rice Research Institute. The Consequences of Small Farm Mechanization on Rural Employment, Incomes and Production in Selected Countries of Asia. Workshop report no. 3. Department of Agricultural Engineering. October 1-4, 1979.
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4. The International Rice Research Institute. The Consequences of Small Farm Mechanization on Rural Employment, Incomes and Production in Selected Countries of Asia. Report of a Joint ADC-IRRI workshop. Department of Agricultural Engineering. September 14-18, 1981.
5. The International Rice Research Institute. The Consequences of Small Farm Mechanization. Selected papers from 1981 workshop. September 1983.
6. The International Rice Research Institute. 1983. Consequences of Small Farm Mechanization in Indonesia. Proceedings of a workshop jointly sponsored by the Agency for Agricultural Research and Development, Directorate General for Food Crops and International Rice Research Institute. July-August.
7. The International Rice Research Institute. 1983. The Consequences of Small Rice Farm Mechanization in Thailand. Proceedings of a workshop jointly sponsored by the National Economic and Social Development Board, Department of Agriculture, Kasetsart University Research and Development Institute and the International Rice Research Institute. Bangkok, Thailand. November 10-11.
8. The International Rice Research Institute. 1983. The Consequences of Small Rice Farm Mechanization in the Philippines. Proceedings of a workshop jointly sponsored by the National Economic and Development Authority, Philippine Institute for Development Studies, Ministry of Agriculture and the International Rice Research Institute. Tagaytay City, Philippines. December 1-2.
9. The International Rice Research Institute. The Consequences of Small Farm Mechanization on Rural Employment, Incomes and Production in Selected Countries of Asia. Summary Report - Philippines. Department of Agricultural Engineering. 1984.
10. The International Rice Research Institute. The Consequences of Small Farm Mechanization on Rural Employment, Incomes and Production in Selected Countries of Asia. Summary Report - Thailand. Department of Agricultural Engineering. 1984.
11. The International Rice Research Institute. The Consequences of Small Farm Mechanization on Rural Employment, Incomes and Production in Selected Countries of Asia. Summary Report - West Java, Indonesia. Department of Agricultural Engineering. 1984.
12. The International Rice Research Institute. The Consequences of Small Farm Mechanization on Rural Employment, Incomes and Production in Selected Countries of Asia. Summary Report - South Sulawesi, Indonesia. Department of Agricultural Engineering. 1984.

LIST OF WORKING PAPERS

1. * Juarez, F. and B. Duff. The Economic and Institutional Impact of Mechanical Threshing in Iloilo and Laguna. October 1979.
2. Pathnopas, R. The Economics of Rice Threshing Machines in Thailand: A Case Study of Chachoengsao and Supanburi Provinces. October 1979.
3. Gardezi, J., A. Rauf, M. Munir, K. Altaf, Q. Mond-ud-Din, and B. Lockwood. A Study of Mechanical and Traditional Wheat Threshing in Multan District, Punjab, Pakistan: Some Preliminary Results. October 1979.
4. Habito, C. and B. Duff. A Simulation Model to Evaluate Mechanization of Rice Post-harvest Operations in the Philippines. October 1979.
5. Chapman, J. The Potential of Mechanization for Crop Intensification in a Rainfed Area - Iloilo, Philippines. October 1979.
6. * Thapa, G. The Economics of Tractor Ownership and Use in the Nepal, Terai. October 1979.
7. Jongswat, N. Productivity Growth and Farm Machinery Adoption in Thai Agriculture. April 1980.
8. Bernstein, R. H. and R. Sinaga. A Methodology for Identifying Lowland Rice Farms that Would Benefit from the Mechanization of Land Preparation. October 1979.
9. Bernstein, R. E. and A. Rochim. Labor Shortage as a Constraint to Increasing Cropping Intensity. Revised March 1980.
10. Ayob, A. M. The Economics and Adoption of the Combine Harvester in the Muda Region of Malaysia. October 1979.
11. Lubis, R. Impact of Cropping Pattern Technology on Income, Employment and Production: A Case of Expanded Crop Production in Lampung. October 1979.
12. Wicks, J. A. Modelling the Consequences of Future Mechanization: An Outline of Possible Procedures. October 1979.
13. Khoju, M. R. and J. A. Wicks. Economics of Pump-Irrigation in Eastern Nepal. August 1980.
14. Tan, Y. L., J.P.G. Webster and J. A. Wicks. The Decomposition of Differences in Output Between Two Groups of Farms. Revised 1981.
10. Ayob, A. M. The Economics and Adoption of the Combine Harvester in the Muda Region of Malaysia. October 1979.
11. Lubis, R. Impact of Cropping Pattern Technology on Income, Employment and Production: A Case of Expanded Crop Production in Lampung. October 1979.
12. Wicks, J. A. Modelling the Consequences of Future Mechanization: An Outline of Possible Procedures. October 1979.

* Denotes the working paper has been formally published in a journal, proceedings, book or monograph.

13. Khoju, M. R. and J. A. Wicks. Economics of Pump-Irrigation in Eastern Nepal. August 1980.
14. Tan, Y. L., J.P.G. Webster and J. A. Wicks. The Decomposition of Differences in Output Between Two Groups of Farms. Revised 1981.
15. * Herdt, R. W. Mechanization of Rice Production in Developing Asian Countries: Perspective, Evidence, and Issues. September 1981.
16. * Lantin, R. M. Mechanization Policy and the National Agricultural Mechanization Council - Philippines. September 1981.
17. * Lockwood, B. Farm Mechanization in Pakistan: Policy and Practice September 1981.
18. * Wiboonchutikula, P. The Total Factor Productivity Growth of the Three Digit Manufacturing Industries in Thailand. September 1981.
19. * Ahammed, C. S. and R. W. Herdt. A General Equilibrium Analysis of the Effects of Rice Farm Mechanization in the Philippines. September 1981.
20. * Mikkelsen, K. and N. Langan. Technology Change in the Philippine Agricultural Machinery Industry. September 1981.
21. * Boughton, D. Energy Use in Alternative Rice Production Systems in Nueva Ecija, Central Luzon, Philippines. September 1981.
22. * Hurun, A. Financial Analysis of Power Tiller Ownership in Mariuk Village, West Java, Indonesia. September 1981.
23. * Hafsah, J. The Economics of Tractor Operation and Use in South Sulawesi, Indonesia. September 1981.
24. Maranan, C. L. A Comparative Analysis of Tractor Contract Operations in Nueva Ecija, Philippines, 1972 and 1980. September 1981.
25. * Monge, V. S. and E. Duff. Analysis of the Demand for Farm Power for Small Rice Farm Agriculture in Nueva Ecija, Philippines. September 1981.
26. Muniz, M. An Evaluation of the Farmers' Decision-Making for Investment in Farm Machinery. September 1981.
27. Jabbar, M. A., Md. S. R. Bhuiyan and A. K. Maksudul Bari. Causes and Consequences of Power Tiller Utilization in Two Areas of Bangladesh. September 1981.
28. * Juarez, F. and R. Pathnopas. A Comparative Analysis of Thresher Adoption and Use in Thailand and the Philippines. September 1981.
29. * Ahmed, J. U. Labour Use Patterns and Mechanization of Paddy Postharvest Processing in Bangladesh. September 1981.
30. * Colter, J. M. The Impact of Hand Tractors on the Income and Employment Opportunities of Migrant Laborers in Java. September 1981.
31. Santoso, K. The Potential for Agricultural Mechanization and Labor Markets in East Java. September 1981.

27. Bernstein, R. H. Effects of Mini-Tractor Mechanization on Employment and Labor Use Intensity, Sidrap and Pinrang, South Sulawesi, Indonesia. September 1981.
28. Collier, W. Improved Cropping Patterns, Labor Absorption and Small Farm Mechanization in Indonesia. September 1981.
29. Moran, P. and E. Camacho. Consequences of Farm Mechanization, Project Site Description: Philippines. September 1981.
30. Generalla, A. and A. Aguilar. Effects of Mechanization on Intensity of Land Use. September 1981.
31. *Tan, Y. and J. A. Wicks. Production Effects of Mechanization. September 1981.
32. Sison, J. F. and P. B. Moran. Farm Labor Utilization and Employment in Two Selected Municipalities in Nueva Ecija - A Preliminary Analysis. September 1981.
33. Saefuddin, Y. Site Description: Mechanization Consequences Project in West Java, Indonesia. September 1981.
34. Handaka, S. Effects of Mechanization on Intensity of Land Use, West Java, Indonesia. September 1981.
35. Handaka, S. A Technical and Economic Evaluation of Rice Mills in West Java, Indonesia. September 1981.
36. Sinaga, R. Effects of Mechanization on Productivity: West Java, Indonesia. September 1981.
37. Sinaga, R. Effects of Mechanization on Productivity: South Sulawesi, Indonesia. September 1981.
38. Sri-Bagyo, A. The Impact of Mechanization on Production and Employment in Rice Areas of West Java, Indonesia. September 1981.
39. Maamun, Y. Site Description: Mechanization Consequences Project in South Sulawesi. September 1981.
40. Sarasutha, I.G.P. and R. Bernstein. Effect of Mechanization on Intensity of Land Use, South Sulawesi, Indonesia. September 1981.
41. Bockhop, C. W. and M. Nafziger. The Impact of Economics Upon the Design of Machinery at IRRI. September 1981.
42. *Wattanutchariya, S. Economic Analysis of the Farm Machinery Industry and Tractor Contractor Business in Thailand. September 1981.
43. Hussain, K. A. An Assessment of the Capacity of Workshops and Farmers to Repair and Maintain Farm Machinery in District Faisalabad: Summary of Major Findings and Policy Recommendations. September 1981.
44. *Gonzales, L. A., R. W. Herdt and J. P. Webster. Evaluating the Sectoral Impact of Mechanization on Employment and Rice Production in the Philippines: A Simulation Analysis. September 1981.
45. *Khoju, M. R. The Economics of Pump Irrigation in Eastern Nepal. September 1981.

51. Sudaryanto, T. The Effect of Tubewells on Income and Employment: A Case Study in Three Villages in Kediri, East Java, Indonesia. September 1981.
52. Santoso, K. Economics of Pumpsets in East Java. September 1981.
53. Wicks, J. A. and M. A. Sumiran. Data Management for Analyzing the Consequences of Mechanization. September 1981.
54. Webster, J.P.G. An Evaluation of Mechanization Data Using the FAO's Farm Management Data Collection and Analysis System (FMDCAS). September 1981.
55. Lingard, J. Measuring the Impact of Mechanization on Output. September 1981.
56. Moran, P. A Descriptive Study of Farm Households in 8 Villages in Nueva Ecija, Philippines. 1982.
57. Sharrock, G.O'G. Analysis of the Household Census: Thailand 1978. May 1982.
58. Webster, J.P.G. A Rice Policy Model for the Philippines: Structure and Data Requirements. 1982.
59. *Lingard, J. and J. A. Wicks. The Impact of Mechanizing Small Scale Rice Production in the Philippines, Indonesia and Thailand: Some Empirical Evidence. 1982.
60. *Lim, P. C. Problems and Solutions in the Analysis of Survey Data: A Philippine Case Study. 1983.
61. *Sri-Bagyo Al and J. Lingard. The Impact of Agricultural Mechanization on Production and Employment in Rice Areas of West Java. Revised. March 1983.
62. Rahman, H. and J. A. Wicks. A 0-1 Integer Programming Algorithm for Optimal Selection of Mutually Exclusive Machinery Sets. 1983.
63. *Ahammed, C. and R. W. Herdt. Measuring Consumption Linkages of Mechanical Technologies in Philippine Rice Production. Revised. March 1983.
64. *Bunator, S. and J. Lingard. Power Tiller Use on Rice Farms in West Java, Indonesia: An Analysis of their Employment Effects and Private Profitability. 1983.
65. Bernstein, R. Perspective on Aspects of Small Farm Mechanization in Indonesia. 1981.
66. Sinaga, R. S. and R. H. Bernstein. Myths About Land Preparation Mechanization: Research Results in Indonesia. 1983.
67. *Duff, B. and P. M. Kaiser. The Mechanization of Small Rice Farms in Asia. 1983.
68. *Saefudin, Y., Y. Maamun, Siregar, Sarasutha, Handaka, R. Sinaga and R. Bernstein. Consequences of Mechanical Land Preparation in Indonesia: South Sulawesi and West Java. 1983.
69. Saefudin, Y. and B. Duff. Comparative Advantage, Mechanization and Rice Production in West Java, Indonesia. June 1983.

70. * Saefudin, Y. and B. Duff. The Impact of Mechanized Land Preparation on Employment and Income Distribution in West Java, Indonesia. June 1983.
71. * Maamun, Y. and B. Duff. The Economics of Tractor Ownership and Use in South Sulawesi, Indonesia. June 1983.
72. Reyes, B. The Economic Impact of Mechanical Land Preparation under Conditions of Weather Uncertainty. June 1983.
73. Maranan, C., Y. Maamun and B. Duff. Results of a Comparative Evaluation of Four-wheel, Two-wheel and Traditional Land Preparation Methods in Luwu South Sulawesi. Indonesia. June 1983.
74. * Ahammed, C. and B. Duff. Farm Mechanization Strategy in an Economy - Wide Model: Indonesia. August 1983.
75. * Sukharomana, S. The Farm Power Strategy of Thailand. November 1983.
76. Pongsrikul, T. and B. Duff. The Impact of Small Farm Mechanization on the Indonesian Rice Economy: A Simulation Analysis. November 1983.
77. * Adulavidhaya, K. and B. Duff. The Growth and Impact of Small Farm Mechanization in Asia. November 1983.
78. * Shields, D. The Impact of Mechanization on Agricultural Production in Selected Irrigated Villages of Suphanburi Province, Thailand. November 1983.
79. * Saitan, S. The Impact of Mechanization on Rural Income and Income Distribution in Supanburi, Thailand. November 1983.
80. * Shields, D. The Impact of Mechanization on Agricultural Employment in Supanburi, Thailand. November 1983.
81. * Maranan, C., D. Shields and S. Sukharomana. The Economics of Mechanical Land Preparation: Evidence from Suphanburi Province. November 1983.
82. * Sukharomana, R. The Economics of Mechanical Rice Threshing in Thailand. November 1983.
83. * Pongsrikul, T. An Ex Ante Evaluation of Small Farm Mechanization Policies in Thailand. November 1983.
84. * Loohawenchit, C. Indigenous Manufacture of Farm Machinery in Thailand. November 1983.
85. * Lantin, R. A Review of Past, Present and Proposed Mechanization Strategies in the Philippines. December 1983.
86. * Tan, Y. Factor Share Analysis (Some Notes and Results). December 1983.
87. * Gonzales, L. A., R. W. Herdt and J. P. Webster. An Ex Ante Evaluation of National Mechanization Policies in the Philippines. December 1983.
88. * Shields, D. Employment and Agricultural Mechanization: An Analysis of Survey Results. December 1983.

89. * Sison, J., R. Herdt and B. Duff. The Effects of Small Farm Mechanization on Employment and Output in Selected Rice-Growing Areas in Nueva Ecija, Philippines, December 1983.
90. * Ebron, L., G. Castillo and P. M. Kaiser. Changes in Harvesting-Threshing Arrangements and Landless Laborers. December, 1983.
91. * Maranan, C. Comparative Evaluation of Tractor and Carabao Use in Rice Land Preparation, Nueva Ecija, Philippines, 1980. December, 1983.
92. * Juarez, F. The Private and Social Profitability of Mechanical Threshing. December, 1983.
93. * Shields, D. The Impact of Mechanization on Agricultural Production in Selected Villages of Nueva Ecija, Philippines. December, 1983.
94. * Lim, P. The Effects of Agricultural Mechanization on Rice Farm Income Patterns in the Philippines. December 1983.
95. * David, C. C. Government Policies and Farm Mechanization in the Philippines. December 1983.
96. * Agabin, M. E. A History of Credit Programs Supporting Mechanization in the Philippines. December, 1983.
97. * Gonzalo, B. C. and R. E. Stickney. MA-IRRI Industrial Extension Program for Small Farm Equipment. December, 1983.
98. * Chancellor, W. J. The Sustainability of Mechanization in Thailand. 1983.
99. Smith, J. and B. Duff. Efficiency or Equity: The Mechanization of Rice Threshing in the Philippines. 1983.
100. * Carbonell, P. U. and K. Moody. Weed Control Practices in Irrigated and Rainfed Rice Farms in Nueva Ecija, Philippines. 1983.
101. Nehen, K. An Economic Comparison of Manual, Animal and Tractor Land Preparation in West Java, Indonesia. July 1983.
102. * Pineda, M. R., B. Duff, E. A. Heinrich and P. Carbonell. Insect Control Practices in Irrigated and Rainfed Rice Farm in Nueva Ecija, Philippines. 1984.
103. * Lingard, J. Mechanization of Small Farms in the Philippines: Some Income Distribution Aspects. 1984.

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**ANNEX B: GRADUATE STUDENTS SUPPORTED UNDER THE "CONSEQUENCES OF MECHANIZATION PROJECT (csd-tac-1466)
(IRRI/ADC GRANTS)**

COUNTRY: INDIA

Name	Year	Degree	Institution	Research Support	Title of Research
1. Anoke Kumar	1981	H. Sc.	Ag. Economic Research Center	ADC	"The Impact of Agricultural Mechanization on Farm Structure and Farm Management"
2. Vepuru Abraham	1981	Post-Doc	Andhra University	ADC	"The Long Term Impact of Tractors on Farm Structure in Coastal Andhra Pradesh"

GRADUATE STUDENTS SUPPORTED UNDER THE "CONSEQUENCES OF MECHANIZATION PROJECT (csd-tac-1466)
(IRRI/ADC GRANTS)

COUNTRY: INDONESIA

Name	Year	Degree	Institution	Research Support	Title of Research
1. Djanvir Zein	1982	Ph. D.	Gadjah Mada University	ADC	"An Anticipatory Analysis of the Influence of Tractor Use in Swah Farms on Cropping Intensity, Labor, Income and Aggregate Income in West Sumatra"
2. Jusuf Colter	1981	M. Sc.	IPB/Bogor Agric. Univ.	ADC	"The Project Analysis of Income and Employment Opportunities of Migrant Laborers and their Determinants"
3. Imam Santoso	1981	M. Sc.	IPB/Bogor Agric. Univ.	ADC	"The Impact of Change in Water Management on Cropping Intensity and Labor Demand in the Jatiluhur Irrigation Area"
4. Chaerul Saleh	1981	M. Sc.	IPB/Bogor Agric. Univ.	ADC	"Economic Analysis of Using Water Pumps by the Farmers in Karawang District, W. Java"
5. Rusdian Lubis	1981	M. Sc.	IPB/Bogor Agric. Univ.	ADC	"Socio-Economic Aspects of Tractor Ownership and Rental Markets in South Sulawesi"
6. Kabul Santoso	1981	Ph. D.	Jember University	ADC	"Mechanization Case Studies in East Java: Mechanization Potential, Tractor Economics, Pump Set Economics, and Labor Migration"

GRADUATE STUDENTS SUPPORTED UNDER THE "CONSEQUENCES OF MECHANIZATION PROJECT (csd-tac-1466)
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COUNTRY: INDONESIA /page 2

Name	Year	Degree	Institution	Research Support	Title of Research
7. Tahlim Sudaryanto	1981	M. Sc.	IPB/Bogor Agric. Univ.	IRRI/ADC	"Economic and Financial Analysis of Using Tubevelia for Irrigation in East Java"
8. Aten Hurun	1981	M. Sc.	Bogor Agric. Univ.	IRRI/ADC	"Project Analysis and Technical and Socio-Economic Aspects of Tractor Ownership in West Java"
9. Al Sri Ngoyo	1981	M. A.	U. P. at Los Baños	IRRI	"The Impact of Mechanization on Production and Employment in Rice Areas of West Java"
10. Sanim Bunawor	1981	M. A.	U. P. at Los Baños	IRRI/ADC	"Power Tiller (Hand Tractor) Utilization and Its Impact on Employment in Rice Producing Farms in West Java, Indonesia"
11. Husejidi Siregar	1982	M. A.	U. P. at Los Baños	IRRI	"Cost and Returns of Using Hand Tractors on Rice Farms in West Java, Indonesia"
12. Tjahjadi Sugianto	1982	Ph. D.	University of Illinois	IRRI	"The Relative Economic Efficiency of Irrigated Rice Farms, West Java, Indonesia"
13. Sinwosumarto Hamlaka	1982	M. Sc.	Asian Institute of Technology	IRRI	"Effect of Mechanization on Cropping Intensity, Employment and Productivity at Village Level"

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COUNTRY: INDONESIA...../page 3

Name	Year	Degree	Institution	Research Support	Title of Research
14. Sultoni Arifin	1982	Ph. D.	Cornell University	IRRI	"The Economic Analysis of Farm Tractor Adoption in South Sulawesi, Indonesia"
15. Jafar Hafnab	1981	Ph. D.	Bogor Agric. University	IRRI	"The Economics of Tractor Operation and Use in South Sulawesi, Indonesia"
16. Yusuf Hanuman	1983	M. Sc.	U. P. at Los Baños	IRRI	"The Economics of Tractor Ownership in South Sulawesi, Indonesia"
17. Yusuf Saefudin	1983	M. Sc.	U. P. at Los Baños	IRRI	"The Effect of Land Preparation Mechanization on Farmers' Income and Factor Share in West Java, Indonesia"
18. Helen Ketut	1981	Ph. D.	Monash University	Colombo Plan/IRRI	"Choice of Technique with Reference to Land Preparation in Densely Populated Areas, West Java, Indonesia"
19. Saranatha	1981	M. Sc.	IPB/Bogor Agric. Univ.	IRRI	"Effects of Mechanization on Intensity of Land Use"
20. Sakti, M. H. Tempubolon	1982	M. Sc.	U. P. at Los Baños	IRRI	"The Impact of Rice Intensification Loans on Production and Income Distribution"

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COUNTRY: MALAYSIA

Name	Year	Degree	Institution	Research Support	Title of Research
1. Ahmad Mahdzan Ayoh	1981	Ph. D.	University of Florida	ADC	"Adoption, Impact, Costs and Benefits of Combine Harvester in the Muda Irrigation Project, Malaysia"

**GRADUATE STUDENTS SUPPORTED UNDER THE "CONSEQUENCES OF MECHANIZATION PROJECT (csd-lac-1466)
(IRRI/ADC GRANTS)**

COUNTRY: NEPAL

Name	Year	Degree	Institution	Research Support	Title of Research
1. Ganesh Thapa	1979	M. Sc.	U. P. at Los Baños	IRRI/ADC	"The Economics of Tractor Ownership and Use in the Nepal Terai"
2. Mahab Raj Khoju	1980	M. Sc.	U. P. at Los Baños	IRRI/ADC	"Economics of Pump-Irrigation in Eastern Nepal"

GRADUATE STUDENTS SUPPORTED UNDER THE "CONSEQUENCES OF MECHANIZATION PROJECT (csd-tac-1466)
(IRRI/ADC GRANTS)

COUNTRY: PAKISTAN

Name	Year	Degree	Institution	Research Support	Title of Research
1. Muhammad Hunir	1981	H. Sc.	Univ. of Agriculture	ADC	"An Evaluation of the Farmers' Decision-Making for Investment in Farm Machinery, Faisalabad"
2. Kizja Altaf	1981	H. Sc.	Univ. of Agriculture	ADC	"An Assessment of Capacity of Workshops and Farms to Repair and Maintain Farm Machinery in District Faisalabad"
3. Javed Gardezi	1981	H. Sc.	Univ. of Agriculture	ADC	"Evaluation of Effect of Mechanical Field Work in Threshers on Farm Employment, Multan, April 1977"
4. Hussain Gardezi	1981	H. Sc.	Univ. of Agriculture	ADC	"Socio-economic investigation into Custom-leasing of Agricultural Machines, Pakistan"
5. Hazeer Hussain	1981	H. Sc.	Univ. of Agriculture	ADC	"The Pattern of Marketing of Farm Machinery in Faisalabad"
6. Habib ur-Rahman	1982	H. Sc.	U. P. at Los Baños	IRRI	"A 0-1 Mixed Integer Programming Model for Farm Machinery Selection and Crop Planning"

GRADUATE STUDENTS SUPPORTED UNDER THE "CONSEQUENCES OF MECHANIZATION PROJECT (csd-tac-1466)
(IRRI/ADC GRANTS)

COUNTRY: PHILIPPINES

Name	Year	Degree	Institution	Research Support	Title of Research
1. Virgilio Mouge	1980	H. Sc.	U. P. at Los Baños	IRRI	"Analysis of Factors Affecting the Demand for Tractor and Power Tiller Services in Nueva Ecija"
2. Yolanda Tan	1980	H. Sc.	U. P. at Los Baños	IRRI	"The Impact of Farm Mechanization on Small-Scale Rice Production"
3. Jerome F. Sison	1982	Ph. D.	University of Manitoba	IRRI/ADC	"The Effects of Small Rice Farm Mechanization on Employment and Income in Central Luzon Region, Philippines"
4. Blanquita Y. Reyes	1983	H. Sc.	U. P. at Los Baños	IRRI	"The Economic Impact of Mechanical Land Preparation on Rice Farmers in Nueva Ecija Under Conditions of Weather Uncertainty"
5. Leonarda Hallawa	1983	H. Sc.	U. P. at Los Baños	ADAB	"Income Levels, Income Distribution and New Rice Technology: A Case Study of Eight Philippine Villages".
6. Zaldy Catedrilla	1983	H. Sc.	Univ. of Pertanian Malaysia	ADC/IRRI	"The Effects of Mechanical Thresher Adoption on Labour Utilization and Employment in Iloilo Province, Philippines"
7. Leonarda Ebron	1984	H. Sc.	U. P. at Los Baños	IRRI	"Changes in Harvesting-Threshing Labor Arrangements in Nueva Ecija"
8. Fleurdeliz Juarez	1984	H. Sc.	U. P. at Los Baños	IRRI	"The Institutional and Economic Impact of Mechanical Rice Threshing in Laguna and Iloilo, Philippines"

**GRADUATE STUDENTS SUPPORTED UNDER THE "CONSEQUENCES OF MECHANIZATION PROJECT (ead-tac-1466)
(IRRI/ADC GRANTS)**

COUNTRY: THAILAND

Name	Year	Degree	Institution	Research Support	Title of Research
1. Hongluck Jongsuwat	1980	M. Sc.	Thammasat University	IRRI	"Productivity Growth and Farm Machinery Adoption in Thai Agriculture"
2. Renu Pathnopas	1980	M. Sc.	Thammasat University	IRRI	"The Economics of Rice Threshing Machines in Thailand: A Case Study of Chachoengsao and Supanburi Provinces"
3. Paitoon Wiboonchutikula	1980	Ph. D.	University of Minnesota	ADC	"The Total Factor Productivity Growth of the Two Digit Manufacturing Industries in Thailand".
4. Anuvat Wongnangroonsri	1982	M. Sc.	Thammasat University	IRRI	"Farm Mechanization, Production and Growth and Farm Employment: A Case Study of Supanburi Province"
5. Somporn Saitan	1983	M. Sc.	Kasetsart University	IRRI	"Effect of Tractor Use on Income Distribution of Small Rice Farm in Supanburi, 1981/82"

**GRADUATE STUDENTS SUPPORTED UNDER THE "CONSEQUENCES OF MECHANIZATION PROJECT (casl-tac-1466)
(IRRI/ADC GRANTS)**

COUNTRY:

Name	Year	Degree	Institution	Research Support	Title of Research
1. Kent Hikkelen	1982	Ph. D.	Yale University	IRRI	"An Analysis of Technology Design and Transfer in the Farm Machinery Industry of the Philippines"