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ANNOTATED BIBLIOGRAPHY ON DEVELOPMENT AND TRANSFER OF AGRICULTURAL TECHNOLOGY

Volume 1

Compiled by
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Technology Development and
Transfer Systems in Agriculture

a project of

INTERPAKS, International Program for Agricultural Knowledge Systems
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University of Illinois at Urbana-Champaign

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Foreword

INTERPAKS (International Program for Agricultural Knowledge Systems) of the Office of International Agriculture at the University of Illinois is pleased to share these materials from the INTERPAKS Resource Center with you.

They have been compiled as a part of the literature search in carrying out a collaborative research program funded by the U.S. Agency for International Development entitled, "Technology Development, Transfer and Feedback Systems in Agriculture: An Operational Systems Analysis".

Citations and annotations cover literature relevant to the research underway and

have been organized under five topical areas. The five topics include: (1) general agricultural development; (2) policy and planning; (3) technology development; (4) technology transfer; and (5) technology utilization.

INTERPAKS is indebted to a number of people for this intensive review. The leadership of Jane S. Johnson and Kathleen Cloud from the faculty, and graduate students, Carolyn M. Sands, Robert T. Raab, Mohamed M. Samy, and Timothy L. Koehnen is noted and appreciated.

—Burton Swanson
Project Leader

Preface

The development and transfer of improved technology to farmers is a critical factor in agricultural development. Yet, despite major investments on the part of both national governments and external donors, agricultural research and extension institutions in many developing countries still remain ineffective in making available to farmers improved technology that is suited to their needs. Consequently, there is a growing consensus among national leaders, donors and scholars that the process of agricultural technology development and transfer is poorly understood and is in serious need of reassessment and improvement. The overall thrust of the Technology Development, Transfer and Feedback Systems in Agriculture Project at INTERPAKS at the University of Illinois is to undertake this reconsideration and then to disseminate the results so as to improve national technology development and transfer systems.

One of the objectives of this project is to review the literature relevant to national technology systems in agriculture and to develop a bibliographic data base which supports the development of a conceptual model of technology development, transfer and utilization in agriculture. This publication seeks to organize the most relevant citations collected during the past year around the primary functions and tasks identified in the conceptual model.

The bibliography is divided into five sections: (1) Agricultural Development - General; (2) Policy and Planning; (3) Technology Development; (4) Technology Transfer; and (5) Technology Utilization. The first section includes documents of two types. Most deal with agricultural development or agricultural systems in an integrated way, linking issues of policy, research, transfer and utilization. A smaller number deal with a particular issue, such as management or institutional functioning, that are relevant to several elements in the system. The annotation and subject terms provide a sense of where their major emphasis lies. The second

section consists mainly of materials on policy and planning as they relate to national technology systems. The remaining three sections deal with the various functional activities within the systems and the interrelationships among them.

Most of the citations date from 1975 onwards. However, a few older citations which have become classics and remain relevant to the study of technology systems in agriculture in the 1980s are included.

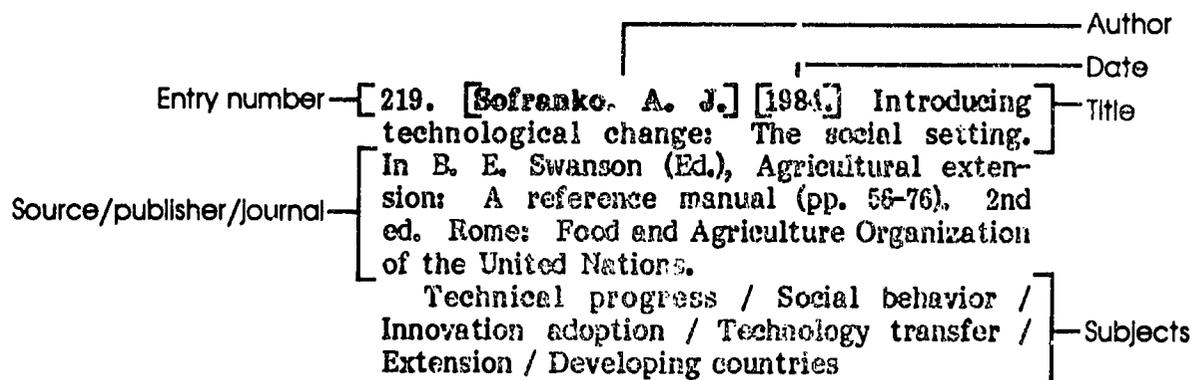
In addition to the categorical divisions, each citation has been assigned specific subject terms which allow more depth in searching. There is a subject index which brings together the citations on the more specific subjects irregardless of the category in which they are located in the bibliography.

It is hoped that this annotated bibliography will assist those who are interested in the subject of technology development, transfer, and feedback systems in agriculture to locate a wide variety of materials on the subject. The INTERPAKS Resource Center houses about 95% of the citations in this bibliography. The remaining are accessible to INTERPAKS researchers through the University of Illinois Libraries. The entries provide complete bibliographic information so interested persons may locate the materials in libraries in their own areas or via inter-library loan.

I am grateful to Kathleen Cloud and Andrew J. Sofranko for their assistance in guiding the literature review process through to this stage and to the INTERPAKS research team for their input in the selection of citations to be included in the bibliography. Special appreciation goes to Carolyn M. Sands and Bonnie J. Irwin for their invaluable knowledge of editing and their willingness to help out on short notice.

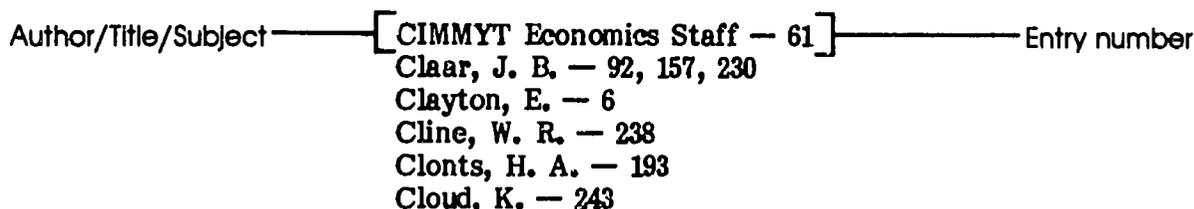
—Jane S. Johnson

Guide to Entries



Annotation — [The chapter starts from the premises that technological change is required for agricultural development, and that a gap exists between the levels of technology available and in use in most developing countries. The issue thus becomes one of addressing the obstacles preventing farmers from changing their behavior in general, and adopting new technologies in particular. The focus throughout is on the real and presumed socio-cultural impediments, the relationship between these impediments and infrastructural requirements, and the requirements for understanding how to implement change at the farm level. The author discusses several concepts for understanding rural culture, looks at obstacles to agricultural change, discusses ways of reducing resistance to change, compares strategies for introducing change in agriculture, and details some of the dimensions of the role of the extension worker. The emphasis throughout the chapter is on applied social change, namely what should extension workers know about rural culture and behavioral change principles to affect change among third world farmers.]

Guide to Indexes



Agricultural Development-General

1. **Asian Development Bank.** 1977. Rural Asia: Challenge and opportunity. New York: Praeger. 489 pp.

Agricultural development / Asia / Rural development

This second Asian Agricultural Survey comes a decade after the first, and is intended to evaluate significant aspects of recent agricultural and rural development experience in the Asian region. Divided into four parts, the report concerns itself with recent developments, projection, future strategies, and the role of foreign aid in agriculture and rural development. Emphasis is given to the urgent need to reduce poverty in rural areas. The book is organized by topic area, rather than country, but contains many tables with country specific data. The report notes that the most significant development in agriculture in South and Southeast Asia during the decade from 1967-77 has been the shift from traditional to modern agriculture using science based technologies epitomized by the adoption of new, fertilizer-responsive varieties of rice and wheat. Yet the rapid growth of population has prevented significant per capita food production gains, and the region appears to be no nearer to solving the food problem than it was a decade earlier. Five priority areas for technology development should be biological-chemical technologies, irrigation management, appropriate mechanical technologies, cropping systems research, and socio-economic research. Improved agricultural credit and price policies, creation of off-farm employment, and more effective donor assistance will also be necessary if agricultural development is to proceed effectively.

2. **Binswanger, H. P., Ruttan, V. W. (Eds.)** 1978. Induced innovation: Technology, institutions, and development. Baltimore, MD: Johns Hopkins University Press. 423 pp.

Innovations / Institutions / Economic development / Technical progress

Based on a set of interrelated studies initiated at the University of Minnesota.

The four objectives of the book are: (1) using the induced innovation framework to relate the historical analysis of the sources of technical change to the normative process of research resource allocation and planning; (2) to combine the several different approaches to the analysis of the rate and direction of technical change into one investment framework; (3) to expand the concept of induced innovation to include institutional as well as technical change; and (4) to explore the implications of induced innovation for development theory and policy.

3. **Binswanger, H. P.** 1978. Induced technical change: Evolution of thought. In H. P. Binswanger and V. W. Ruttan (Eds.), Induced innovation: Technology, institutions, and development (pp. 13-43). Baltimore, MD: Johns Hopkins University Press.

Technical progress / Policy / Induced innovations / Models

Reviews and evaluates literature on induced innovation. Describes models of induced innovation and empirical tests of such models to discover the roles played by factor prices, goods prices, and other economic variables in determining the rate and direction of technical change. Examines a variety of models of induced innovation and describes some empirical evidence that is consistent with that theory. Notes that with one exception, the models do not describe how firms choose among alternative research processes so that they end up generating technical changes that save expensive resources.

4. **Binswanger, H. P.** 1978. The micro-economics of induced technical change. Issues in modelling induced technical change. (2 chapters). In H. P. Binswanger and V. W. Ruttan (Eds.), Induced innovation: Technology, institutions, and development (pp. 91-163). Baltimore, MD: Johns Hopkins University Press.

Technical progress / Models / Induced innovations

2 Agricultural Development - General

Develops a microeconomic theory of induced innovation. Included in the model are the effects on the amount and direction of scientific and technical effort at the individual firm level of factor prices, scale of operation, interest rates, final demand, and exogenous advances in basic and applied knowledge, the impact of these economic variables on the rate and direction of technical change, while leaving open the possibility that there are fundamental or exogenous biases in technical change. Also considered are effects on the inducement process of market imperfections, including the inability of innovating firms to capture a significant share of social benefits that stem from innovating activity. Reviews of some controversies found in the literature on induced innovation from the viewpoint of the investment model of research. Finally, it shows that it may be impossible to develop entirely satisfactory long-term equilibrium growth models that incorporate endogenous technical change in any meaningful way.

5. **Burger, P. J., Duvel, G. H.** 1961. An operational model for programmed agricultural development. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development*. Vol. 2: Experience in strategies for planned change (pp. 51-64). Chichester, England: John Wiley.

Planning / Agricultural development / Training / Models

Critically examines existing program planning models and proposes an alternative with a view to meeting many divergent activities essential to effective agricultural development programming. This model is considered to meet more adequately the needs of those engaged in training field extension workers.

6. **Carruthers, I., Clayton, E.** 1979. Monitoring management performance in agricultural projects. In *Institutions, management and agricultural development* (pp. 35-38). (Agricultural Administration Unit

occasional paper 3). London: Overseas Development Institute, Agricultural Administration Unit.

Agricultural development / Management / Monitoring

Provides an analysis of management by functional areas and activities. Emphasizes the importance of one of these activities, monitoring by management, both as an aid to management and as an index of the quality of management, and discusses the limited utility for management of existing monitoring procedures.

7. **Cerne, M. M., Coulter, J. K., Russell, J. F. A.** 1985. Building the research-extension-farmer continuum: Some current issues. Washington, DC: World Bank. 19 pp. Draft manuscript.

Agricultural research / Extension / Linkages / Agricultural policy

A recurrent theme of most discussions on agricultural research and extension is that the linkages between these two vital parts of the agricultural support services are often weak or nonexistent. This paper briefly discusses the main causes of the weak links between extension and research, the choices confronting policy makers in deciding on investments for research and extension, the overriding need for responding to the production problems of the farmers, and the neglect and importance of the social science perspective in developing the research-extension-farmer continuum.

8. **Cohen, J. M., Uphoff, N. T.** 1977. Rural development participation: Concepts and measures for project design, implementation and evaluation. Ithaca, NY: Rural Development Committee, Center for International Studies, Cornell University. 317 pp. (Rural development monograph no. 2).

Rural development / Implementation of research / Social participation / Development projects / Planning / Evaluation

Presents the ideas developed by the working group of the Rural Development Committee on rural development participation. Issues found in a review of the literature were discussed. The results of the analysis are included in the monograph. Part I covers the "what", "who", and "how" of participation in rural development projects and the effects of project characteristics and of task environment on participation. Part II deals with the application of concepts for measuring participation and uses as an example a project in Ethiopia. Separate chapters consider participation in decision making, implementation, benefits and evaluation of programs. The final chapter discusses future directions of rural development participation.

9. **de Janvry, A., LeVeen, E. P.** 1983. Aspects of the political economy of technical change in developed economies. In M. Pineiro and E. Trigo (Eds.), *Technical change and social conflict in agriculture: Latin American perspectives* (pp. 25-36). Boulder, CO: Westview Press.

Technical progress / Social behavior

Examines technological change as an instrument of change in social relations. Traces the history and development of California's heavily mechanized, large-scale agriculture to illustrate the effect of technological change in social terms. Describes the role the public research institution played in designing machinery and developing new plant varieties to meet a change in labor supply in the tomato industry. The reactions to and effects on labor are addressed. Four levels of social conflicts that influence the rate and bias of technical change are identified: (1) structure of the agricultural system such as land tenure; (2) agricultural research; (3) level of the organization of the labor process; and (4) impact on factor and product prices and their effect on surplus control.

10. **Hayami, Y.** 1974. Conditions for the diffusion of agricultural technology: An

Asian perspective. *Journal of Economic History*, 34, 131-148.

Utilization / Induced innovations / Institutions / Adaptation / Agricultural policy / Japan / Korea Republic / Diffusion of research / Taiwan / South East Asia / South Asia

Both research in agricultural technology and construction of land infrastructure are characterized by indivisibility, externality, and jointness in supply and utilization. The theory of public good economics of the Samuelson-Musgrave tradition tells us that the goods and services with such attributed cannot be supplied at socially optimum levels if the supply is left to private firms within a competitive market mechanism. Public investments are required to correct for such market failure. The need for public institutions to conduct adaptive research and to build and coordinate the use of irrigation systems is especially critical in Asian agriculture, where the possibility for farm producers to conduct such activities by themselves is limited. In this article, the author attempts to demonstrate the critical importance of adaptive research and land infrastructure investment in the process of diffusion of agricultural technology, drawing on the history of rice technology development in Japan, Taiwan, and Korea, in contrast to the more recent development of rice technology in South and Southeast Asia, which has been heralded as the "green revolution". He attempts to identify what institutions have to be evolved for satisfying basic requirements for technology diffusion in agriculture, and to infer what forces were responsible for inducing institutional evolution.

11. **Hillman, J. S., Schmitz, A. (Eds.)** 1979. *International trade and agriculture: Theory and policy*. Boulder, CO: Westview Press. 333 pp. (Westview special studies in international economics and business).

International trade / Agricultural trade

This edited volume results from an Symposium on International Trade and Agriculture

4 Agricultural Development - General

held at the University of Arizona in 1977 in response to the world food crisis of 1972-77. The patterns of agricultural trade of the early and mid-1970's shifted, precipitating major gains and losses within and between countries. The levels and content of trade are now quite different than the past. World agricultural exports are approaching \$200 billion, up from \$20 billion in 1953 and \$40 billion in 1960. Much of increase came from changes in the types of commodities traded, rather than increase in volume, a fact which has implications for developing countries. The book focuses primarily on research needs. Chapters are organized around: (1) general subject matter in trade and agriculture; (2) gains from trade, theory reexamined; (3) analyses of agricultural trade problems; and (4) current research and research needs.

12. **Howell, J.** 1979. Assessing management and organizations for agricultural development projects. In *Institutions, management and agricultural development* (pp. 17-34). (Agricultural Administration Unit occasional paper 3). London: Overseas Development Institute, Agricultural Administration Unit.

Agricultural development / Management / Farmers' associations / Organizations

Concerned with how best to organize agricultural activities or programs which are being undertaken for the first time. Looks closely at farmers' organizations and, in particular, points out the difficulty of predicting how an existing organization will cope with new functions and new procedures. The papers' main concern is with the organization of government services. Discusses the extent to which classic principles of management theory are likely to help in finding an appropriate organizational form of a particular agricultural program. Gives some specific suggestions on how to assess, in advance of a decision about whether to fund a program, the capacity of the organization involved to perform their destined roles in implementing agricultural development. Two appendices list the sort of information that

should be collected in a preinvestment survey of organizations and management and the issues or questions which should be revised and considered in coming to a final decision on organization and managerial form.

13. **Jiggins, J., Hunter, G.** 1979. Institutions and culture: Problems of criteria for rural and agricultural development projects. In *Institutions, management and agricultural development* (pp. 7-16). (Agricultural Administration Unit occasional paper 3). London: Overseas Development Institute, Agricultural Administration Unit.

Agricultural development / Rural development / Institutions / Organizations

Concerned with how target groups of farmers are organized or organize themselves rather than with the organization of government services. Raises fundamental questions such as asking if organizations in agricultural development are simply vehicles for other change or are themselves a main force for change. The major part of the paper is concerned with the question of whether criteria can be established by which to judge the appropriateness of institutional form.

14. **Johnston, B. F., Kilby, P.** 1975. *Agriculture and structural transformation: Economic strategies in late-developing countries.* New York: Oxford University Press. 474 pp.

Agricultural development / Labor / Resource allocation / Farm size / Policy / Case studies / USA / Japan / England / Mexico / Taiwan / USSR

Presents an analysis of long term alterations in economic structure focusing on the reciprocal interactions between agricultural development and the expansion of manufacturing and other nonfarm sectors. Earlier view that rapid industrialization would suffice have not proved correct: two thirds of the world's population live in countries characterized by acute poverty and an economic structure in which agriculture provides 50

to 80 % of the labor force with work and income. Three factors are seen as conditioning the process of structural transformation of these economies. First is the simple fact of being late, which brings a large technological backlog to draw upon. Second is the interdependence between agriculture and other sectors of the economy. The two facets which have received most attention are the need to transfer investable resources from agriculture to nonfarm sectors and maintenance of increasing farm productivity to support low urban food prices. The authors emphasize three additional aspects; rates of labor transfer between sectors, the level of commodity flows, and composition of these flows. The third factor they emphasize is the size distribution of farms, and the types of agricultural technologies available. They argue that farm size distribution has a significant impact on industrial development, through differing patterns of demand for consumer goods and agricultural inputs. The analysis is concerned with policy variables that determine the pattern of farm size, in terms of technology development, training, agricultural development, and investments in infrastructure. They contrast the costs and benefits of 'unimodal' strategies, designed to raise the productivity of large numbers of small farmers, and 'bimodal' strategies, designed to increase productivity of a small number of large farmers. Case studies of the structural transformation of England, the Soviet Union, the United States, Japan, Mexico and Taiwan are used to illuminate the discussion, which closes with general conclusions believed to be of wide applicability.

15. **Lele, U.** 1975. The design of rural development: Lessons from Africa. Baltimore: Published for the World Bank by the Johns Hopkins University Press. 246 pp. (A World Bank research publication).

Rural development / Africa / Evaluation

A World Bank sponsored study of rural development in Africa that grew out of a substantial interest within the Bank in

finding ways of designing relevant projects that could be accomplished despite limited resources, particularly of money and trained manpower and that would reach a large proportion of the low-income rural population. The focus is therefore consciously operational. One of the main objectives has been to investigate whether and how the reviewed projects and similar programs should have been designed had there been more concern with broad participation, overall welfare, and the utilization of local financial and institutional resources. Investigates whether institutional and procedural changes are needed in planning and implementing rural development projects to increase their effectiveness in realizing the new objectives of development. Analyzes 17 sets of evaluations of rural development projects and programs selected from nearly 60 programs in various parts of sub-Saharan Africa chosen to represent a wide range of diversity in design and implementation as well as their environment.

16. **Mellor, J. W.** 1966. The economics of agricultural development. Ithaca, NY: Cornell University Press. 402 pp.

Agricultural development / Technical progress / Economic development

The book, written for both the teacher and practitioner, provides an analysis of the role that agriculture can play in national development. A full understanding of the economic development of agriculture demands treatment of three interrelated parts: (1) the role of agriculture in overall economic development; (2) the economic nature of traditional agriculture; and (3) the economic process of modernization of agriculture, and the book is organized to reflect these themes. Part I emphasizes the early stages of economic development, when agriculture, occupying one half to three quarters of the population, and generating at least half the national income, is the dominant sector of the economy. Part II is an analysis of traditional agriculture, and Part III of the modernization process.

6 Agricultural Development - General

17. **Moris, J. R.** 1981. Managing induced rural development. Bloomington, IN: International Development Institute. 190 pp.

Rural development / Bibliographies / East Africa

Discusses the management of induced rural development projects from the perspective of the practitioner. Explores the issues which must be weighed when extending administrative prescriptions in developing countries, especially 'fourth world' nations which depend largely upon their agrarian performance for development. The objectives of this work include: (1) review what has been learned about arrangements for induced planned change in the poorer nations; (2) make available a concise guide to the current literature on this topic; and (3) present insights about rural development based on field experience. The author concentrates on situational constraints to successful planned change which are commonly encountered in the field; the structure and culture of technical assistance, the organizational environment, diverse technical functions, and the extreme poverty in areas where most programs are implemented.

18. **Morss, E. R., Hatch, J. K., Mickelwait, D. R., Sweet, C. F.** 1976. Strategies for small farmer development: An empirical study of rural development projects in The Gambia, Ghana, Kenya, Lesotho, Nigeria, Bolivia, Colombia, Mexico, Paraguay and Peru. Boulder, CO: Westview Press. 2 volumes. (Westview special studies in social, political and economic development).

Development projects / Planning / Social participation / Implementation of research / Case studies / Gambia / Ghana / Kenya / Lesotho / Nigeria / Bolivia / Colombia / Ecuador / Mexico / Paraguay / Peru

A comprehensive report of an AID sponsored study which was used to improve the design and implementation of projects to assist small, subsistence farmers. This report is a detailed examination of 36 rural development projects sponsored by various institutions

operating in 11 African and Latin American countries. The complete report is in three volumes. Volume 1 deals with the research and the focus of the research; measurement and definition of indicators of project success, project components, findings, and implications of the findings. It was found that 49% of the variation in project success could be explained by the factors of farmer participation in implementation and in farmer resource commitment to the project. Includes a description of a process for project development and implementation which leads to maximization of these factors. Volume 2 contains the case studies from the various projects. Projects were studied in Mexico, The Gambia, Ghana, Kenya, Lesotho, Nigeria, Bolivia, Colombia, Ecuador, Paraguay, and Peru. Volume 3 is the executive summary.

19. **Mosher, A. T.** 1966. Getting agriculture moving: Essentials for development and modernization. New York: Praeger. 191 pp.

Agricultural development / Developing countries

Intended as a "primer" on agricultural development to be used during in-service training of middle-echelon personnel of agricultural development agencies in developing countries. Describes a variety of interdependent activities which are necessary to achieve agricultural development. Of these, markets for farm products, new technology, adequate incentives for farmers, improving and expanding agricultural land and national planning for development are also highly desirable if progress is to be at all rapid.

20. **Mosher, A. T.** 1976. Thinking about rural development. New York: Agricultural Development Council. 350 pp.

Rural development / Extension / Education
A collection of articles written by Arthur T. Mosher which have proven to be of continuing interest to scholars and practitioners in the field of rural development. The papers are grouped under five headings: Rural

Development Projects; Extension Programs; Research on Rural Development, The University and Rural Development, and Social and Cultural considerations. Chapters within the Rural Development Projects section include Projects of Integrated Rural Development, Administrative Experimentation or a "way of life" for development projects, Agricultural Planning, and Organizing for Agricultural Development. The section dealing with Extension Programs examines various aspects of the extension process, i.e., the evaluation of the extension worker as the agriculture region in which the worker operates becomes more advanced, and program building. The segment devoted to Research on Rural Development identifies topics on which more research is needed as well as examining a framework within which researchers of all disciplines could work together to solve problems. Asia is singled out in this process. Within the segment devoted to The University and Rural Development, Mosher examines: (1) education, research, and extension in agricultural economics in Asia and Latin America; (2) the proper function of the University experience (to learn to think about farming, to understand its social and economic aspects, and to analyze farms); and (3) the role of higher education in rural social sciences. Finally, the portion devoted to Social and Cultural Consideration examines various aspects of the disciplines of sociology within agricultural development.

21. **Mosher, A. T.** 1981. Three ways to spur agricultural growth. Washington, DC: International Agricultural Development Service. 61 pp.

Agricultural development / Innovation adoption / Institutions / Organizations

Examines three actions which, if taken simultaneously, may accelerate a nation's rate of agricultural growth. These include: (1) mount one or more commodity production programs; (2) launch a few farming-district projects; and (3) improve the efficiency of regular agricultural agencies. The introduction provides a concise review of important

considerations in accelerating agricultural growth. This is followed by three chapters, each describing in some detail one of the three approaches. Adopting these three approaches will not make the task of accelerating growth simple, but ignoring even one of them will slow the pace of change.

22. **Overseas Development Institute. Agricultural Administration Unit.** 1979. Institutions, management and agricultural development. London: Overseas Development Institute. 61 pp. (Agricultural Administration Unit occasional paper 3).

Agricultural development / Institutions / Management / Developing countries

Contains five papers originally prepared for a one-day meeting to explore the possibilities of developing methods of assessing organizational and management factors which could be incorporated into the regular appraisal and evaluation of agricultural projects and programs in developing countries. Papers included are: (1) Institutions and culture: Problems of criteria for rural and agricultural development projects (J. Jiggins and G. Hunter); (2) Assessing management and organizations for agricultural development projects (J. Howell); (3) Monitoring management performance in agricultural projects (I. Carruthers and E. Clayton); (4) The appraisal, monitoring, and evaluation of agricultural extension programmes (D. Belshaw); and (5) Evaluating organization and management: A proposed methodology for use on large irrigation projects (A. Bottrall).

23. **Pineiro, M. E., Fiorentino, R., Trigo, E. J., Balcazar, A., Martinez, A.** 1983. Social relations of production, conflict and technical change: The case of sugar production in Columbia. In M. Pineiro and E. Trigo (Eds.), Technical change and social conflict in agriculture: Latin American perspectives (pp. 47-69). Boulder, CO: Westview Press.

Technical progress / Social behavior / Sugarcane / Colombia / Case studies

Case study which clearly describes the modernization process of sugar cane production in the Cauca Valley, Colombia. Detailed account traces the growth and consolidation of the valley's sugar production industry from the early 1960s to 1978. Effects on society, i.e., labor, suppliers, and producers, are emphasized. Empirical evidence demonstrates that the modernization process was subordinate to social relationships. Modernization was characterized by four elements: (1) technology was subordinated to the growth of a strong cartel; (2) the dominant social groups' ability to negotiate with the government for special economic concessions; (3) the eventual control of technology generation by the private sector; and (4) technology adapted was capital intensive. Supplemented by numerous tables and figures.

24. **Pineiro, M. E., Trigo, E., Fiorentino, R.** 1983. Technical change in Latin American agriculture: A conceptual framework for its interpretation. In M. Pineiro & E. Trigo (Eds.), *Technical change and social conflict in agriculture: Latin American perspectives* (pp. 37-44). Boulder, CO: Westview Press.

Technical progress / Models / Technology development / Latin America / Utilization

Identifies basic components of a conceptual framework to analyze and interpret the uneven rate of technical change in agricultural production in Latin America. Factors identified as impediments to comprehensive implementation of technical change include: (1) diversity of agriculture; (2) proclivity of the state to form policy and allocate resources for research by reacting to factions holding political power; and (3) the existence of special interest groups tied to specific agricultural activities. The model emphasizes the crucial role of the state in effecting uniform technical change and the sociological aspects of the effort. Identifies the need for functional articulation among: (1) social groups; (2) state and economic policies affecting agricultural production; (3) technology generation tied to actual demand; and (4) coordination

activities. The socioeconomic space, where technological changes occur, is the basic unit used for analysis. The space is a specific location or area and the accompanying physical, social, and political activity that could affect technical change.

25. **Pineiro, M., Trigo, E.** 1983. Social articulation and technical change. In M. Pineiro & E. Trigo (Eds.), *Technical change and social conflict in agriculture: Latin American perspectives* (pp. 139-161). Boulder, CO: Westview Press.

Technical progress / Social behavior / Innovation adoption / Case studies / Latin America / Agricultural policy

Analysis and interpretation of modernization and technical change in Latin America based on empirical data from eight case studies covering a 20-year period. A variety of technical change processes are described addressing production of sugar, potatoes, rice, corn, tomatoes, dairy, and livestock. Social aspects are emphasized. Interpretation of results focuses on the basic components of each type of production, how production integrates with national economy, and attempts to determine the social articulation that occurs which allows technical change to take place. The study identifies type of production unit, organization of production, amount of homogeneity, and regional importance of the product on the most important factors influencing the success of technology adoption. Where the rural sector displays political clout, it appears that national government responds by supporting or promoting technical change.

26. **Pineiro, M., Trigo, E. (Eds.)** 1983. *Technical change and social conflict in agriculture: Latin American perspectives*. Boulder, CO: Westview Press. 248 pp.

Technical progress / Agricultural policy / Case studies / Methodology / Latin America

Presents the results of a large Latin American cooperative research project, the

Cooperative Research Project on Agricultural Technology in Latin America (PROTAAL). Using seven case studies in six Latin American countries, technological change is examined and the methodology created by PROTAAL is described. The project resulted in a new interpretation of the technical change process in agricultural development. The new appraisal is compared with two other theories of technical change in agriculture, the theory of induced innovation and the political economy approach. Important issues affecting how agricultural research activities are organized at the national and international levels are considered, together with theoretical and policy implications for future examination of technical change in Latin America.

27. **Ruttan, V. W., Binswanger, H. P., Hayami, Y., Wade, W. W., Weber, A.** 1978. Factor productivity and growth: A historical interpretation. In H. P. Binswanger and V. W. Ruttan (Eds.), *Induced innovation: Technology, institutions, and development* (pp. 44-87). Baltimore, MD: Johns Hopkins University Press.

Induced innovations / Technical progress / Developed countries

Tests the induced technical change hypothesis against the historical experience of the agricultural sectors in Japan, France, Germany, Denmark, the United Kingdom, and the U.S.A. between 1880 and 1970. First establishes the plausibility of the induced innovation hypothesis along the line used by Hayami and Ruttan in their earlier work on Japan and the United States. A new test is then used to try out the model to determine whether the observed changes in factor ratios of the late nineteenth century and the changes that have emerged over time are consistent along a common production function or whether they were generated by non-neutral shifts in production functions among countries. Results show that the U.S. has followed a more labor saving path of technical change than have the four European countries. However, the paths followed by the

U.S. and Japan since the 1950s have converged somewhat on the extreme labor density characterizing Japanese agriculture in 1880 and has been reduced to some degree. It also appears that the rate of growth in demand for agricultural products has played a significant role in inducing differential rates of technical change, especially in France and Germany.

28. **Ruttan, V. W., Binswanger, H. P.** 1978. Induced innovation and the green revolution. In H. P. Binswanger and V. W. Ruttan (Eds.), *Induced innovation: Technology, institutions, and development* (pp. 358-408). Baltimore, MD: Johns Hopkins University Press.

Induced innovations / Utilization / Technology transfer / Technical progress / Institutions / Socioeconomic organization / International agricultural research centers

Uses the induced innovation model to interpret the process of technical and institutional change that has occurred in agriculture's green revolution in a number of developing countries beginning in the mid-1960's. Illustrates the dialectical interaction between technical and institutional change during the process of agricultural development and suggests that the new seed-fertilizer technology weakened the potential for revolutionary change in political and economic institutions in rural areas in many parts of the developing world in the late 1960's and early 1970's. Raises the possibility that the revolutionary changes in rural institutions anticipated in radical literature on rural development may arrive as a result of increasing immiserization in the rural areas of many developing countries in the next decade.

29. **Ruttan, V. W.** 1978. Induced institutional change. In H. P. Binswanger and V. W. Ruttan (Eds.), *Induced innovation: Technology, institutions, and development* (pp. 327-357). Baltimore, MD: Johns Hopkins University Press.

Technical progress / Institutions / Models

Examines the possibility of more effective direction of scientific and technical resources toward varieties of institutional change that are suitable to the resource and cultural endowments of a particular society. Elaborates on the elements of a theory of institutional change in which shifts in the demand for institutional change are induced by changes both in the relative prices of factors and products and in the technology associated with economic growth, and in which shifts in the supply of institutional change are induced by advances in knowledge in the social sciences and in fields such as law, business, social service, and planning. Considers the implications of imperfections in market organizations in which economic and political resources are exchanged for institutional innovation and for improvements in institutional efficiency. Notes that the proposed theory is incomplete and takes an incrementalist approach to the concept of institutional innovation.

30. **Sanders, J. H., Ruttan, V. W.** 1978. Biased choice of technology in Brazilian agriculture. In H. P. Binswanger and V. W. Ruttan (Eds.), *Induced innovation: Technology, institutions, and development* (pp. 276-296). Baltimore, MD: Johns Hopkins University Press.

Technical progress / Prices / Policy / Mechanization / Brazil

Analyzes the effects of over-valued exchange rates and subsidies to mechanization on technical change in Brazilian agriculture. Concludes that the resulting distortion in factor prices has affected both the choice of available technology and the direction of technical change. Consequences include more rapid mechanization and less rapid growth in the demand for labor in rural areas than would have occurred in the absence of governmental manipulation. Larger farmers in the south appear to be the primary beneficiaries; widening the income disparities among regions is another effect.

31. **Scers, D.** 1981. The meaning of development. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development. Vol. 1: International experience in communication and innovation* (pp. 7-23). Chichester, England: John Wiley.

Economic development / Planning / Developing countries

Raises fundamental issues involved with development. Attempts to define development and points out that a plan which conveys no targets for reducing poverty, unemployment, and inequality can hardly be considered a development plan. Delineates some of the problems of measurement involved with development and focuses attention on the internal consistency of the development process.

32. **Trigo, E., Pineiro, M.** 1983. Foundations of a science and technology policy for Latin American agriculture. In M. Pineiro and E. Trigo (Eds.), *Technical change and social conflict in agriculture: Latin American perspectives* (pp. 165-173). Boulder, CO: Westview Press.

Technology / Science / Policy / Public sector / Latin America / National research programs

This paper offers guidelines for the definition of science and technology policy for Latin American agriculture during the 1980s. Suggests that the profound transformations undergone by the agricultural sectors in most countries have substantially altered the role of the public sector in the innovation process. Discusses the establishment of the national research institutes and the context in which technology became an important social question. Also considers the emergence and resolution of problems within the institutes. Priorities for technological policy are examined.

33. **Uphoff, N.** 1981. Farmers' participation in project formulation, design and operation. In promoting increased food production in the 1980s: Proceedings of the

Second Annual Agricultural Sector Symposia, January 5-9, 1981. 48 pp.

Agricultural development / Development projects / Social participation / Developing countries

With policy guidelines of donor agencies endorsing greater participation in rural development and food production efforts, there remains considerable ambiguity about what is meant by "participation" and how to provide for and support it in projects. Section I tries to provide a sharper focus on the subject, disaggregating it in ways that clarify the application of "participation" to project activities. A review of experience with three World Bank projects for integrated rural development in Sections II, III and IV gives examples. Other experiments with participation are considered in section V. Two final sections deal with general and specific considerations relating to increasing farmers' participation in project formulation, design and operation. It is often difficult to achieve the goals of participatory development, but the climate of support seems to be improving as the failures of non-participatory approaches accumulate. Examples in the paper come from Nepal, Ghana, Mexico, Philippines, Taiwan, South Korea, Yemen, Ecuador, and Nicaragua.

34. **Wortman, S., Cummings, R. W., Jr.** 1978. *To feed this world: The challenge and the strategy.* Baltimore, MD: Johns Hopkins University Press. 440 pp.

Agricultural development / Agricultural policy / Utilization

This volume is a clear, simple summary of the World Food Crisis: both problems and possible solutions. It is intended for the

concerned citizen and policy maker rather than specialists. The authors argue that rapid population growth must call forth a strategy of forced-pace agricultural and rural development in the developing countries and that success for such a strategy is now possible. The essential elements in such a strategy include improved farming systems, instruction of farmers, reliable input supplies, and availability of markets for their production. A number of strategies for providing these elements to the broad base of farmers are described, together with examples of their use. The authors conclude with a plea for an organized effort at the national and international levels to mobilize the resources necessary for the task.

35. **Yeung, P., Roe, T. L.** 1978. A CES test of induced technical change. In H. P. Binswanger and V. W. Ruttan (Eds.), *Induced innovation: Technology, institutions, and development* (pp. 243-260). Baltimore, MD: Johns Hopkins University Press.

Technical progress / Models / Japan

Reports on the effort to develop a modified constant elasticity of substitutions (CES) production function that will permit the measurement of both the rate of technical change and the effect of factor prices on factor augmentation. Also offers a test for hysteresis, the tendency for a firm, an industry, or an economy to remain locked into a particular path of technical change. Examines an empirical test of the induced innovation hypothesis within the framework of the adopted CES model: data from Japanese agricultural development from 1880 to 1940. Also discusses methods for making parameter estimates of the CES production function.

Policy and Planning

36. **Abbott, J. C.** 1967. The development of marketing institutions. In H. M. Southworth and B. F. Johnston (Eds.), *Agricultural development and economic growth* (pp. 364-398). Ithaca, NY: Cornell University Press.

Marketing / Institutions / Developing countries

Comprehensive examination of marketing institutions in developing countries. Discusses the role of marketing in development, noting that the two basic requirements for enabling market demand to provide production incentives are: (1) reasonably stable prices; and (2) adequate marketing channels and facilities. The need for investments in marketing is discussed at some length, identifying the following marketing components as being necessary in a functioning market system: (1) processing; (2) storage, as adequate facilities are often lacking in developing countries; and (3) transportation. The importance of public input into marketing are emphasized, including: (1) training of individuals to fill marketing posts; (2) establishing marketing departments in government services; (3) providing market information; (4) regulating sales practice and determining quality standards; and (5) regulating the market. The roles of private firms, public enterprises and cooperatives are also examined. The adequacy of pricing systems, price formation, competition, and marketing costs, efficiency and channels are discussed.

37. **Adams, D. W.** 1978. Mobilizing household savings through rural financial markets. *Economic Development and Cultural Change*, 26, 547-560.

Savings / Rural areas / Developing countries

In early stages of development most low income countries must rely heavily on agriculture for capitalizing their economies. Yet only a few have stressed mobilization of voluntary household savings through rural financial markets, because it has been assumed that households are too poor to save.

Argues that substantial voluntary savings capacities exist, and that household savings are strongly influenced by rural financial markets. Gives an outline of household decision-making processes which determine savings behavior followed by a discussion of how financial market relate to household behavior. Shows evidence on the extent of household saving capacities from Taiwan, Korea, Japan, Malaysia, India, Zambia, and Kenya. Finally, reviews the benefits which result from mobilization of voluntary rural financial savings and gives suggestions on savings mobilization strategies.

38. **Ashby, J. A.** 1981. New models for agricultural research and extension: The need to integrate women. In B. C. Lewis (Ed.), *Invisible farmers: Women and the crisis in agriculture* (pp. 144-195). Washington, DC: Agency for International Development.

Developing countries / Agricultural research / Extension / Women / Technology development

Argues that new agricultural research and extension strategies need explicitly to encompass women as participants if objectives of increased agricultural productivity and equity are to be attained. Presents a cross-national survey of the current needs, problems and policy measures associated with developing agricultural extension services which benefit women as well as men. Includes an extensive list of references relating women to agricultural extension in developing countries.

39. **Barker, R., Hayami, Y.** 1976. Price support versus input subsidy for food self-sufficiency in developing countries. *American Journal of Agricultural Economics*, 58, 617-623.

Subsidies / Agricultural policy / Price policy / Philippines / Developing countries

Self-sufficiency in food grains has been a goal of government policy in many

developing countries. Among policy options to achieve this goal, two, outright price support and fertilizer subsidy, both characterized by government intervention into market pricing, are evaluated for the Philippine rice economy. Results demonstrate a possibility that subsidies to modern inputs, such as fertilizer, that are being used below optimum, can be more beneficial than supporting product prices.

40. **Johnson, G. L., Rossmiller, G. E.** 1978. Improving agricultural decision making: A conceptual framework. In G. E. Rossmiller (Ed.), *Agricultural sector planning: A general system simulation approach* (pp. 23-51). East Lansing, MI: Agricultural Sector Analysis and Simulation Projects, Department of Agricultural Economics, Michigan State University.

Decision making / Agricultural policy / Systems analysis

Discusses the situation of the agricultural policy decision maker, particularly in a developing country. Presents the information and tools available to assist in various conceptual models of the decision making process. Discusses the use of a general system simulation approach.

41. **Krishna, R.** 1967. Agricultural price policy and economic development. In H. M. Southworth and B. F. Johnston (Eds.), *Agricultural development and economic growth* (pp. 497-547). Ithaca, NY: Cornell University Press.

Price policy / Developing countries / Agricultural policy

This classic article is a summary of knowledge on pricing policy for "excess demand" countries with dense populations. It aims to derive general principals and norms of policy rather than to discuss the empirical details of particular situations. Objectives of price policy in Western Europe and the United States have been price stabilization and income stabilization. Terms of

trade have generally been against agriculture, both to keep food, bread, and raw materials cheap for the growing industrial sector, and to transfer to the city for investments the profits and taxes from agriculture. Nevertheless, for agriculture to sustain necessary growth rates, it is increasingly clear that price incentives are needed. Such positive price policy has three functions, to accelerate or decelerate output of particular crops, or to secure increases in marketed supplies of food crops in semi-subsistence economies. The price responsiveness of single crops is discussed in detail, with a strong pattern of responsiveness to price increasing with degree of commercialization of that crop. The magnitudes of response depend on the total regional economy, and availability of resources and alternatives rather than intrinsic differences in farmers. Guidelines for effective pricing policies are discussed at some length. The article also notes that although pricing policy contributes to agricultural growth, it cannot alone bring it about; transformation of traditional agriculture is primarily a techno-organizational effort.

42. **Miller, L. F.** 1977. *Agricultural credit and finance in Africa*. New York: Rockefeller Foundation. 115 pp.

Agricultural credit / Finance / Africa

This book constitutes a primer on agricultural credit. It includes definitions, common credit interventions analyzed in terms of their strengths and weakness, and "how to do it" sections on record keeping and analytic tools such as income statements, balance sheets, compounding, discounting and capitol budgeting. It discusses a number of approaches to small farmer finance problems, and gives practical advice on how to avoid problems often encountered by government financial institutions.

43. **Cram, P. A.** 1981. Recurrent cost problems of agricultural research and

extension in developing countries. Washington, DC: International Food Policy Research Institute. Paper prepared as working document no. 9 for the Workshop on Linkages Between Agricultural Research on Farmers in Developing Countries, 13th-14th May 1981, Paris, France, sponsored by the Organization for Economic Cooperation and Development. 41 pp.

Agricultural research / Extension / Economic evaluation / Research policy / Developing countries

Notes the distressing downward trend in developing countries, particularly in Latin America, in the number of scientists trained in agricultural research. Points out the urgency for the training of scientists particularly at the higher levels. Extension poses different problems as there is no comprehensive study of extension services in developing countries and the resources allocated to them. Suggests that a further comparative analysis and evaluation of the costs, returns, manpower, equipment and training requirements of alternative approaches and systems of transferring research results to farmers would be worthwhile. Concludes with a section on types of action that might be taken to economize on recurrent costs. Includes several tables in the annex such as research expenditures for 65 countries, 1975 and 1980; research and development expenditures as a percent of GNP and ratio of technicians to scientists and engineers; staffs and expenditures for agricultural research and extension systems in 36 low-income countries; regional education and training costs for research and extension services; and limitations on ability to finance recurrent expenditures.

44. **Pineiro, M., Trigo, E.** 1983. Public policy and technical change in Latin American agriculture. *Food Policy*, 8, 46-66.

Technical progress / Case studies / Agricultural policy / Methodology / Latin America

Analyses and interprets the modernization and technical change of Latin American agri-

culture over the past two decades. Discusses the conceptual framework that was used for evaluating the technical change process in eight case studies. Analyses the innovation process through the case studies of various products in a variety of countries and methods of production. Provides a general interpretation of technical change and the public policy process in Latin American agriculture.

45. **Ruttan, V. W.** 1982. Agricultural research policy. Minneapolis, MN: University of Minnesota Press. 369 pp.

Agricultural research / Research policy / Technology development

Assumes that the ability to develop and manage an agricultural technology appropriate to a nation's physical and cultural endowments is the single most important variable in achieving an increase in productivity. This book on issues of agricultural research policy addresses the problem of how to maximize gains by rethinking the organization and goals of global, national and local systems of agricultural research. Asserts that an effective research institution must relate its goals to the particular economic and political environment in which it operates and discusses the ethical and social consequences of technological change. Reviews the criticisms that have been levelled against agricultural development and attempts to provide research scientists and managers a larger context within which to make responsible decisions. Main chapters cover: implications of factor endowments for agricultural research strategy and planning; behavioral and institutional aspects of research and development; historical developments of national systems in the U.S., Germany, United Kingdom, India, Malaysia, and Brazil; international research institutes; quality controls; location, size and publicly vs. privately funded research; implications of institutional and grant funding; results and the contribution of research to output and productivity growth; application of increasingly formal resource allocation

procedures; social science research related to agriculture and rural development; and social and moral responsibilities.

46. Shapiro, P. S. (Ed.) 1982. Technology and science in World Bank operations. Washington, DC: World Bank. Various pagings.

Technology / Science / Policy / World Bank

Intended to inform both generalists and specialists about the workings of a multilateral lending institution from the point of view of technology and to provide a factual basis for those interested in policies and programs related to the application of science and technology to meet development objectives. Of particular interest is the chapter on Technology and Science in Agriculture and Rural Development. Presents the Bank's strategy for investing in the agricultural sector, research and extension, and training and education. The final section of the chapter outlines the lessons learned from the Bank's experiences in implementing over 600 projects in agriculture and rural development.

47. Stewart, F. 1979. International technology transfer: Issues and policy options. Washington, DC: World Bank. 116 pp. (World Bank staff working papers no. 344).

Technology transfer / Development policy / Developing countries

Surveys the issues raised by technology transfer to developing countries. Technology is a vital part of the development process, a necessary input into all activity. Because of the historical domination of research and development by developed countries, a very large part of the technology used is transferred from developed countries. The transfer raises four major issues: those of the costs of the transfer, the appropriateness of products and techniques which are trans-

ferred, the effects of transfer on learning and technological development in LDCs, and the effects on independence. Considers the consequence of the transfer and the range of policies that might be adopted, nationally and internationally, in relation to each of these issues. Argues that the appropriate policies will vary according to the stage of development of each country, its technological capacity and its own objectives. However, in general, concludes that an active technology policy is called for if the costs associated with technology transfer are to be reduced and the benefits increased.

48. Timmer, C. P., Falcon, W. P., Pearson, S. R. 1983. Food policy analysis. Baltimore, MD: Published for the World Bank by Johns Hopkins University Press. 301 pp.

Food policy / Agricultural development / Decision making

The authors argue that solutions to the problem of hunger lie in understanding the food system--the processes that produce agricultural commodities on farms, transform these commodities into foods, and markets them. Their analysis has three components; the behavior of food consumers and food producers, the effects of micro-economic forces on the performance of the food system, and the role of markets, both domestic and international, in linking household issues in the micro sector to policy issues in the macro economy. Chapter 3, Analysis of Food Production Systems (p. 77-147), is of particular interest, addressing four questions about national food production systems: (1) What are the agricultural sector objectives? (2) How do farmers make decisions? (3) What government interventions are available to change household decision making and thereby, the performance of the food producing sector? (4) What are the elements of a successful agricultural development strategy? There are bibliographic essays at the end of each chapter.

Technology Development

49. **Ampuero, E.** 1981. Cooperation between national research organizations and international centers: Opportunities and limitations. Ithaca, NY: Program in International Agriculture, Cornell University. 14 pp. (Cornell international agriculture mimeograph 87).

Agricultural research / Public sector / Technology development / National research programs / International agricultural research centers

Examines the present strategy for cooperation between the International Agricultural Research Centers and national research centers. Also looks at the present state of the national research institutions. The need for such an examination is evident as national programs expand, and as interrelationships and influence between the international centers and the countries are constantly growing. Suggestions to facilitate and improve linkage and cooperation between the international and national research centers include: (1) increase ties between the centers and the countries at the regional level; (2) encourage the organization of regional programs to achieve self-sufficiency with their own resources; (3) ensure that the most highly qualified scientists and research of the developing countries take a stronger role in the planning, determination of priorities, and evaluation of the international centers; (4) encourage formation and coordination of stronger linkages between the international research centers; and (5) encourage national research centers to clearly define their respective roles at the national level so that the countries know what to expect from the centers.

50. **Ampuero, E.** 1981. Organization and administration of experiment stations in developing countries. Ithaca, NY: Program in International Agriculture, Cornell University. 27 pp. (Cornell international agriculture mimeograph 86).

Technology development / Organizations / Management / Administration / Developing countries / Experimental stations

Examines in detail the requirements that must be considered when setting up experiment stations in developing countries, with special reference to Latin America. All aspects of establishing experiment stations are examined, including number of stations, location, organization, and operations (i.e., administrative support, budget, institutional coordination, training and technology transfer). The physical complex is also considered such as number of experimental plots, laboratories, greenhouses and a network of services and facilities.

51. **Ampuero, E.** 1981. Organization of agricultural research for the benefit of small farmers in Latin America. Ithaca, NY: Program in International Agriculture, Cornell University. 31 pp. (Cornell international agriculture mimeograph 85).

Technology development / Agricultural research / Institutions / Technology transfer / Small farms / Latin America

Discusses the structure, scope, performance and shortcomings of agricultural research institutions in dealing with the problems of small, traditional farmers, referring especially to Latin America. Identifies some reasons for their frequent failure to serve the needs of this group that include: (1) irregular financial support; (2) researchers' inadequate understanding of the socio-economic reality of the farmers; and (3) lack of coordination between researchers and extensionists. Experience gained from the green revolution, the Puebla Project and other sources is examined. Analyzes a research program initiated in Ecuador in 1977 involving maize, wheat, rice, potatoes, and dairy production systems. Intensive effort was devoted to ensure the direct participation of the small farmers.

52. **Anderson, R. S., Brass, P. R., Levy, E., Morrison, B. M. (Eds.)** 1982. Science, politics, and the agricultural revolution in Asia. Boulder, CO: Westview Press for the American Association for the Advancement of

Science. 512 pp. (AAAS selected symposium 70).

Agricultural development / Asia / Green revolution / Research policy / Politics

Agriculture in southern Asia has undergone a radical transformation in recent years, one that continues to alter the political economy of the area. Beyond the familiar elements of the green revolution, there has been an increase in resource exploitation for food production, and a rise in the economic and political strength of food producers, as well as the emergence of new political parties, land reform, and class polarization. In this context, the authors of the various papers review the experience of Asian farmers with commercial agriculture and the role of research institutions in fostering commercialism. They examine major issues associated with the "technology-first" phase of the agricultural revolution, then explore alternate routes to productive agriculture and rural development. After looking at specific examples of the interplay between science, technology, and agricultural change in Asia, they point to expected future developments, describe the kinds of research that may be needed for the next phase of agricultural development, and analyze the role of international funding agencies in encouraging what increasingly appears to be inappropriate research. The papers are divided into four groups. Part 1 reviews the experiences of the cultivators with commercial agriculture in South Asia and the role of the research institutions, including the agricultural university at Pantnagar. Jointly they identify some of the major issues associated with high-yielding varieties (HYV's) or the technology-first phase of the agricultural revolution. Part 2 examines alternative routes to productive agriculture and rural development. Building from a specific focus on dry land agriculture, independent smallholder innovation or the Chinese transition from provincial self sufficiency to regional specialization, these papers point to future developments. Part 3 raises the question of the role and responsibility of rice scientists in the

technology-first phase and the change in assumptions and in research which will probably accompany the next phase. The final section reviews the role of "underwriters", the major international funding agencies which support agricultural research and development. It discusses the responsibility of those who define the way in which agricultural problems will be approached.

53. Andrew, C. O., Hildebrand, P. E. 1982. Planning and conducting applied agricultural research. Boulder, CO: Westview Press. 94 pp. (A Westview special study).

Agricultural research / Methodology / Planning

Focuses on applied research as a service to a client with a problem that research can help solve. Because applied research has a definite purpose, there is usually a time constraint, a deadline by which the work must be completed, as well as a limit on the resources the client has available or is willing to use. Consequently, the researcher must concentrate on the efficient use of the research resources while trying to maximize the likelihood of providing a useful product. The book offers an approach to identifying researchable problems and proceeding efficiently to their resolution.

54. Barker, R., Herdt, R. W. 1982. Setting priorities for rice research in Asia. In R. S. Anderson, P. R. Brass, E. Levy, and B. M. Morrison (Eds.), Science, politics, and the agricultural revolution in Asia (pp. 427-461). (AAAS selected symposium 70). Boulder, CO: Published by Westview Press for the American Association for the Advancement of Science.

Agricultural research / Rice / Asia

Reports the results from an exercise undertaken by the International Rice Research Institute (IRRI) to clarify its own research priorities. The paper is divided into five parts: (1) sketches the historical development of rice breeding research in

Asia; (2) reviews the productivity of research investment and the structure of the research system; (3) discusses methodologies for establishing priorities among rice research programs; (4) presents the results of the analysis; and (5) discusses the implications of these results for rice research in Asia.

55. **Engstrom, M. L.** 1983. Rural development research and agricultural innovations: A comparative study of agricultural changes in a historical perspective and agricultural research policy for rural development. Uppsala, Sweden: Department of Plant Husbandry, Swedish University of Agricultural Sciences. 377 pp. (Rapport/Report 115).

Agricultural research / Research policy / Extension / Technology transfer / Linkages / Ethiopia / Trinidad and Tobago / Sweden / Methodology / Innovation adoption / Case studies

Focuses on the research orientation in agronomy, technical changes, the adoption of innovations and agrarian change over time for different categories of farmers. Three case studies provide empirical data on soil fertility, crop cultivars, cultural practices, weeds, pests, diseases, yield developments and major agricultural innovations. Compares the main thrust of agricultural research policy in the three case studies from Trinidad and Tobago, Ethiopia and Sweden. Compares also the organization and methodology of the extension services in each of the cases. Concludes that there is a need for changes in research policy using an analytical framework that takes into consideration the complexity of the problem areas. Also calls for research to take into consideration the farmer-level needs in problem identification.

56. **Einswanger, H. P., Ryan, J. G.** 1980. Village-level studies as a locus for research and technology adaptation. In V. Kumble (Ed.), Proceedings of the International Symposium on Development and Transfer

of Technology for Rainfed Agriculture and the SAT Farmer, 28 August - 1 September 1979 (pp. 121-129). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology development / Adaptation / International agricultural research centers

Discusses several traditions of socio-economic inquiries in India and then shows how the village-level studies (VLS) of ICRISAT combine several features of previous traditions in a novel way. The objectives, scope, and results of the socioeconomic observation phase of the VLS are discussed, together with a description of the ongoing research and adaptation phase of the studies. Views VLS as a locus for many types of socioeconomic inquiries and adaptive technology development and research efforts. Attempts to impart a grassroots approach to technology development at ICRISAT.

57. **Blase, M. G., Mann, F. L., Taylor, C. S.** 1981. Methodologies and PMC system development. In E. G. Knox and A. A. Theisen (Eds.), Feasibility of introducing new crops: Production-marketing-consumption (PMC) systems (pp. 5-21). A report prepared for the National Science Foundation by Soil and Land Use Technology, Columbia Maryland. Printed by the Rodale Press, Emmaus, Pennsylvania.

Technology development / Methodology / Systems analysis

Describes the methodology used in studying established and potential new crops in order to elucidate the production-marketing-consumption (PMC) system concept and its application to the crop introduction process. Shows how a systems approach was utilized to collect, synthesize, and analyze information on PMC systems. Much of the work was primarily descriptive; however, a farm-level linear program was used to evaluate one type of production and a simulation model was developed to examine the functioning of another system. The second section describes the systems approach used to

anticipate, identify, evaluate, monitor, and coordinate interactions so that participants located in different components are made aware of developments elsewhere in the system.

58. **Boyce, J. K., Evenson, R. E.** 1975. *Agricultural research and extension programs: National and international*. New York: Agricultural Development Council. 229 pp.
Extension / Agricultural research

Discusses annual investment levels for agricultural research by major world regions. Differentiates between agricultural research in the public and private sectors. The measure used is the number of papers abstracted in Dairy Science Abstracts, Plant Breeding Abstracts and Biological Abstracts. Stresses the commodity emphasis of research.

59. **Bunch, L., Lacy, W. B.** 1983. *Science, agriculture and the politics of research*. Boulder, CO: Westview Press. 303 pp. (Westview special studies in agricultural science and policy). (Rural studies series of the Rural Sociological Society).

Agricultural research / Communication / Management

Reviews the rise of public agricultural science in the latter part of the last century, and provides an overview of the contemporary agricultural research enterprise. Provides a demographic profile of agricultural scientists, discussing, in particular, the influence of age, race, sex, family origins, and education upon research problem choice. Analyzes the role of formal and informal communications in agricultural research. The disciplinary, organizational, and extraorganizational influences on research are discussed. The last part of the book discusses for whom and for what purpose research is conducted.

60. **Byerlee, D., Collinson, M.** 1980. *Planning technologies appropriate to*

farmers: Concepts and procedures. Mexico, DF: Economics Program, Centro Internacional de Mejoramiento de Maiz y Trigo. 71 pp.

Technology development / Methodology / On-farm testing / Developing countries / Farming systems

Prepared for professionals involved in research on improving agricultural technology for farmers. Treats issues related to a single crop within the farmers' total cropping system. The manual is divided into three parts. Part I provides an overview of the concepts of a collaborative research process to deliver technologies appropriate to farmers and of the types of information regarding farmer circumstances that are needed for planning this research. Part II describes a set of procedures, with examples, for obtaining information from farmers at relatively low costs. Part III then provides procedures and examples for incorporating this information into the design of a research program. Does not treat the management of on-farm experiments, the second dimension of on-farm research.

61. **CIMMYT Economics Staff.** 1984. *The farming systems perspective and farmer participation in the development of appropriate technology*. In C. K. Eicher and J. M. Staatz (Eds.), *Agricultural development in the third world* (pp. 362-377). Baltimore, MD: Johns Hopkins University Press.

Technology development / Methodology / Farming systems / Social participation

Describes research methods conducted with a farming systems perspective that emphasize farmer participation in the research process. First, conceptual and definitional issues related to this approach are discussed. Then research methods that are consistent with the resources of national agricultural research programs and that should receive high priority in efforts to improve the effectiveness of these programs are presented.

62. **Collinson, M., Kean, S., Ebenkele, E., Parker, J. M. H., Vernon, D., Prior, A.** 1981. Demonstration of an interdisciplinary approach to planning adaptive agricultural research programs in the Serenje District, Central Province, Zambia 1978. Mexico, DF: International Maize and Wheat Improvement Center. 38 pp.

Technology development / Adaptation / Farm management / Maize / Zambia / On-farm testing

Presents the results of work conducted in conjunction with the Zambian agricultural research program whose objective was to describe farmer circumstances in a maize-producing region. It emphasizes the use of secondary data and informal and formal survey techniques for identifying potential research avenues for improving maize technology in the region. Illustrates productivity improvements that could be obtained from new management practices diagnosed as appropriate to the circumstances of the mass of farmers in the area.

63. **Collinson, M.** 1984. Diagnosing the problems of small farmer needs. In T. J. Davis (Ed.), Proceedings of the Fourth Agricultural Sector Symposium (pp. 124-146). Washington, DC: World Bank.

Technology development / Farming systems / Linkages / Small farms

Organized into six sections. Section one discusses the terminology of farming systems research (FSR) and emphasizes the importance of effective problem identification to the development of small holder agriculture. Section two outlines some important concepts underpinning the application of FSR as a means of effective problem diagnosis. Sections three and four respectively detail an FSR approach and discuss FSR methods. Section five reviews potentials for FSR in technology generation and through this in linking research, extension and farmers. FSR's role in project identification, preparation, and policy formulation is also considered. The final section sets out some needs if these potentials are to be realized.

64. **Collinson, M.** 1984. On farm research with a systems perspective as a link between farmers, technical research and extension. Paper presented to the African Workshop on Extension and Research, Eldoret, Kenya, June 10-16, 1984. 11 pp.

Technology development / Linkages / On-farm testing / Extension / Africa / Farming systems

Outlines the systems approach used by on-farm research/extension to review technical research outputs and to identify and modify, where necessary, those most relevant to the current needs of local specific groups of farmers. Shows the roles that the farming systems perspective plays in linking research, extension and farmers. Delineates some of the operational linkages that have been used in selected African countries for introducing the farming systems perspective into the agricultural planning process.

65. **Collinson, M. P.** 1982. Farming systems research in Eastern Africa: The experience of CIMMYT and some national agricultural research services, 1976-81. East Lansing, MI: Department of Agricultural Economics, Michigan State University. 61 pp. (MSU international development paper, no. 3).

Farming systems / Training / Surveys / East Africa / Kenya / Zambia / Agricultural research

Reports on CIMMYT's (International Maize and Wheat Improvement Center) experience helping to institutionalize farming systems research (FSR) methods in national agricultural research services in Eastern and Southern Africa from 1976 to 1981. Focuses on the need to develop cost-effective research programs that are compatible with small pools of trained scientists and limited budgets for recurrent expenses. Discusses a number of lessons learned including: (1) the use of conducting demonstrations of FSR; (2) the use of the exploratory (informal) survey as the pivotal step in diagnosing the farming system; (3) problems encountered by

junior economists when trying to work effectively with senior technical scientists; (4) how the agricultural research system in Zambia was reorganized based on the Kenyan FSR experience; and (5) the need for linkages between FSR and in-service and short-term training workshops. Questionnaire for exploratory surveys included. Table outlines the procedural steps in the adaptive research cycle.

66. **Coulter, J. K.** 1983. The interdependence of research and extension: A comment. In M. M. Cernea, J.F.S. Russell & J. K. Coulter (Eds.), *Agricultural extension by training and visit: The Asian experience* (pp. 49-52). Washington, DC: World Bank.

Technology development / Extension / Linkages / Research / Assessment

Presents a critical analysis of Mehta's paper which notes that improved technology is one of the essential components of an effective extension system. Where such technology is not available, overoptimistic expectations of what can be generated by adaptive research, can be counterproductive. The expectations of simple, low cost solutions to the problems of farming will be unfulfilled unless more realistic assessments of the problems are made.

67. **Coulter, J. K.** 1983. International technology: The international agricultural research centers. In M. Pineiro & E. Trigo (Eds.), *Technical change and social conflict in agriculture: Latin American perspectives* (pp. 175-187). Boulder, CO: Westview Press.

Agricultural research / Research policy / Linkages / International agricultural research centers

Presents a brief history of the international agricultural research centers. Notes how the emphasis shifted, during the 1950s through the 1960s, from extension services to research, primarily as a result of the "green revolution". Attempts to chart the future of agricultural research centers,

taking into account the role of the Consultative Group for International Agriculture Research (CGIAR) formed in 1971. Stresses the need for: (1) coordination between the centers and individual national policy makers; and (2) setting priorities.

68. **Council for Agricultural Science and Technology.** 1984. *Development of new crops: Needs, procedures, strategies, and options*. Ames, IA: Council for Agricultural Science and Technology. 30 pp. (Report no. 102).

Technology development / Models / Innovation adoption / Methodology / Systems analysis

Presents the findings of a team of researchers on the needs for research and development of new crops. Outlines the methodology for developing new crops as well as adapting and modifying present species to supply new products. Of particular interest is the conceptual production-marketing-consumption system developed by Knox and Theisen to aid in assessing the probable success of a potential new crop. Components of the system are listed in a table which identifies 40 items that require attention in new crop development. The neglect of or failure to implement only one of these items may lead to failure.

69. **Crawford, P. R., Barclay, A. H., Jr.** 1982. *AID experience in agricultural research: A review of project evaluations*. Washington, DC: Office of Evaluation, Bureau for Program and Policy Coordination, U.S. Agency for International Development. 257 pp. (AID program evaluation discussion paper no. 13).

Agricultural research / Agency for International Development

Reviews the experience of the U.S. Agency for International Development (AID) in the area of agricultural research. Reviews the historical trends in agricultural research, especially of AID's expenditure in that sector. Identifies the set of projects

comprising AID's agricultural research portfolio. Delineates major issues affecting the design and implementation of agricultural research projects by reviewing evaluations of a sample of those projects. Includes a review of the literature and, from interviews with various professionals, identifies several recent trends in agricultural research.

70. **Cummings, R. W., Jr.** 1981. Strengthening linkages between agricultural research and farmers: An overview. New York: Rockefeller Foundation. Paper prepared as a background document for the Workshop on Linkages Between Agricultural Research and Farmers in Developing Countries, 13th - 14th May 1981. 25 pp.

Agricultural research / Extension / Linkages / Developing countries / Technology development / Technology transfer

Begins with an overview of the technology development process which includes three principal action agents: (1) the research service; (2) the farmers advisory service; and (3) the farmers. Points out the significant influence the service institutions and government policies have on the process. Delineates some of the weaknesses presently seen in the effectiveness of the various types of agents and points out the key variables in the technology development process. Raises the issues that need resolution for better linkages between agricultural research systems and the farmer. Outlines some objectives to be pursued in accelerating agricultural development. Points out the information needed on agro-climatic conditions, social and cultural characteristics, institutional and infrastructural performance, and technical potential to plan effective technology development programs. Presents strategies for technology development through discussion of the interrelated components of generation, assessment and diffusion. Discusses the role organizations play in the process and the need to identify alternative means of implementation. Concludes with a section on the implications for assistance from donor agencies.

71. **Dalrymple, D. G.** 1977. Evaluating the impact of international research on wheat and rice production in the developing nations. In Arndt, T.M., Dalrymple, D. G., and Ruttan, V. W. (Eds.), Resource allocation and productivity in national and international agricultural research (pp. 171-208). Minneapolis, MN: University of Minnesota Press.

Agricultural research / International agricultural research centers / Evaluation / Wheat / Rice / Developing countries / Methodology

Outlines the main conceptual and empirical considerations in evaluating the impact of international agricultural research on crop production in developing countries. Focuses on only one measure: the direct quantitative effect.

72. **Davis, C. G.** 1975. Agricultural research and agricultural development in small plantation economies: The case of the West Indies. Social and Economics Studies, 24, 117-152.

Agricultural research / Institutions / Technology development / West Indies / Jamaica

Attempts to: (1) identify the organizational or institutional framework in which agricultural research is carried out in the West Indies; (2) quantify the kinds and levels of inputs going into the research system; (3) identify the distributional aspects of certain research inputs for domestic and export research systems as well as assess any fundamental differences in the orientation of the two systems; and (4) assess the economic implications of existing organization and research structure on the agricultural development potential of the region. The objectives are approached from both the research input side and from the output side. West Indian agricultural research systems are heavily concentrated on 'adaptive research' which appears to be largely stock importation and varietal trials for adaptability. The general exception to

the situation appears to be the new indigenous hybrid maize varieties X304 and X306 developed in Jamaica. These inputs appear to be the only generally 'new' high potential biological input to emerge from domestic research systems up to 1969.

73. **Donaldson, G.** 1984. Technology in agricultural development. In C. Weiss & N. Jequier (Eds.), *Technology, finance and development: An analysis of the World Bank as a technological institution* (pp. 19-34). Lexington, MA: Lexington Books.

Technology development / Technology transfer / Agricultural development / World Bank

Suggests that one of the central functions of an agricultural project is to serve as a vehicle for technological change. Recognizes three main variables in a technology development strategy for agriculture. The first is the technology package of on-farm inputs (machinery, improved seeds, fertilizers, irrigation equipment); the second is the physical infrastructure (roads, dams, irrigation systems, storage facilities); and the third is the institutional infrastructure (credit institutions, extension services, distribution services) and the overall policy measures taken by the government to promote agricultural development. Shows how the Bank's technology strategy in this sector has evolved over the years and examines its role as a direct sponsor of particular kinds of technology, as the indirect instigator of further investment in new technology, and, more recently, as the direct originator of new technology.

74. **Drilon, J. D., Jr., Pantastico, E. B.** 1980. Philippine experience in crops in dry areas. In V. Kumble (Ed.), *Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer*, 28 August-1 September 1979 (pp. 251-264). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology development / Philippines / Farming systems

Discusses the introduction of cropping patterns into areas with old, established cropping practices into portions of the Philippines that have a dry period between November and April. Crop production trends in the wet, wet-and-dry, and dry areas reflects the influence of environmental parameters, e.g., amount of rainfall, temperature, relative humidity, soil fertility and texture, and market situation. Applied research trials were conducted to gain and establish confidence that the new package of technology would be adaptable to actual conditions. The trials emphasized the selection of the testing site, design and testing of the cropping system in the farmers' fields, and a series of data evaluation. The KABSAKA technology, incorporating two rice croppings and one upland crop for the rainfed areas, was developed from the applied research trials and has given excellent results. With appropriate modifications, the technology can be adopted for other areas.

75. **Eklund, P.** 1983. Technology development and adoption rates: Systems for agricultural research and extension. *Food Policy*, 8, 141-153.

Technology development / Methodology / Farming systems / Linkages / Developing countries

Discusses the need to take the farming system as a whole into account when designing experimental methodologies for research. Defines technology development as differentiated from scientific research. Notes how the management of technology development requires clearly stated government objectives for the type of agricultural development to be pursued. Gives the institutional linkages necessary to make the technology development and diffusion process operational.

76. **Elz, D. (Ed.)** 1984. *The planning and management of agricultural research.*

Washington, DC: World Bank. 143 pp. (A World Bank and ISNAR symposium).

Agricultural research / Management / Planning / Developing countries / Linkages

Stresses the importance of improved agricultural performance, particularly among small farmers, who make up the bulk of the population in many developing countries. Predicts that future growth in agricultural output will depend substantially on improved farming technologies. Looks at the World Bank and the International Service for National Agricultural Research (ISNAR) in relation to future sources of financing and the problems encountered in agricultural development. Focuses on setting priorities for research, research structure and organization, links between research and extension, financial management and evaluation of research programs, and managing human resources. Paper was presented at a seminar sponsored by the Economic Development Institute of the World Bank and ISNAR, October 31 thru November 10, 1983.

77. **Evenson, D. D., Evenson, R. E.** 1983. Legal systems and private sector incentives for the invention of agricultural technology in Latin America. In M. Pineiro and E. Trigo (Eds.), Technical change and social conflict in agriculture: Latin American perspectives (pp. 189-233). Boulder, CO: Westview Press.

Technology development / Private sector / Law / Policy / Latin America

Discusses the role of private sector research in agriculture in Latin America. Until recently, research sponsored by public institutions was of primary importance, especially in developing countries where the evolution of appropriate patent and other legal systems has failed to keep pace with the competition in international invention. Reviews a series of alternative legal systems that are then compare to Latin American legal systems. Discusses the problem of agricultural patenting, emphasizing two recent developments that will have a

considerable effect, the USDA Plant Variety Protection Act and advances in genetic engineering. Addresses three policy issues: (1) welfare implications of alternative invention stimulation; (2) the specialized requirements of developing countries; and (3) the implications for both public and private sectors. An extensive appendix cites the appropriate patent laws for several Latin American countries and the United States.

78. **Evenson, R. E.** 1984. Benefits and obstacles in developing appropriate agricultural technology. In C. K. Eicher and J. M. Staatz (Eds.), Agricultural development in the third world (pp. 348-361). Baltimore, MD: Johns Hopkins University Press.

Technology development / Developing countries / Appropriate technology

Presents a discussion of the benefits and obstacles to appropriate agricultural technology. The author is concerned mainly with the developing regions of the world and with the possibilities for transfer of technology produced in other regions to these regions. Attention is first given to the relevance of the biological process dimension to the issue at hand. After considering both the premodern and modern approaches to plant and animal improvement through selective breeding, the author discusses the chemical and mechanical dimensions. Finally, the author reviews the evidence regarding the effectiveness of research by agricultural scientists to produce more appropriate agricultural technology for different parts of the world.

79. **Evenson, R. E.** 1977. Cycles in research productivity in sugarcane, wheat and rice. In T. M. Arndt, D. G. Dalrymple, and V. W. Ruttan (Eds.), Resource allocation and productivity in national and international agricultural research (pp. 209-236). Minneapolis, MN: University of Minnesota Press.

Technology development / Wheat / Rice / Sugarcane

Attempts to draw inferences from certain observable aspects of technical change which have relevance for the eventual formal models of technology development. Observed cyclical behavior in realized productivity gains and in tangible measures of technology discovery has served as a basis for inferences regarding the role of scientific knowledge.

80. **Flinn, J. C., Lagemann, J.** 1980. Evaluating technical innovations under low-resource farmer conditions. *Experimental Agriculture*, 16, 91-101.

Technology development / Small farms / Adaptation / On-farm testing / Maize / Innovation adoption / Economic situation / Nigeria

Proposes that before an innovation can be judged as superior to existing technology, its relevance should be jointly evaluated by researchers and farmers by testing the proposed practice in a farm environment. Using a proposed maize technology as an example, it is demonstrated how site-related and management variables can be used to quantify the factors influencing actual yields on farmers' fields. Similarly, economic and management analysis of the practice provides an estimate of the probability of the farmer being better off by using the technology. The integrated analysis of the practice provides insights for the design of problem-oriented research projects.

81. **Flora, C. B.** 1983. Farming-systems research and farm-management research: What's the difference? *Rural Sociologist*, 3, 292-297.

Farming systems / Farm management

Discusses the characteristic approaches of farming systems research and farm management research and argues that there are significant differences between them. The farm management approach is concerned with management objectives and efficiency and is suitable to the USA where the goal of farming is the greatest continuing profit.

Farming systems research is more appropriate to developing countries as it attempts to integrate differing goals into programs aimed at limited resource farmers.

82. **Gilbert, E. H., Norman, D. W., Winch, E. E.** 1980. Farming systems research: A critical appraisal. East Lansing, MI: Department of Agricultural Economics, Michigan State University. 135 pp. (MSU rural development paper no. 6).

Farming systems / Methodology / Training

Intensive examination of farming systems research (FSR). Recommends a working definition of FSR and explores various methodologies for implementation. Discusses problems in expanding FSR in national research systems as well as training. Appendix describes several FSR programs including international research centers, i.e., CIMMYT, ICRISAT, IRRI, and IITA, one regional institution in Costa Rica, and national FSR programs in Guatemala, Senegal, and Colombia. Examines FSR according to two programs, the "upstream" type that seeks to generate prototype solutions to facilitate major shifts in the potential productivity of farming systems and "downstream" type that focuses on site specific programs designed to rapidly identify and test innovations which can be easily integrated into existing farming systems.

83. **Gostyla, L., Whyte, W. F.** 1980. ICTA in Guatemala: The evolution of a new model for agricultural research and development. Ithaca, NY: Rural Development Committee, Center for International Studies, Cornell University. 48 pp. (Special series on agriculture research and extension no. 3).

Agricultural research / Technology development / Social participation / Guatemala

Presents a study of the organizational development of the Institute of Agricultural Science and Technology (ICTA), the research unit in the Guatemala Ministry of Agriculture, which is a leading example of a major

shift in strategy and organization that is occurring in agricultural research and development programs worldwide. The new model that is emerging does not assume that scientists working on stations can promote ready-made technologies that will serve the farmer's interests. Appropriate technologies will only come from an understanding of the local conditions in which they are to be implemented. Research is oriented towards relatively simple technologies which are implementable and profitable at the farm level. The agricultural research organization takes on broader interests in rural development, coordinating its efforts with those of other organizations serving the farmer. Farmer participation in research is also greatly encouraged.

84. **Hart, R. D., Pinchinat, A. M.** 1980. Integrative agricultural systems research. Turrialba, Cost Rica: Centro Agronomico Tropical de Investigacion y Ensenanza. Paper presented at the Inter-Caribbean Seminar on Farming Systems Research Methodology, Pointe-a-Pitre, Guadeloupe, May 5-9, 1980. 14 pp.

Agricultural research / Farming systems

Paper argues that there are strong reasons for putting aside the assumption that complex regional agricultural processes can be improved by independently breeding better crops, setting up more fertilizer experiments, or carrying out another marketing study. Suggests that this reductionist approach should be replaced by a systems approach in which the relationships among agricultural systems receive at least as much attention as the study of the isolated phenomena. Notes that the systems approach requires the integration of an interdisciplinary team of agricultural research specialists. Recommends that the research strategy followed by the team should include regional and farm system studies and experiments with agroecosystems and the biological and physical components that form the agroecosystems.

85. **Harwood, R. R.** 1982. Centralized research and the complexity of social agriculture. In R. S. Anderson, P. R. Brass, E. Levy, and B. M. Morrison (Eds.), *Science, politics, and the agricultural revolution in Asia* (pp. 299-322). (AAAS selected symposium 70). Boulder, CO: Published by Westview Press for the American Association for the Advancement of Science.

Agricultural research / Institutions / Farming systems

Argues that a new conceptual framework is urgently required for agricultural research and that, at present, centralized agricultural research institutions lack some of the capabilities for carrying out the required types of research. Discusses four areas that need to be developed and coordinated in order to remedy the deficiencies in the research systems. These include: (1) the need to better understand appropriate technology components and how they interact within the environment; (2) the ability to put together combinations of components such as crop sequences, crop rotations and crop animal enterprises; (3) the study of the microstructure of farming systems; and (4) research on the macrostructure of farming systems such as off-farm interactions like market structure, energy capital, etc. Concludes that although a good deal of research has been done on farming systems, a more holistic approach to agriculture is needed in order to involve both conceptual and institutional changes in agricultural research.

86. **Harwood, R. R.** 1979. Small farm development: Understanding and improving farming systems in the humid tropics. Boulder, CO: Westview Press for International Agricultural Development Service. 160 pp.

Farming systems / Small farms / Asia / Technology development / Communication / Technology transfer

Aims to help agriculturalists and others better understand farming systems in the humid tropics. Recognizes that the development of a greater number of the world's small

farms requires a shift of emphasis in thinking in technological research and in communications with farmers. Analyzes the several aspects of small farm production systems that foster efficiency in conditions of limited resources. Emphasizes that the blending of traditional and modern technologies may prove to be the key to starting the most disadvantaged farmers along a more rapid development path. Proposes collaborative work among scientists, extension workers, and farmers to both develop and extend relevant technology to resource limited farmers. Concludes with a discussion of the critical aspects of small farm development that are either little emphasized or completely overlooked in current development programs.

87. Hildebrand, P. E. 1980. Motivating small farmers, scientists and technicians to accept change. *Agricultural Administration*, 8, 375-383.

Technology development / Motivation / Technical progress / On-farm testing

Explains that the reason for resistance on the part of small farmers to accepting change is not one of motivation but rather one of not having available technology which is appropriate from these farmers' own points of view. Because of the location specificity of the agrosocioeconomic conditions of small farmers, and because they are not subject to the homogenizing influence of tractors and capital, it is a much greater challenge to develop technology which they will be motivated to accept than it is to develop technology for commercial farmers. The most efficient way is by means of strong multidisciplinary teams who live and work in each area and who orient the technology development work to the needs of the small farmers in their zone. Suggests that this method of technology development will require a drastic change in the traditional role of scientists. It may be necessary to motivate scientists and technicians, as well as farmers, to accept change.

88. International Agricultural Development Service. 1979. Preparing Professional staff for national agricultural research programs: Report of a workshop, Bellagio, Italy, February 16-21, 1979. New York, NY: International Agricultural Development Service. 122 pp.

Agricultural research / Training / Human resources / Developing countries / Public sector

Discusses the need for training and orientation programs in national research programs, international centers, universities, foundations, etc. Defines the specific operational needs of several target groups of agricultural scientists and administrators including young professionals entering into their first major work responsibility, mid-career scientists moving into managerial positions, and senior government officials responsible for policies and priorities in national agricultural development. Discussion at the workshop helped define the types of problems particular to each target group. Includes reports of the three working groups and their recommended programs for each target group.

89. International Agricultural Development Service, International Service for National Agricultural Research, International Federation of Agricultural Research Systems for Development. 1982. The role of international associations in strengthening national agricultural research: Report of a conference, Bellagio, Italy, Dec. 1-4, 1981. The Hague, Netherlands: International Service for National Agricultural Research. 68 pp. (ISNAR - C4).

Agricultural research / National research programs / Institution building / Developing countries

Discusses the potential role of international associations in strengthening national agricultural research in developing countries. It identifies a sample of these associations and notes some general characteristics and behavior by looking into the

association's objectives, activities, and organizational arrangements. Discusses major problems influencing national research systems and activities in developing countries.

90. **Jarrett, F. G.** 1982. Location specificity, critical mass and the allocation of resources to agricultural research. *Agricultural Administration*, 11, 49-65.

Technology development / Agricultural research / Adaptation / Resource allocation

Agricultural innovations have a degree of location specificity. This location specificity makes for limited direct transfer of agricultural innovations developed in one bio-physical environment to other environments. Local adaptation and modification of the original innovation is often necessary. The innovations have to fit into existing farming systems and they may very well slot into one socio-economic environment more readily than another, i.e., both the bio-physical and the socio-economic environments may act as constraints on the direct transfer. Because many innovations in agriculture originate from organized agricultural research and development conducted both by private and public agencies, the question arises as to the quantum of scientific and technical resources which must be collected in order to carry out the R & D and to extend the results to farmers. On a number of occasions the notion of a critical mass of such resources has been advanced and, in the context of the development of the International Agricultural Research Centers, the critical mass was often said to be beyond the capabilities of many developing countries. The paper goes on to discuss the concept of critical mass in the context of agricultural R & D and the proposition is advanced that the concept provides an inadequate basis for determining the quantum of resources that should be allocated to such R & D. Discusses regional groupings for agricultural research and shows they can often be fragile where there are disparities in the distribution of the research benefits

and the costs of carrying out the research between the various members of the group.

91. **Johnson, D. G.** 1984. Agricultural research policy in small developing countries. In C. W. Howe (Ed.), *Managing renewable natural resources in developing countries* (pp. 64-94). Boulder, CO: Westview Press.

Technology transfer / Research policy / Agricultural research / Developing countries

Presents ideas concerning the three major components of agricultural research policy: (1) the amount to invest in research; (2) the allocation of responsibility or opportunity among the potential providers of research; (3) the mechanisms for allocating public funds among institutions and alternative lines of research. Puts forward a number of suggestions aimed at assisting small developing countries in making more effective use of their research resources. Other topics to be considered which provide background on the setting within which agricultural research is undertaken are: (1) differences in agricultural productivity among countries; (2) transferability of the research; (3) sources of borrowing; (4) returns to agricultural research; (5) investment in research—how much? (6) institutional setting for the research; (7) allocating funds among institutions and projects; (8) effects of national agricultural policies on research; and (9) a research policy for a small country.

92. **Johnson, S. H. III, Clear, J. B.** Forthcoming 1985. Agricultural research and technology transfer. Draft manuscript for Chapter V in V. W. Ruttan (Ed.), *Agricultural research policy and development*. Rome: Food and Agriculture Organization by the United Nations. 45 pp.

Farming systems / Technology transfer / Linkages / Private sector / Technology development / On-farm testing / Utilization / Adaptation

Explores the relationship between research and extension systems. Details the factors determining the utilization of research results as well as the importance of the feedback mechanisms. Presents examples of approaches to improve linkages between research and extension, such as on-farm trials, farming systems research, and use of extension technical liaison personnel. The final section discusses complementarity between research and extension and provides suggestions toward facilitating cooperation between the two organizations.

93. **Johnson, S. H. III, Kellogg, E. D.** 1984. Extension's role in adapting and evaluating new technology for farmers. In B. E. Swanson (Ed.), *Agricultural extension: A reference manual* (pp. 40-55). 2nd ed. Rome: Food and Agriculture Organization of the United Nations.

Technology development / Extension / Adaptation / Evaluation / Farming systems / On-farm testing

Provides an overview of extension's role in adapting and evaluating new technology for farmers, especially in the situation where countries are using farming systems research (FSR) approaches. In the first section, a brief outline of the FSR process is presented and the role of extension agents in the process is detailed. In particular, extension's role in selection of target areas and farmer situation diagnosis as well as on-farm testing and verification is emphasized. The final section discusses alternative ways of organizing for adapting and evaluating new technology. This section stresses the critical need to jointly involve both research and extension in the process and argues that, in many cases, FSR field trials should be a shared responsibility of both agencies with joint budgetary, staffing and operational responsibilities.

94. **Kampen, J.** 1980. Farming systems research and technology for the semi-arid tropics. In V. Kumble (Ed.), *Proceedings of*

the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer, 28 August-1 September 1979 (pp. 39-56). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

On-farm testing / Farming systems / Technology development

Highlights ICRISAT's (International Crops Research Institute for the Semi-Arid Tropics) approaches to farming systems research. Improvements in productivity resulted using interdisciplinary and cooperative efforts. Results include introduction of tool carriers that increased timeliness and efficiency of draft animal use, controlling excess water to facilitate cultural operations, use of intercropping to increase yields on Vertisols and Alfisols, and effective weed control by integrating mechanical, biological and chemical means. Places importance on watershed-based resource development and management for greater and more stable yields. Initiates on-farm study to incorporate farmers in appropriate technology development and to discover effective frame of group action.

95. **Kean, S. A., Chibasa, W. M.** 1984. Institutionalizing farming systems research in Zambia. Chilanga, Zambia: Adaptive Research Planning Team, Research Branch, Department of Agriculture. 12 pp.

Technology development / Adaptation / Linkages / Farming systems / Zambia / Organization of research

Describes how the farming systems research approach was incorporated into the overall Research Branch structure of the Department of Agriculture in Zambia. Presents the various options that were considered for incorporating diagnostic farm research work and on-farm trials into the structure of the Research Branch. Describes the objectives and functions of the unit formed to undertake adaptive research programs. Concludes with an explanation of the role these adaptive research teams play in linking the research with other organizations.

96. **Martinez, J. C., Sain, G.** 1983. Economic returns to institutional innovations in national agricultural research: On-farm research in IDIAP Panama. Mexico, DF: International Maize and Wheat Improvement Center. 53 pp. (CIMMYT Economics Program working paper 04/83).

On-farm testing / Agricultural research / Economic evaluation / Panama

Examines the benefits and costs of on-farm research. Recognizes that the farming innovations under consideration could have come through station research or through farmer experiments as well as through the on-farm research process. Each implies a different path through time for development and diffusion of the innovation and for the rate at which increases in productivity are achieved. The differences are the focal point of the analysis. Shows a high rate of return to investment in on-farm research, largely because the resulting technology was taken up so rapidly by area farmers. The rapid diffusion, in turn, was the result of a research process well tuned to their needs and circumstances.

97. **Moreno, R. A., Saunders, J. L.** 1978. A farming system research approach for small farms of Central America. Turrialba, Costa Rica: Centro Agronomico Tropical de Investigacion y Ensenanza, Programa de Cultivos Anuales. 30 pp.

Farming systems / Research / Central America / Methodology

Describes three integrated research projects in Central America that are now being implemented, i.e., small farmers cropping systems, milk and beef production systems, and agroforestry. CATIE works to improve small farmers' living standards by increasing agricultural and forest production through rational use of natural resources. Because the majority of the locally consumed foods are produced on small farms where low income and size limit the farmers' ability to take full advantage of new technology, the focus of these projects is on small farmers.

Concern about increase in food production is encouraged by the fact that population increase in Central America remains about 3% per year and an estimated total of over 35 million people will have to be fed by the year 2000.

98. **Morrison, B. M.** 1982. Alternate routes to increasing rice yields and the implications for research in Sri Lanka. In R. S. Anderson, P. R. Brass, E. Levy, and B. M. Morrison (Eds.), Science, politics, and the agricultural revolution in Asia (pp. 221-240). (AAAS selected symposium 70). Boulder, CO: Published by Westview Press for the American Association for the Advancement of Science.

Technology transfer / Agricultural research / Rice / Sri Lanka

Shows how great increases in rice production and yields in Sri Lanka, which began in the mid-1950s and continued to the early 1970s, were achieved by at least three different routes. One of these routes was centered on the high yielding varieties (HYV's) with heavy fertilizer inputs and major irrigation works. This route illustrates how research station-developed agrarian technology was successfully transferred to an environment that was modified to receive it. The second route, the minor irrigation route, was based on the cultivator led adaptations of a pre-existent agrarian system. In the third route to high rice yields, the diversified rural economy route, the cultivators and research staff contributed both to identifying local constraints to yields and to means of offsetting them.

99. **Moseman, A. H.** 1970. Building agricultural research systems in the developing nations. New York: Agricultural Development Council. 137 pp. (An A/D/C monograph).

Agricultural research / Developing countries

Reviews some pertinent features or components of effective agricultural research

programs, with special reference to the U.S. experience, and their interrelationships in a functioning national system. Special attention is given to research experience in crop improvement.

100. **Mosher, A. T.** 1982. Some critical requirements for productive agricultural research. The Hague, Netherlands: International Service for National Agricultural Research. 22 pp.

Agricultural research / Technology development

This short paper identifies agricultural research requirements. Written with both the general administrator and scientist in mind, the paper identifies 15 propositions the author feels should be considered when planning an agricultural research program. In this context, agricultural research includes all systematic efforts to develop: (1) more productive farm technologies; (2) organizational forms and operating procedures for agricultural support services; and (3) national policies that can accelerate agricultural growth.

101. **Norman, D. W., Simmons, E. B., Hays, H. M.** 1982. Farming systems in the Nigerian savanna: Research and strategies for development. Boulder, CO: Westview Press. 275 pp.

Agricultural research / Technology development / Nigeria / Farming systems / West Africa

Considers the role of new technology and appropriate development strategies in improving agricultural production and the welfare of farming families in the semi-arid tropical region of West Africa. The study draws extensively on comprehensive studies conducted over an 11-year period in northern Nigeria. The discussion of these studies, which focused on production, consumption, and marketing systems and included the testing of improved technology packages, is supplemented by results from research undertaken in other

parts of semi-arid West Africa. Emphasizing the importance of a proper understanding of the technical and human environment in which farming families operate, the authors describe the essential characteristics of a farming systems approach and consider problems of methodology and implementation that must be solved if it is to become a widely accepted development strategy in the 1980s.

102. **Oram, P.** 1982. Collaboration between national and international institutions in the development of improved agricultural technology. In R. S. Anderson, P. R. Brass, E. Levy, and B. M. Morrison (Eds.), *Science, politics, and the agricultural revolution in Asia* (pp. 379-425). (AAAS selected symposium 70). Boulder, CO: Published by Westview Press for the American Association for the Advancement of Science.

Technology development / International agricultural research centers / National research programs

Examines the role of the Consultative Group of International Agricultural Research (CGIAR) in the growth of the international agricultural centers. Shows how the relationship between the centers and the national institutes is complicated by the fact that each has a different role to play. Achieving a balance therefore requires continuous attention and review, because when CGIAR attempts to make rational allocation of finances, it must try to sustain the scientific capability of the international centers but not diminish the sovereignty of the national research centers.

103. **Oram, P., Bindlish, V.** 1984. Investment in agricultural research in developing countries: Progress, problems, and the determination of priorities. Washington, DC: International Food Policy Research Institute. Draft manuscript. Various pagings.

Research policy / Agricultural research / Resource allocation / Developing countries

The analysis of agricultural research policy and the allocation of resources to agricultural research in developing countries is of particular importance given the crucial role which technological innovations can play in improving the performance of agriculture. This monograph is the result of a study undertaken in two parts. First, time-series data on the allocation of resources to agricultural research in 67 developing countries are used to assess progress during the last decade. Particular attention is paid to identifying problems which hamper their further development. Inconsistencies demonstrated in this assessment lead logically into the second part of the study which addresses the question: What can be done to improve the allocative mechanism? In that context, the authors examine empirically the process of prioritizing research by applying selected criteria to actual resource allocations by commodity in 17 countries.

104. **Oran, P. A., Bindlish, V.** 1981. Resource allocations to national agricultural research: Trends in the 1970's. (A review of Third World Systems). The Hague, Netherlands: International Service for National Agricultural Research and Washington, DC: International Food Policy Research Institute. 104 pp.

Agricultural research / National research programs / Resource allocation / Developing countries

This report represents the first stage of a collaborative effort between the International Service for National Agricultural Research (ISNAR) and the International Food Policy Research Institute (IFPRI) to upgrade and analyze available knowledge on the current state of national agricultural research systems in developing countries. Analyzes recent trends in the evolution of national systems such as research expenditures, staff development, etc. Assesses education and training requirements for the future. Discusses the role of external assistance to agricultural research. Identifies further areas for research in the areas of resource

allocation to agricultural research, research organization and management, human resources for research, and research information services.

105. **Perrin, R. K., Winkelmann, D. L., Moscardi, E. R., Anderson, J. R.** 1976. From agronomic data to farmer recommendations: An economics training manual. Mexico, DF: Centro Internacional de Mejoramiento de Maiz y Trigo. 51 pp. (Information bulletin, no. 27).

Technology development / Innovation adoption / Methodology / Developing countries

Describes the factors that affect the farmer's choice of technology and provides procedures for dealing with them from the farmer's point of view. Shows how the variable factors interact in order to make reasonable recommendations. Goals of the manual are to make the researcher able to: (1) identify the benefits associated with treatment alternatives and place values on those which match farmers' goals; (2) identify which inputs change from treatment to treatment and place values on those which match farmers' goals; (3) identify sources of variability which will make the farmer uncertain about the net benefits which he will get from each treatment; and (4) Derive recommendations from cost, benefit and variability data, which are consistent with the farmer's desire to increase average income, with the farmer's desire to avoid risks, and with the scarcity of investment capital which is typical of most farm situations. The approach is deliberately non-mathematical.

106. **Pinstrup-Andersen, P.** 1982. Agricultural research and technology in economic development. Harlow, Essex: Longman. 261 pp.

Agricultural research / Policy / Developing countries

Studies in detail how research affects agricultural production and economic growth

and how research priorities can be established to achieve the maximum benefit to the rural poor. Emphasizes that the effectiveness of research is largely determined by the attitudes of governments. Suggests ways in which government policy can best be integrated with the planning and implementation of research. Among aspects discussed are: (1) basic relationships between agricultural research and technology and economic growth, income distribution and nutrition; (2) agricultural research for developing countries; (3) the estimated pay-off from agricultural research and the distribution of the associated economic benefits among groups in society; (4) environmental effects of technological change; (5) national activities to expand research pay-offs; (6) public policy measures aimed at the achievement of the desired distribution of research benefits; and (7) international assistance.

107. **Potts, M. J., de los Santos, A. B., Soliman, J. A.** 1983. Transfer of technology to small farmers: On-farm research in the Philippines. *Agricultural Administration*, 12, 27-42.

Technology development / Small farms / Philippines / On-farm testing

Examines the program adopted by the Philippine Potato Programme based on the International Potato Centre's approach of optimizing potato productivity, which is an integral part of their "farmer back to farmer" strategy of technology transfer. Describes the evolution of a program intended to: (1) identify factors currently limiting potato production; (2) suggest and test, through the medium of 'on-farm trials', alternative practices; and (3) evaluate agronomically, economically and socially the implications of the alternative practices. Describes the major philosophical, organizational and practical features experienced in the field. Presents also the steps taken to overcome the difficulties.

108. **Pray, C. E.** 1983. Private agricultural research in Asia. *Food Policy*, 8,

131-140.

Agricultural research / Private sector / Asia

Reviews the status of private sector research in Asia and the relationship between privately and publicly supported research. Discusses the role of the private sector in the transfer of technology in developing countries.

109. **Pray, C. E.** 1983. Research and productivity in grain production in Asia: The colonial heritage. In B. L. Greenshields & M. A. Bellamy (Eds.), *Rural development: Growth and inequity, contributed papers read at the 18th International Conference of Agricultural Economists* (pp. 250-256). (I.A.A.E. occasional paper no. 3). Aldershot, Hants, England: Gower.

Agricultural research / South Asia / South East Asia

Examines the allocation of research resources and the impact of research on productivity in South and Southeast Asia. Attempts to identify the main determinants of the allocation of agricultural research resources during the colonial period.

110. **Rhoades, R. E., Booth, R. H.** 1982. Farmer-back-to-farmer: A model for generating acceptable agricultural technology. *Agricultural Administration*, 11, 127-137.

Technology development / Postharvest systems / On-farm testing / Adaptation / Models

Presents a model that outlines an alternative approach to solving farm-level technological problems. The model stresses that applied research must begin and end with the farmer. Presents and illustrates a series of logical activities that address specific goals in the model.

111. **Schuh, G. R., Tollini, H.** 1979. Costs and benefits of agricultural research: The

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state of the arts. Washington, DC: World Bank. 70 pp. (World Bank staff working paper no. 360).

Agricultural research / Evaluation / Resource allocation

Reviews the issues to be faced in allocating funds between projects and between institutions involved in agricultural research, and between agricultural research and other activities. Identifies and elaborates on the goals of agricultural research, including: (1) increasing consumer welfare; (2) increasing farm employment and incomes; (3) increasing net income of the rural sector; (4) allowing agriculture to contribute to rural economic development; (5) preserving the environment; and (6) promoting overall rural development. Identifies and reviews a wide range of methods and procedures that might be used for evaluating the contribution and effectiveness of agricultural research programs. These include: (1) those which might be used to evaluate research efforts that have been underway for some time; and (2) those which are appropriate in attempting to evaluate the research that is proposed but not begun. Examines some of the implications of using such tools in evaluating research.

112. **Schultz, T. W.** 1984. The economics of agricultural research. In C. K. Eicher and J. M. Staatz (Eds.), *Agricultural development in the third world* (pp. 335-347). Baltimore, MD: Johns Hopkins University Press.

Agricultural research / Developing countries

Estimates the growth and magnitude of agricultural research throughout the world and in Latin America and notes some observations on the increases in agricultural productivity from this research. Considers what the author deems to be a very important question, namely, who should pay for agricultural research? The author then discusses some of the organizational issues. The final sections deal briefly with the

harm that is done to agricultural research by distortions in agricultural prices and the function of research entrepreneurship.

113. **Senanarong, A.** 1980. Development and transfer of technology for rainfed crop production in Thailand. In V. Kumble (Ed.), *Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer*, 28 August - 1 September 1979 (pp. 247-250). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology development / Technology transfer / Farming systems / Thailand

Focuses on the Northeast region of Thailand where the problems of rainfed agriculture are most evident. Problems of low and unstable yields of all crops, especially rice, underutilization of land, and low soil fertility combine to make per capita income of farmers the lowest in the country. Notes that until recently, research emphasized varietal improvement rather than cultural practices or soil and water conservation and management. Underscores the need to emphasize multidisciplinary research and long-range programs to maintain continuity. Recommends that researchers, extension personnel, and practicing farmers should be enabled to work together to develop technology that the farmer can adopt profitably. Accepting existing farming systems and introducing simple, low-cost innovations that will result in visible increases in yields is a first step.

114. **Shaner, W. W., Philipp, P. F., Schuchel, W. R.** 1982. *Farming systems research and development: Guidelines for developing countries*. Boulder, CO: Westview Press. 414 pp. (A Consortium for International Development study).

Farming systems / Developing countries / On-farm testing / Institutions / Organization of research / Methodology

Farming systems research and development (FSR&D) is an approach that is being used increasingly to meet the need for greater food production and a better standard of living for small-scale farmers in developing countries. This book synthesizes the FSR&D procedures used by national governments and international research centers around the world emphasizing methodologies that have proved successful in practice. Describes the characteristics and objectives of FSR&D and then presents information on selecting target and research areas, problem identification and development of a research base, research design, on-farm research, extending research results and implementation and training procedures. Emphasizes that the FSR&D approach requires a clear understanding of farmers and their families, farmers' conditions and governmental staffing and organizational capabilities. Discusses how to determine whether an FSR&D approach is in a particular country's best interests. Appendixes present detailed examples of procedures described in the text, covering a variety of countries with different cropping and livestock systems, environmental conditions and research and development capabilities.

115. **Shaner, W. W.** 1983. Linking extension with farming systems research. In J. B. Claar & L. H. Watts (Eds.), *Knowledge transfer in developing countries: Status, constraints, outlook* (pp. 45-54). Urbana, IL: INTERPAKS, Office of International Agriculture, University of Illinois at Urbana Champaign.

Farming systems / Extension / Linkages / On-farm testing

This article is divided into two sections. In the first the author deals with a description of his synthesis of farming systems research approaches. Included are a definition, characteristics, activities, and implementation of farming systems research. The second section contains the author's thoughts about the opportunities for further work in extension and the relationship

between extension and farming systems research. Farming systems research concentrates on applied, on-farm research but stops short of extension's role in conveying research to broad segments of farmers.

116. **Shaner, W. W., Philipp, P. F., Schmehl, W. R. (Eds.)**. 1982. *Readings in farming systems research and development*. Boulder, CO: Westview Press. 175 pp. (A Consortium for International Development Study).

Farming systems / Methodology

This collection offers a comprehensive view of the commonalities and diversities of the farming systems research and development (FSR&D) approaches being applied around the world. The authors—among the leading practitioners in FSR&D—discuss conceptual frameworks, research methodology, data collection and several on-going FSR&D programs.

117. **Simmonds, N. W.** 1984. The state of the art of farming systems research. In T. J. Davis (Ed.), *Proceedings of the Fourth Agricultural Sector Symposium* (pp. 185-191). Washington, DC: World Bank.

Farming systems / On-farm testing / Technology development

An extended summary of a World Bank commissioned study to sort out the terminology of farming systems research (FSR) and to assess the usefulness of FSR studies in agricultural research.

118. **Stavis, B. R.** 1982. *Agricultural research in socialist China*. In R. S. Anderson, P. R. Brass, E. Levy, and B. M. Morrison (Eds.), *Science, politics, and the agricultural revolution in Asia* (pp. 241-248). (AAAS selected symposium 70). Boulder, CO: Published by Westview Press for the American Association for the Advancement of Science.

Agricultural research / China

Describes the structure of China's

research system. Reviews the results of research, both positive and negative. Finally, it highlights the importance of the institutional environment in transcribing research into changes in people's lives.

119. **Swanson, B. E.** 1975. Organizing agricultural technology transfer: The effects of alternative arrangements. Bloomington, IN: International Development Research Center. 76 pp. (PASITAM design study).

Technology development / Technology transfer / Institutions / Training / International agricultural research centers / National research programs / Agricultural research

Two papers examine different aspects of technology development and transfer from the international research center to the national research center. The first paper examines the development of improved genetic technology, i.e., improved germ plasma crop varieties, or population, at the International Maize and Wheat Improvement Center (CIMMYT), Mexico. Also described is the organizational pattern that combines research methodology with institutional mechanisms that systematically link national wheat research programs into an overall international wheat improvement system. The second paper describes CIMMYT's and IRRI's (International Rice Research Institute) training programs and their roles in building national research capacity. Each employs a different training philosophy that contributes, in its own way, to the building of national research systems.

120. **Trigo, E., Pineiro, M., Sabato, J. F.** 1983. Technology as a social issue: Agricultural research organization in Latin America. In M. Pineiro and E. Trigo (Eds.), Technical change and social conflict in agriculture: Latin American perspectives (pp. 125-137). Boulder, CO: Westview Press.

Technology development / National research programs / Agricultural research / Latin America

Description of the development and characteristics of national agricultural research institutes in Latin America. A common institutional research model, based on the U.S. Land Grant College system, was adopted by the various Latin American countries to fulfill several needs, i.e., to adapt existing technology to local or regional conditions, to promote increased production, and to ensure optimum use of limited technical and financial resources. Problems encountered by the national institutes are discussed, and the need for reevaluation is noted.

121. **Trigo, E. J.** 1984. Critical considerations for the development of national agricultural research capacities. The Hague, Netherlands: International Service for National Agricultural Research. Paper presented at the Agricultural Research Policy Seminar, University of Minnesota, April 8-19, 1984. 19 pp. Mimeographed.

Agricultural research / Public sector / National research programs

Attempts to synthesize the main ideas and concepts that the International Service for National Agricultural Research (ISNAR) follows in its work with developing countries in helping them improve their national agricultural research capacities. Section 1 introduces the topic. The second section discusses the policy environment of agricultural research. It focuses on agricultural research as a research activity and as an agricultural policy instrument, briefly examining the determinants of political support for agricultural research. Section 3 reviews the processes that are essential to the operation of the research system. Section 4 concentrates on the role of the system's organizational structure, emphasizing the interrelationship between different organizational formats and the performance of some of the essential processes. The last section points to areas of uncertainty and raises some questions for discussion in the context of specific country experiences.

122. **Trigo, E. J., Pineiro, M. E.** 1981. Dynamics of agricultural research organization in Latin America. *Food Policy*, 6, 2-10.

Technical progress / Socioeconomic organization / Agricultural research / Research policy / Developing countries

Summarizes the conditions that led to the development of national research institutes in Latin America and to the creation of the international agricultural research centers. Reviews the modernization process of the agricultural sector and the role played by public and international organizations in the appearance of nonpublic research. Discusses the impact of these institutional developments on the effectiveness of national research institutes and the implications for agricultural science, technology policy, and the organization of agricultural research in developing countries.

123. **Valdes, A., Scobie, G. M., Dillon, J. L. (Eds.)** 1979. *Economics and the design of small-farmer technology*. Ames, IA: Iowa State University Press. 211 pp.

Technology development / Small Farms / Latin America

Presents the proceedings of an International Conference on Economic Analysis in the Design of New Technology for Small Farmers, held at the Centro Internacional de Agricultura Tropical, November 26-28, 1975. The papers are grouped in three broad areas: (1) methodological aspects; (2) design of technology; and (3) technology, rural development and welfare. On the whole the participants supported the view that economists in cooperation with biologists can make valuable contributions to the ex ante design of new technology for small-scale farmers. Considers the recent trend towards more formal analytical modelling advantageous because it: (1) forces an objective view; (2) leads to consideration of all relevant data; and (3) necessitates consistent and logical argument, thereby exposing false assumptions. Delineates the main problems as those concerned with research priorities,

the role of policy, the need for institutional change, and the inadequacy of knowledge of the resource and psychological attributes of small-scale farmers.

124. **Wang, K.** 1981. Agricultural technological research and development in developing countries. *Seoul National University economic review*, 15, 1-35.

Agricultural research / Technology transfer / Developing countries

The paper is divided into five main sections: (1) introduction: agriculture in national development; (2) technological change and agricultural development; (3) agricultural research and development and social returns; (4) technology transfer and developing appropriate technology; and (5) concluding remarks. Concludes that it is essential that each developing country should be keenly aware that: (1) the role of agricultural research and development is positively significant not only for agricultural technological change and development but also for general economic and national development; and (2) national agricultural research and development systems must be evolved in such a way that they can not only take advantage of international agricultural technology transfers of an interdisciplinary nature, but also reach the so-called 'capacity phase' in which creative and innovative indigenous research and development activities in agriculture are carried out.

125. **Waugh, R. K.** 1981. Research and promotion of technology use. In N. R. Usherwood (Ed.), *Transferring technology for small-scale farming* (pp. 67-99). (ASA special publication no 41). Madison WI: American Society of Agronomy.

Technology transfer / Linkages / Systems analysis / Guatemala / Technology development

Discusses the evolution of new strategies for technology development and transfer, emphasizing farm-level experimentation and analysis and farmer participation. Describes

ICTA in Guatemala as an example of the application of multidisciplinary strategies at the field level. Points out that there is no one system that is best for all countries and that consideration must be made for infrastructure, political, economic and cultural aspects of the system. Uses ICTA as an example to show a new way of linking research and extension and discusses a continuous and sequential system of technology generation and promotion of its use.

126. **Whyte, W. F., Boynton, D. (Eds.).** 1983. Higher-yielding human systems for agriculture. Ithaca, NY: Cornell University Press. 342 pp.

Farming systems / Small farms / Technology development / Systems analysis / Policy / Socioeconomic organization / Developing countries

Presents a new strategy for incorporating small-scale farmers into the agricultural research and development process. Part I (Foundations for a New Approach) reviews past research and development efforts, indicating how increasing recognition of the limitations of these programs has led to change. Part II (Physical and Biological Bases for Small Farm Development) examines the complex range of human elements that must be integrated in the creation of efficient farming systems. Part III (Social Systems from Farm Families to National Programs) presents a way of thinking designed for understanding the role of humans in building efficient systems at village, regional, and national levels. Part IV (Organizational Implications) discusses community and farm organization and examines the nature and problems of government agencies involved in agricultural and rural research and development. Lastly, Part V (Implications for Research, Education, and Government Policy), considers implications of all the foregoing for research in the plant, animal, and social sciences. Also discusses the need for reorientation of education and considers government policies required for supporting the emerging systems of agricultural research.

127. **Whyte, W. F.** 1981. Participatory approaches to agricultural research and development: A state-of-the-art paper. Ithaca, NY: Rural Development Committee, Center for International Studies, Cornell University. 111 pp. (Special series on agriculture research and extension no. 1).

Agricultural research / Technology development / Social participation / Bangladesh / Ethiopia / Mexico / Colombia / Honduras / Guatemala

Begins with a discussion of deficiencies in conventional agricultural research and development strategies. Examines experimentation with new research and development programs with farmer participation that promise to provide better models for agricultural research in developing countries. The bibliography at the end presents some of the literature which supports the reorientation of agricultural research and development to involve more farmer participation. Examines major agricultural research and development projects in Bangladesh, Ethiopia, Mexico and Colombia. Looks at models of agricultural research and development such as those at the Institute of Agricultural Science and Technology in Guatemala and the Programa Nacional de Investigacion Agropecuaria in Honduras.

128. **Winkelmann, D.** 1980. On improved technologies and agricultural research. In Proceedings of the Agricultural Sector Symposium, January 7-11, 1980 (pp. 327-345). Washington, DC: World Bank.

Technology development / Utilization / Agricultural research / Equity

The opening section assesses the distributional consequences of the introduction of improved agricultural technology. The most evident unevenness in access to improved technology is that between agroclimatic regions, often within the same country. Differing sources of natural stress are identified as constraining production and inhibiting farmers from intensifying their practices. Potential solutions or partial

solutions through plant improvement or crop husbandry are considered. With amelioration of the impact of the natural stress in particular regions, farmers of those regions could be expected to move to take up stress-resolving crops, varieties, and husbandry. National research programs will play an important role in formulating needed technologies. These systems are constrained by a number of factors, some of which impinge upon them directly and by others whose impact is indirect. Even so, their effectiveness could be improved by careful attention to their work rules and to their incentives, favoring those changes which encourage researchers to view relevant farmers as their primary clients and to integrate farmer circumstances into their research. In the absence of other mediating agencies which link researchers to farmers, an important requirement is that public sector researchers have easy access to farmers through on-farm research. World Bank staff can facilitate this process by encouraging interaction among policy makers, biological scientists, and economists to establish research priorities in terms of the desirable and the feasible; by encouraging exchange among national researchers and international research agencies; and by encouraging appropriate work rules and incentives in national programs. Finally, technological change is but one of many forces which contribute to agricultural development. While Bank staff should sensitize policy makers to the opportunities in research and technological change, this should not be at the expense of concern for those other factors. It is, in particular, important that there be no diminution in attention to input and information delivery systems and to the functioning of product markets.

129. Workshop on Linkages Between Agricultural Research and Farmers in Developing Countries. 1981. [Record of the Workshop]. Paris, France: Organization for Economic Co-operation and Development. 37 pp.

Technology development / Agricultural research / Extension / Linkages / Developing countries

Presents a summary record of the Workshop on Linkages Between Agricultural Research and Farmers in Developing Countries held in Paris, May 13-14, 1981. Includes abstracts of the working documents prepared for the Workshop. Summarizes the findings of the workshop which pointed out the need for research to respond to the farmer's particular needs and conditions and his economic constraints; the need for multidisciplinary units, although difficult to implement; the variances in time perception for researchers and farmers; and the need to tailor technologies and their diffusion to the intended audience. The final section suggests recommendations for donor agencies involved in agricultural research and extension.

130. World Bank. 1981. Agricultural research: Sector policy paper. Washington, DC: World Bank. 110 pp.

Agricultural research / Development aid / World Bank

Points out that developing countries must invest more in agricultural research if they are to meet the needs of their growing populations. States that studies in Brazil, India, Japan, Mexico, and the United States show that agricultural research yields a rate of return that is more than two to three times greater than returns from most alternative investments and cites some of the successes of the high-yielding varieties of rice and wheat that were developed in the mid-1960s. Notes that developed countries spend between 1 % and 2 % of agricultural GDP on research, the low-income countries around 0.26 % and middle income countries 0.42 %. Developed countries spend four times as much for research as extension. The developing countries spend more on extension than research. Discusses the World Bank's plans to expand its lending for agricultural research and extension, particularly for the production of food and other commodities that are of importance to low-income consumers, small farmers, and resource-poor areas.

131. **Wortman, S.** 1977. Impact of international research on the performance and objectives of national systems. In T. M. Arndt, D. G. Dalrymple, and V. W. Ruttan (Eds.), Resource allocation and productivity in national and international agricultural research (pp. 323-335). Minneapolis, MN: University of Minnesota Press.

International agricultural research centers / National research programs / Agricultural research

Discusses the impact of international research systems on national systems. Identifies some of the contributions which have been made by the international research systems.

Technology Transfer

132. **Abell, H. C.** 1981. Extension strategy--initiative or innovative? In B. R. Crouch and S. Chamala (Eds.), Extension education and rural development. Vol. 2: Experience in strategies for planned change (pp. 11-14). Chichester, England: John Wiley.

Extension / Developing countries

This short paper puts into perspective the relationship between extension strategies and the change agent. It critically examines the strategies, based on North American experience, followed in some developing countries. Few international assistance programs have provided tangible benefits to the rural people in developing countries. The problem is compounded by the way institutionalized agriculture and its concomitant training of extension personnel has been influenced by the interpretation placed on the relative status of rural and urban dwellers and the role of farm families in North America. Such interpretations have influenced effective extension work in North America as well as abroad.

133. **African Workshop on Extension and Research (Eldoret, Kenya: June 10-16, 1984).** 1984. Summary. Washington, DC: Agricultural Sector, Eastern and Western Africa Projects, World Bank. 28 pp. Mimeograph.

Extension / Agricultural research / Linkages / Africa

Summarizes the papers presented at the African Workshop on Extension and Research. Topics discussed were the role of agricultural extension in Sub-Saharan Africa, issues concerning current extension methodologies, and approaches to extension and research-extension linkages. The final section presents an overview of individual country experiences with extension. The countries represented were Kenya, Zambia, Nigeria, Malawi, Somalia, and Zimbabwe.

134. **Agble, W. K.** 1980. Linkages for implementation of programs. In V. Kumble

(Ed.), Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer, 28 August - 1 September 1979 (pp. 275-276). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology transfer / Linkages / Training

Delineates goals for establishing linkages between the activity areas of research, extension (communication), and farmers (production): (1) linkages should transfer technology rapidly to benefit the greatest number of farmers; (2) the new technology should be economically viable, safe, and acceptable to farmers; and (3) the technology should satisfy the political, economic, and social needs of the country. Discusses for each activity area their respective responsibilities, the major problems deserving serious attention in each area, and corrective measures which must be taken to promote the formation of effective linkages.

135. **Anandajayasekeram, P.** 1984. Research and extension linkage: The case of Kenya. Nairobi, Kenya Eastern African Economics Program: International Maize and Wheat Improvement Center. Paper presented at the Farming Systems Research Symposium, Kansas State University, October 7-10, 1984. 20 pp. Mimeographed.

Technology development / Technology transfer / Farming systems / Agricultural research / Kenya / Linkages

Describes Kenya's restructuring of the research and extension network to meet the needs of the majority of small farmers. In order to improve the extension services the Government of Kenya adopted the T and V approach to extension. It also became necessary to redirect agricultural research towards definite goals, related to national needs rather than the customary disciplinary interests. To make the research process more efficient in generating appropriate recommendations for the target group of farmers, the on-farm research with farming

systems perspective (OFR/FSP) has been accepted and will be integrated into the research process in Kenya. The major task is that a strong linkage mechanism is established to make sure the limited research and extension resources are utilized efficiently. Concludes with a discussion of the linkage mechanism that could be established within the existing institutional framework to improve the technology generation and dissemination process.

136. **Arnour, R.** 1980. Experiences with the methodology for transfer and adaptation of research results. In Proceedings of the Agricultural Sector Symposia, January 7-11, 1980 (pp. 352-370). Washington, DC: World Bank.

Technology transfer / Linkages / Communication / Agricultural research / Extension / Brazil

A companion paper to the one presented by J. Lindt entitled, "Experiences with agricultural extension and field research" on the topic of agricultural research and extension. Shows how the organization of research programs is influenced by the producer and how the communication linkage through the extension agent must be strong enough to effectively accommodate the dual role of communication between the two groups if the new technology, produced by research, is to be appropriate and adaptable to farmers needs. Looks at problems and issues related to World Bank projects in Latin America, principally Brazil. The strong general consensus suggests that both research and extension services in many developing countries are still very weak and that the technology now available, particularly that developed by the international agricultural research centers, cannot be disseminated on a large scale until strong national programs in research and extension are established.

137. **Ascroft, J., Roling, N., Kariuki, J., Chege, F.** 1973. Extension and the forgotten farmer: First report of a field experi-

ment. Wageningen, Netherlands: Afdelingen voor Sociale Wetenschappen aan de Landbouwhogeschool. 104 pp. (Bulletin nr. 37).

Methodology / Innovation adoption / Technology transfer / Evaluation / Kenya

Describes the planning, implementation and evaluation of an experiment focusing on a new strategy to promote the adoption of productivity increasing agricultural innovations in the Tetu Division of Nyeri District, Kenya. Less progressive farmers were the target group. The experiment was part of Kenya's Special Rural Development Programme. Basic strategy consisted of: (1) a free, 3-day farmer training course aimed at groups of farmers selected from one or two sublocations of the Tetu Division of Nyeri District. Criteria guiding the selection of the sublocations was based on the level of adoption of innovations on the farms in the areas. Innovations were promoted to suit the needs of specific farmers; (2) follow-up course participants by extension workers; and (3) the provision of a loan-in-kind to facilitate implementation of the innovations taught in the course. An evaluation of the experiment indicated that: (1) 217 of the 225 farmers selected for the course participated; (2) the majority of those recruited were progressive farmers, although the intention was to reach less progressive farmers; (3) 216 accepted a loan; (4) 216 planted the maize (the crop used in the experiment); and (5) that 500 other farmers planted maize on their own, a demonstration of the diffusion effect.

138. **Asian Regional Workshop on the Training and Visit System of Extension, Chiang Mai, Thailand, Nov. 27 - Dec. 6, 1982.** 1982. Summary of Asian Regional Workshop on T & V Extension, 1982. 33 pp. Mimeographed.

T & V system / Asia / Extension

Presents a summary of the various sessions during the Asian Regional Workshop on the Training and Visit System of Extension held in Chiang Mai, Thailand. Emphasizes the discussion that emanated from the smaller

working groups. The five topics covered in the working sessions were: (1) developing farmer participation in T & V methodology and the role of the VEW; (2) technical recommendations and linkages between research and extension; (3) training in T & V; (4) implementation and maintenance of T & V in extension systems; and (5) monitoring and evaluation. Complements the published volume of papers edited by M. M. Cernea, J. K. Coulter, and J. F. A. Russell entitled "Agricultural extension by training and visit: The Asian experience."

139. **Axinn, G. H., Thorat, S.** 1972. *Modernizing agriculture: A comparative study of agriculture extension education systems.* New York: Praeger. 216 pp. (Praeger special studies in international economics and development).

Extension / Agricultural education / Case studies / Developing countries

Supports the proposition that agricultural development, and rural development in the broader sense, depends upon a system of related functions. Agricultural producers, suppliers, marketers, researchers, those who govern and those involved in education and extension are all related as components of the system. Thus, the effectiveness of the extensive education function is crucial to the modernization of a traditional agricultural system and to the maintenance of dynamism in any rural social system. Similarly, applied research, efficient supply and marketing, and supportive governance are associated with expanding agricultural production. The first chapter describes a typical rural social system with special emphasis on its education/extension component. This is followed by a series of case studies describing the agricultural extension systems of 12 different nation-states illustrating similarities and differences. In Chapter 14 each of these systems is compared with the others and are classified in various ways. Finally, in Chapter 15 a set of general principles of agricultural extension education is distilled and some conclusions are presented.

140. **Baidya, B. G., Chou, E. R., Jamison, D. T., Moeck, P. R., Shrestha, R.** 1982. Evaluating the impact of communication on agricultural development: General observations and a case study from Nepal. In M. Jussawalla & D. M. Lamberton (Eds.), *Communication economics and development* (pp. 259-281). New York: Pergamon Press in cooperation with the East-West Center, Hawaii.

Communication / Information flow / Case studies / Agricultural development / Nepal / Innovation adoption / Education

Examines two forms of communication, formal schooling and agricultural extension, and estimates their impact on the crop production behavior of farmers in the Terai Region of Nepal. Results indicate that schooling and extension contact enhance the relative technical efficiency of farmers in the production of late paddy and wheat. It appears that these two factors act as substitute sources of technical information. Unexpectedly, educational attainment does not enhance the impact of extension exposure. In examining adoptive behavior, it was found that the higher the level of the farmer's education, the more likely he is to use chemical fertilizers. The effect of schooling appears to be indirect, with schooling affecting the farmer's numeracy, and numeracy affecting adoption. It was also found that a farmer's likelihood to grow wheat or use chemical fertilizers is directly related to the number of neighboring farmers who follow similar practices.

141. **Ban, A. W. van den, Muntjewerff, C. A.** 1981. Goals, organization, and strategies of change agencies. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development. Vol. 2: Experience in strategies for planned change* (pp. 149-156). Chichester, England: John Wiley.

Organizations / Social change / Extension

Describes briefly the organizational goals and strategies of change agencies. Discusses the type of leadership practiced within the organization. Organizations must be aware

that they, too, must change to accommodate the changes they expect in the community.

142. **Beal, G. M.** 1981. The change agent and change agent roles. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development*. Vol. 2: Experience in strategies for planned change (pp. 109-121). Chichester, England: John Wiley.

Social change

Provides an operational definition of 'change agent' as an individual or group of actors who desire to bring about social change and are considered to play one or more major roles in the social change process. Considers the various roles of change agents and develops a typology.

143. **Belshaw, D.** 1979. The appraisal, monitoring, and evaluation of agricultural extension programmes. In *Institutions, management and agricultural development* (pp. 39-43). (Agricultural Administration Unit occasional paper 3). London: Overseas Development Institute, Agricultural Administration Unit.

Extension / Monitoring / Evaluation / Indicators

Discusses some of the problems of appraising, monitoring, and evaluating the performance and management of agricultural extension programs. Deals with the development of new programs and emphasizes the need to establish clear objectives and detailed monitoring procedures at the planning stage. The indicators to be used and the data to be collected should be determined in accordance with the needs and capacities of those who will be responsible for management. If these conditions have been met, it is seen as the function of the project managers to identify the causes of any shortcomings in performance which may occur. In this respect, the purpose of evaluation might be largely to establish the extent of the program's financial and economic success.

144. **Benor, D., Harrison, J. Q., Baxter, M.** 1984. *Agriculture extension: The training and visit system*. Washington, DC: World Bank. 85 pp.

Extension / T & V system / Developing countries / Feedback

Contains guidelines for reform of agricultural extension services along the lines of the training and visit system. The central objective--making the most efficient use of resources available to governments and farmers--is achieved through encouraging and facilitating feedback from farmers to research workers through extension personnel who visit and advise farmers on a regular, fixed schedule, thus helping research to solve actual production constraints faced by the farmer. Explains the complex relationship in training and extension and draws attention to the range of considerations that are important to implementing the system.

145. **Benor, D., Baxter, M.** 1984. *Training and visit extension*. Washington, DC: World Bank. 202 pp.

Extension / T & V system / Feedback / Organizations

Contains a comprehensive explanation of the organization and operation of the training and visit system of agricultural extension. Emphasizes simplicity and decisiveness. Defines organization and mode of operation and allows continuous feedback from farmers to extension and research workers. Useful to extension staff at all levels, agricultural research personnel, trainers, and staff of agricultural organizations, as well as universities and training institutions involved in agricultural and rural development and public administration.

146. **Blanchenburg, P. von.** 1982. Basic concepts of agricultural extension in developing countries. *Agricultural Administration*, 10, 35-43.

Extension / Developing countries

Reviews the conditions under which extension work takes place in developing countries. Discusses the functions and objectives of extension work seen mainly in the educational field. Points out some frequently observed weaknesses of the extension approach like the problem of coordination with other rural services and an unsatisfactory adaptation of organization and methodology to changing objectives and external circumstances. Discusses the organizational and political conditions under which extension services must work and their impact on the extension services achievements. Proposes several starting points for improvement.

147. **Blaukenburg, P. von.** 1982. The training and visit system in agricultural extension--a review of first experiences. *Quarterly Journal of International Agriculture*, 21, 6-25.

Extension / T & V system / India

Presents the prominent components of the training and visit extension system and describes the first experiences in Asian countries. The critical issues gleaned from the first experiences are: the selection of the contact farmer and his capability to assist actively in conveying messages to other farmers; motivation of extension staff, who may have a higher workload than before; qualifications to train field staff supervisors and subject-matter specialists; transport facilities for staff; availability of new research results; and a firm government commitment to implement the system. The system appears to be adaptable to different farming conditions, provided the pace of introduction is not too fast, and evaluation takes place right from the beginning. Suggests the T & V system may not be suitable for agricultural systems at very high and very low development levels.

148. **Brady, N. C.** 1981. Significance of developing and transferring technology to farmers with limited resources. In N. R.

Usherwood (Ed.), *Transferring technology for small-scale farming* (pp. 1-21). Madison, WI: American Society of Agronomy.

Technology transfer / Small farms / Developing countries

Examines the characteristics of small farms and small-scale farmers and outlines reasons given for lack of technology adoption. Argues that even though small-scale farmers are not well educated and appear to resist change, their rapid adoption of new wheat and rice varieties is evidence of their willingness to adopt technology if it provides them decided economic or social benefits. Discusses the inappropriateness of technology developed for U.S. agriculture and the need for developing or modifying technology for small-scale farmers in developing countries.

149. **Brown, L. A.** 1981. Innovation diffusion: A new perspective. London: Methuen. 345 pp.

Technology transfer / Innovations / Sierra Leone / Kenya / Mexico / Developing countries

Directed towards developing a contemporary understanding of innovation diffusion. Four main perspectives are presented. (1) The processes by which adoption occurs, i.e., the demand aspect of diffusion. Views the spread of innovation as the outcome of a communications process. (2) The market and infrastructure perspective. Considers the supply side of diffusion with the attention on the diffusion agency. (3) The continuity of innovation and its adaptation is reviewed in the economic history perspective. (4) The development perspective which deals with the impact of diffusion upon individual welfare and its role in the process of regional development often leading to economic disparities among regions and social classes. Case studies from agricultural innovations in Kenya, commercial dairying in Mexico, agricultural cooperatives in Sierra Leone, and family planning programs in developing countries illustrate the innovation diffusion processes.

150. **Brown, W. M. Jr.** 1983. Constraints in effective extension program development in Third World countries: The manpower development and deployment issue. In J. B. Claar and L. H. Watts (Eds.), Knowledge Transfer in developing countries: Status, constraints, outlook (pp. 42-44). Urbana, IL: INTERPAKS, Office of International Agriculture, University of Illinois at Urbana-Champaign.

Extension / Manpower / Training

Discusses what the author considers to be the three major problems which prevent LDC's from becoming agriculturally independent: (1) promotion of inappropriate technology; (2) inadequate training of field staff; and (3) unrealistic deployment of field staff. The author believes that there exists a critical need for appropriate technology and too much emphasis has been placed on "institution building" and not enough on implementation. SMS backstopping is felt to be an area which is often the weakest link in the system and therefore training and deployment of SMS's should receive the highest priority in development activities.

151. **Busch, L., Lacy, W. B.** 1983. Information flows in research and extension: An alternative perspective. *Rural Sociologist*, 3, 92-97.

Information flow / Linkages / Agricultural research / Extension

Information flow among research and extension organizations has traditionally been portrayed as emanating from the research system. An alternative perspective of information flow in the research and extension system expands the number of participants in the model to include farmers, agribusiness people, legislators, government officials, and scientific disciplines. This perspective adds three dimensions previously neglected: (1) the researcher is seen as producing research in response to demands of clients; (2) it is recognized that some clients have more access to the research system than others; and (3) diffusion is seen largely as giving certain clients what

they initially requested. This perspective is illustrated by the information flows that must take place in sorghum research.

152. **Cernea, M.** 1981. Sociological dimensions of extension organization: The introduction of the T & V System in India. In B. R. Crouch & S. Chamala (Eds.), Extension education and rural development, Vol. 2, Experience in strategies for planned change (pp. 221-235). Chichester, England: John Wiley.

Socioeconomic organization / Monitoring / T & V system / Evaluation / Case studies / India

Considers six Indian states as case studies to highlight key principles of the T & V System and its introduction into the field system. Discusses deficiencies in traditional extension services, details of the organizational structure of the T & V System which overcome such deficiencies, and the method used to monitor and evaluate T & V extension projects.

153. **Cernea, M. M., Russell, J. F. A., Coulter, J. K. (Ed.)**. 1983. Agricultural extension by training and visit: The Asian experience. Washington, D. C.: World Bank. 176 pp.

Extension / Linkages / T & V system / Evaluation / Asia

Captures nearly 10 years of experience with the Training and Visit Extension System. Addresses five issues: farmer participation, the research-extension linkage, training, system management, and monitoring and evaluation. Within this framework, extension system managers and evaluators from six Asian countries and six discussants met at the Asian Regional Workshop in the T & V System of Extension in Chiang Mai, Thailand, to present their experiences and analyses.

154. **Cernea, M. M., Tepping, B. J.** 1977. A system for monitoring and evaluating

agricultural extension projects. Washington, DC: World Bank. 115 pp. (World Bank staff working paper, no 272).

Evaluation / Monitoring / Extension / Indicators

Presents the design of a system of monitoring and evaluation for agricultural extension and research projects. Designed as a management tool to ensure that the extension organization is operating efficiently, to enable management to take corrective action when necessary and to provide policy makers with appropriate information. The system consists of a conceptual framework, a set of indicators for monitoring project implementation, a set of indicators for estimating impact on farmers, and the design of a data generation system consisting of a set of sample surveys and ad hoc studies which would produce information concerning the accepted indicators. Includes recommendations for the organization, structure and staffing of a Monitoring and Evaluation Unit and suggests an implementation time table. Detailed specifications were prepared describing sample allocations, recommended sampling procedures, draft questionnaires and appropriate data collection and processing techniques.

155. **Charlick, R. B.** 1984. Animation rurale revisited: Participatory techniques for improving agriculture and social services in five francophone nations. Ithaca, NY: Rural Development Committee, Center for International Studies, Cornell University. 243 pp. (Special series on animation rurale, AR no. 1).

Rural development / Animation / Social participation / Cameroon / Haiti / Niger / Senegal / Upper Volta

This monograph is the culmination of a series of studies on "animation" as a technique for promoting rural development. The project involved two phases: (1) a qualitative analysis of 31 projects located in 37 sites in five countries (Cameroon, Haiti, Niger, Senegal and Upper Volta); and

(2) an effort to synthesize the case studies in a way which makes the interrelationship between techniques and results much clearer, and which leads to generalizations which can transcend these particular experiences. This report is the outcome of the second phase of the project. It identifies the major elements of "animation" as they have been employed by actors in different settings with markedly different conceptions of development. It also treats development as a multidimensional concept which involves not only the growth in material benefits, and a relatively broad distribution of benefits, but also some "process-oriented" goals of development.

156. **Chen, C. W.** 1981. Effective extension approaches applied in Taiwan, Republic of China. In B. R. Crouch and S. Chamala (Eds.), Extension education and rural development. Vol. 2: Experience in strategies for planned change (pp. 33-40). Chichester, England: John Wiley.

Extension / Methodology / Innovation adoption / Taiwan

A presentation of empirical evidence dealing with various extension approaches that have been tried for promoting the adoption of agricultural and home improvement practices in Taiwan. The purpose of this paper is to: (1) describe a study of extension teaching methods in Taiwan; (2) discuss the organization of extension clubs as a method of working with farm people; (3) discuss the use of local leaders as a procedure for carrying out extension activities (principally to help low income farmers); and (4) state implications of the study relevant to other developing countries. The three most effective methods through which farmers obtained information were individual contacts of farmers' associations, contacts with neighbors, and extension clubs. Mass media was not regarded as an effective approach in Taiwan. The use of local leaders was found to be very important for successful information dissemination.

157. **Claar, J. B., Watts, L. H. (Eds.)** 1983. Knowledge transfer in developing countries: Status, constraints, outlook. Urbana, IL: INTERPAKS (International Program for Agricultural Knowledge Systems), Office of International Agriculture, University of Illinois at Urbana-Champaign. 59 pp.

Diffusion of information / Technology transfer / Linkages / Developing countries

The proceedings of a conference between selected faculty members of the University of Illinois and Colorado State University. This conference focused on the "state of the art", the constraints to more effective extension work, and the needs of the future. An attempt is made to determine researchable problems that should be studied and also to examine the implications to extension services of the growing use of farming systems research methods. Another principle objective of this conference was to identify specific constraints and problems that will require attention during the carrying out of the INTERPAKS study, "Technology Development, Transfer, and Feedback Systems in Agriculture: An Operational Systems Analysis".

158. **Compton, J. L.** 1984. Linking scientist and farmer: Rethinking extension's role. In M. Drosdoff (Ed.), World food issues (pp. 79-84). 2nd ed. Ithaca, NY: Center for the Analysis of World Food Issues, Program in International Agriculture, Cornell University.

Extension / Technology transfer / Systems analysis / Linkages

Uses a systems perspective in the analysis, design, and operation of agricultural extension programs to assure coherence and efficiency of effort and relevance and effectiveness of result. Emphasizes the questions and issues concerning the interrelatedness of such units and dimensions of the overall system as research-extension-farmer linkages, training, social organization, and administration.

159. **Coombs, P. H., Ahmed, M.** 1974. Attacking rural poverty: How nonformal education can help. Baltimore: Johns Hopkins University Press. 292 pp. (A World Bank research publication).

Non-formal education / Training / Rural areas / Developing countries

Presents the main findings of an international research study designed to assist in improving the conditions of life in the vast rural areas of the world's poorest countries. The introductory chapter explains the background of the research study that underlies the report—its origins; its objectives, scope and limitations; its design and methods; and its conceptual framework. Chapter 2 leads off with an overview of rural education today in the developing world and a discussion of the character and magnitude of future tasks for nonformal education. Chapters 3-7 outline 25 examples of nonformal education in action that were selected for the study. Chapter 8 contains a critique of 'agricultural knowledge systems' and chapter 9 a corresponding critique of training programs for rural artisans, craftsmen and small entrepreneurs. The remainder of the chapters in part two focus on critical issues common to all kinds of nonformal education programs: educational content, methods and media (chapter 10); the economic aspects of nonformal education and the applicability of cost-effectiveness and cost-benefit analysis (chapter 12). Part 3 draws together many conclusions and suggestions that emerge at various points in the analytical chapters of Part 2.

160. **Crouch, B. R., Chamala, S. (Eds.)** 1981. Extension education and rural development. Vol. 1: International experience in communication and innovation. Chichester, England: John Wiley. 371 pp.

Extension / Rural development / Technology transfer / Communication / Adoption

Examines the process of development and the diffusion of innovations. Reports experience of rural change in 19 countries. Delves

into the modes and problems of communication. Each chapter is individually cited and annotated.

161. **Crouch, B. R., Chamala, S. (Eds.)** 1981. Extension education and rural development. Vol. 2: Experience in strategies for planned change. Chichester, England: John Wiley. 325 pp.

Extension / Rural development / Technical progress

Looks at the role of the extension worker as a change agent and at strategies and techniques for rural change. The contributors to the volume reflect actual experience and ideas from 17 countries. The central issues discussed are the organization and ethics of extension work. Each chapter is individually cited and abstracted.

162. **Cummings, R. W.** 1980. The role of international institutes. In V. Kumble (Ed.), Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer, 28 August - 1 September 1979 (pp. 173-177). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology transfer / International agricultural research centers / Linkages

Discusses the 13 international research centers whose primary function is agricultural research. The Consultative Group on International Agricultural Research (CGIAR) provides support for the centers. Notes that putting the research into practice is the task of the national and local agencies. Identifies the responsibility of the international research centers as finding and developing interfaces with national agencies to assure widespread reliable testing of potential technological innovations and to obtain dependable feedback, positive and negative. States that the establishment of ISNAR in 1978 is an important step towards strengthening national research programs

which will, in turn, increase the effectiveness and usefulness of the international centers and help ensure there is no break in the chain from the discovery of knowledge to its final application at the farming level.

163. **de Jong, J.** 1984. Extension techniques in farm management. In T. J. Davis (Ed.), Proceedings of the Fourth Agricultural Sector Symposium (pp. 147-184). Washington, DC: World Bank.

Technology transfer / Extension / Case studies / Linkages / Zimbabwe / Farming systems / Small farms

The paper looks at extension techniques in farm management and their application to farming systems research. Discusses the evolution of appropriate technical and operational recommendations and their adaptation to and acceptance by small scale producers. Deals with the relationship between research stations and extension personnel and the most effective techniques used for reaching the farmer. Through examples from baseline studies in Zimbabwe, the paper shows some possible ways in which extension can best reach the communal farmers.

164. **Dias, G. M.** 1981. The impact of public service agencies in subsistence agriculture in northeastern Brazil: A preliminary evaluation. In B. R. Crouch and S. Chamala (Eds.), Extension education and rural development. Vol. 2: Experience in strategies for planned change (pp. 179-187). Chichester, England: John Wiley.

Extension / Equity / Brazil

Assesses the contribution of government agencies servicing the extension needs of peasants in northwest Brazil. There has been a massive growth in the bureaucracies servicing rural areas over the past 30 years without any apparent benefit to the peasant population and with less than 1% of the rural population being effectively serviced by state and federal government agencies. There is a clear dichotomy between a small group of

new, large-scale planters and the mass of small producers. The inequality between these two is described in terms of distribution of lucrative export crops and traditional subsistence crops, access to innovations, financial help and technical assistance. Points out that few extension workers have direct frequent contact with the client community.

165. **Eicher, C. K.** 1984. International technology transfer and the African farmer: Theory and practice. Mount Pleasant, Harare, Zimbabwe: Department of Land Management, University of Zimbabwe. 34 pp. (Working paper, 3/84).

Technology transfer / Africa

Focuses on the component of increasing food production in the national strategy to increase food security. Examines the changing perspectives on global food security since 1974 and then analyzes Africa's current food security problems within the global context. Analyzes the role of technology transfer in increasing food production and food security. Through case studies, examines technology transfer in theory and practice. Concludes with a discussion of five major issues for further debate and analysis by African states, international and regional research institutes, and donor agencies.

166. **Ekpere, J. A.** 1974. A comparative study of job performance under two approaches to agricultural extension organization. Madison, WI: Land Tenure Center, University of Wisconsin-Madison. 70 pp. (Research paper no. 61).

Extension / Technology transfer / Job performance / Socioeconomic organization / Nigeria / Rubber

Examines the job performance of extension workers operating under the two approaches to agricultural extension organization in the Midwestern State of Nigeria to: (1) determine the level of performance of agricultural extension workers employed under

the general extension and rubber divisions in the Midwestern Nigeria Ministry of Agriculture and Natural Resources; and (2) identify and discuss factors that explain differences, if any, in the levels of performance of extension staff working under the two approaches to agricultural extension organization. From the data in the study, it may be concluded that the performance of rubber extension workers was higher than that of the general extension workers on most of the activity indices of performance measured. The study provided evidence to suggest that the difference in the organizational form--general or multi-commodity extension and the rubber or single commodity extension approach--was not the major block to effective performance. Where differences in the level of performance existed, they were due to the availability of a steady stream of economically viable and ecologically adaptable technology supported by an appropriate system of educational and supply services.

167. **Evenson, R. E., Binswanger, H. P.** 1978. Technology transfer and research resource allocation. In H. P. Binswanger and V. W. Ruttan (Eds.), *Induced innovation: Technology, institutions, and development* (pp. 164-211). Baltimore, MD: Johns Hopkins University Press.

Technology transfer / Agricultural research / Resource allocation / Models

Three theories, research resource allocation, induced innovation, and diffusion of technology, are integrated to focus on the problem of technology transfer. Emphasizes that capacity for adaptive research is essential for efficient technology transfer and that the investment model for efficient technology transfer and the investment modes of induced innovation is broad enough to include the "search" activities involved in the process of such transfer. Tests transferability of agricultural technology across microclimatic regions using an index of environmental sensitivity. Test results indicate that environmental constraints on

technology transfer are such that very high priority must be given to investment in experiment station capacity to generate location specific technology that is adapted to the physical and economic environment of each ecological region. Importantly, the transfer of technology among regions and countries is responsive to essentially the same inducement processes that generate particular agro-climatic or ecological regions.

168. **Feder, G., Slade, R.** 1984. The acquisition of information and the adoption of new technology. *American Journal of Agricultural Economics*, 66, 312-320.

Information flow / Technology transfer / Innovation adoption / Models / India

Presents a dynamic model of diffusion of a new technology involving a variable input. The model highlights the role of active information accumulation, which entails costs. It generates several hypotheses regarding the likely pattern of adoption and use of the variable input over time by farmers of differing holding sizes and different access to information. It provides a possible explanation to the often observed lag in adoption of innovations by smaller farmers. Analysis of data from India on knowledge and adoption of several practices yields results which are generally consistent with the hypotheses suggested by the theoretical framework.

169. **Feder, G., Slade, R.** 1984. Aspects of the training and visit system of agricultural extension in India: A comparative analysis. Washington, DC: World Bank. 37 pp. (World Bank staff working papers no. 656).

Extension / T & V system / India

Recent farm survey is used to analyze the performance of the Training and Visit system in one district the state of Haryana (India). Makes a comparison to a neighboring district served by an older extension

system. Data indicate that a significantly higher level of village-level extension activity was present in the area covered by Training and Visit Extension, reflecting the larger number of staff and higher expenditure on extension under this system. Data further suggest that knowledge of improved practices, especially in wheat cultivation, diffused faster in the area covered by Training and Visit Extension.

170. **Food and Agriculture Organization of the United Nations.** 1983. The need for improved agricultural extension services for women engaged in agriculture. Rome: Food and Agriculture Organization of the United Nations. Paper presented at the Expert Consultation on Women in Food Production, Rome, Italy, 7-14 December 1983. 14 pp. (ESH: WIFP/83/3-Rev. 1).

Extension / Women / Developing countries

Women form a large segment of the agricultural work force. As such, they deserve increased attention from agricultural extension services in every developing nation. Discusses the need for a blueprint, an action-oriented plan for reaching the thousands of women in agriculture who fill the bread baskets of the third world.

171. **Food and Agriculture Organization of the United Nations. Human Resources, Institutions and Agrarian Reform Division.** 1982. Improving the organization and administration of agricultural services for small farmers in Africa: Report of a regional expert consultation held in Nairobi, Kenya, December 1982. Rome: Human Resources, Institutions and Agrarian Reform Division, Food and Agriculture Organization of the United Nations. 86 pp. (Development organization and administration report no. 4).

Agricultural development / Small farms / Socioeconomic organization / Management / Linkages / Africa

Report of an FAO sponsored regional expert consultation held in Nairobi, Kenya. The

broad purpose of this consultation was to discuss with high level officials issues concerning the improvement of the organization and administration of agricultural services to small farmers in Africa. Subject areas covered include delivery of agricultural services to small farmers, organizations and the organization of agencies fulfilling this function, and the need for training and a training strategy. Concludes with a number of recommendations to national governments, FAO, and other agencies involved in the effort to help small farmers in Africa.

172. **Gabriel, T. M.** 1980. Understanding the local social conditions in extension training: A guide to the literature. Reading, England: Agricultural Extension and Rural Development Centre, University of Reading. 49 pp.

Extension / Social behavior / Training / Bibliographies

Compiled as a guide to trainers and trainees to the literature on social systems relevant to extension work. Follows the belief that, by enabling trainees to appreciate local people's ideas about themselves and their society, extension can be made more effective. Includes an introductory discussion on the "local dimension" which crucially affects planned change and how it affects extension and extension training.

173. **Goodell, G. E.** 1983. Improving administrators' feedback concerning extension, training and research relevance at the local level: New approaches and findings from Southeast Asia. *Agricultural Administration*, 13, 39-55.

Extension / Methodology / Training / Agricultural research / South East Asia

Describes selected extension programs in six Southeast Asian countries. Among extension approaches observed in these countries, those programs directed by Southeast Asians

overwhelmingly favored technicians' one-to-one contact with farmers in solving their problems on the spot, whereas those programs designed by Westerners included larger classes and instruction in agricultural concepts. Reviews the advantages of each approach. Given the increasing complexity of irrigated agriculture, technicians and even supervisors were found to need more training in both social and intellectual initiative. Describes how anthropological research methods can be useful in improving the accuracy and insights of administrators' information from the provincial and farm levels and how administrators can benefit from the breadth that anthropologists bring to understanding both technicians' and farmers' decision making.

174. **Hayami, Y., Ruttan, V.** 1971. Agricultural development: An international perspective. Baltimore: Johns Hopkins University Press. 367 pp.

Agricultural development / Technology transfer / Models / Japan / Korea Republic / Taiwan

Proposes a new model of agricultural development which will include technological and institutional change as factors endogenous to the economic system. Success in agricultural growth is based on an ecologically adapted and economically viable agricultural technology which involves a continuous adaptation to available resources as well as a positive response by cultural, economic and political forces. Part IV (pp. 169-237) is particularly relevant to technology development, transfer and utilization research. Presents the theory and history of international technology transfer and discusses the various diffusion models. Studies of technology transfer in Japan, Taiwan and Korea illustrate these models. The last part focuses on changes in agricultural transformation and trade which are required in moving from the successful transfer of technology in one sector of the economy to success in overall development.

175. **Howell, J.** 1982. Managing agricultural extension: The T and V system in practice. *Agricultural Administration*, 11, 273-284.

Extension / T & V system / Nigeria / Malaysia / India

Discusses the T and V extension system that has achieved prominence both because of World Bank pressure and the concern of many ministries of agriculture over low productivity of agriculture of their extension effort. Develops three main themes: (1) examines categories of problems in producing technical advice and information to small farmers; (2) looks at the components of the T and V system against these problems; and (3) identifies the most common criticisms made of T and V and discusses whether the record bears them out. Concludes that the system may eventually deserve a better reputation that it currently has if it is not implemented too rigidly or not too much is claimed for it.

176. **Hulme, D.** 1983. Agricultural extension: Public service or private business? *Agricultural administration*, 14, 65-79.

Extension / Public sector / Developing countries / Private sector / Papua New Guinea

A common strategy for agricultural and rural development in the third world is the operation of a government-run agricultural extension service devoted to augmenting small holder productivity. Numerous evaluations of such services, however, have concluded that they are ineffective. The paper examines an alternative strategy—the provision of agricultural extension services by capitalist enterprise. It presents a case study of the privatization of extension services in Papua New Guinea and discusses the implications. The paper concludes that private agencies have the ability to boost agricultural production, but are unlikely to achieve the broader objectives of contemporary rural development.

177. **Jiggins, J.** 1977. Motivation and performance of extension field staff. In *Extension, planning, and the poor* (pp. 1-19). (Agricultural Administration Unit occasional paper 2). London: Overseas Development Institute, Agricultural Administration Unit.

Extension / Small farms / Motivation / Management

Discusses extension services for the mass of small farmers rather than those provided under government-run or privately-owned commodity schemes, where a relatively efficient superior structure and organization exists. Begins with the accusation that current extension efforts are inadequate for the enormity of the problem, that services are ill-structured to the nature of the task and that junior staff, even if they start with enthusiasm and energy, are pushed by the very system within which they work, and the lack of regard and incentives, towards an attitude of resignation, apathy and self-interest. Looks at the structural reasons for the existing performance and procedural characteristics of extension services; considers what criteria should determine extension organization; and then discusses the type of extension service these criteria would entail. Discusses the problems arising from the bureaucratic setting, the managerial problems these generate, and the management effort needed to meet them. Focuses on the individual aspects of extension motivation, junior staff's relationships with farmers, and recruitment and training. The final section considers the implications for extension organization and the motivation of junior staff.

178. **Kabore, J.** 1980. Reflections on the transfer of technology. In V. Kumble (Ed.), *Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer*, 28 August - 1 September 1979 (pp. 231-233). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology development / Adaptation /
Technology transfer

Identifies the need for a code or framework for the transfer of technology. Discusses the necessity of such a framework to strengthen the capacity of developing countries for organizing and receiving new techniques and improving access to technology at prices all can afford. Identifies the establishment and development of facilities for technical and in-service training in the countries themselves as prerequisites for the efficient and durable transfer to technology. Notes that new techniques must be assimilated, modified, and adapted to conditions peculiar to each country. Discusses fact that agricultural research carried out in developed countries involves means of production that have nothing in common with those of the small farmer of Upper Volta. Stresses that scientists are needed who can assimilate the people's everyday problems and work out a realistic research program that will raise the technological level of the farmer.

179. **Kang, J. T.** 1984. Interorganizational relations between extension agencies and other agricultural development agencies in Asian and Oceanian countries. Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign, Urbana, IL. 175 pp.

Extension / Socioeconomic organization / Institutions / Asia / Oceania

Studies the factors related to the three facets of interorganizational relations (coordination, structural conflict and operating conflict) in extension agencies and other agricultural development agencies. Seeks to determine whether there are differences between general and commodity specific extension agencies in terms of the selected aspects of interorganizational relations. General extension agencies in 15 countries and commodity-specific extension agencies in 10 countries were surveyed for data for the study. Responses came from extension directors in the Asian and Oceanian countries.

The major findings were as follows: (1) resource, power and exchange variables were found to be more important determinants of all three dependent variables (coordination, structural conflict and operating conflict) than were the organizational variables of age, size and complexity. The resource variable was the best predictor of all three dependent variables; and (2) commodity-specific agencies had more frequent contact and more complex interorganizational contacts than did the general extension agencies. In addition, respondents in commodity specific extension agencies reported less structural and operating conflict with the other agricultural development agencies than did those in general extension agencies.

180. **Kellogg, E. D.** 1983. Constraints to developing effective extension programs in agricultural assistance programs: Some brief observations. In J. B. Claar & L. H. Watts (Eds.), Knowledge transfer in developing countries: Status, constraints, outlook (pp. 31-38). Urbana, IL: INTERPAKS, Office of International Agriculture, University of Illinois at Urbana-Champaign.

Extension / Agricultural development / Agricultural policy / Constraints

Discusses constraints facing extension in making a productive contribution to agricultural development in the context of the current policies for agricultural assistance programs. The constraints are classified as external or internal to the extension system. The importance of these constraints in hindering effective performance is discussed and an assessment of each is made regarding the degree to which the constraint can be alleviated.

181. **Kumar, K.** 1981. Technology transfer in Indian agriculture: Processes and problems. In Management of transfer of farm technology (pp. 106-116). Hyderabad, India: National Institute of Rural Development.

Extension / Linkages / India / Technology transfer

Gives several illustrations to lend authenticity to the big and small in agriculture technology development and transfer. A key factor in transferring technology to, and evolving a comprehensive policy for India's agricultural sector is that agriculture is privately owned on the one hand and a state subject on the other. Transfer of technology is a good deal less simplistic than the generation and dissemination explanation. Several linkages at different levels are implied. Suggests areas for improvement in extension such as better use of available media for group or mass communication, training of functionaries, the need to reach women and youth, and a more democratic administration. The author sees a definite link between individual farmers and the groups they constitute, particularly in the area of agricultural practices. Concludes by calling for application of 'extension technology' to realize the potential of the extension system.

182. **Leonard, D. K.** 1977. Reaching the peasant farmer: Organization theory and practice in Kenya. Chicago: University of Chicago Press. 297 pp.

Extension / Organizations / Management / Kenya

Discusses Kenya's agricultural extension system in a framework of organization theory, both to resolve national problems and as an analysis and prescription for extension organizations elsewhere. Kenya has all the background prerequisites for successful agricultural development (research back-up, crop innovation, price incentives, etc.). However, the Kenyan extension services are disturbingly inefficient. The book deals with the practical and organizational issues of Kenyan agricultural extension and administration. Investigates the factors influencing administrative performance by applying western organization theory. Shows how organizational theory can be applied to nonindustrial societies.

183. **Lindt, J. H., Jr.** 1980. Experiences with agricultural extension and field research. In Proceedings of the Agricultural Sector Symposia, January 7-11, 1980 (pp. 346-351). Washington, DC: World Bank.

Extension / Management / T & V system / India / Technology transfer

Discusses the purpose of agricultural extension and suggests that a frequent problem is vagueness of purpose and the failure to identify clear objectives. The primary objectives of extension are to improve agricultural productivity and living standards of farmers by providing them with the increased knowledge and skills necessary to adopt and apply more efficient crop and animal production methods. Describes the application of the training and visit extension system in India and how new technology is transferred in two stages—first to the village extension workers (VEWs) by the subject matter specialists (SMSs) and then to the farmers via the VEWs.

184. **Lionberger, H. F., Chang, H. C.** 1981. Development and delivery of scientific farm information: The Taiwan system as an organizational alternative to land grant universities—U.S. style. In B. R. Crouch and S. Chamala (Eds.), Extension education and rural development. Vol. 1: International experience in communication and innovation (pp. 155-183). Chichester, England: John Wiley.

Diffusion of information / Agricultural research / Extension / Linkages / Taiwan

Presents a description of the agricultural research, extension, and educational system in Taiwan. The differences between the Taiwan and U.S. systems are examined and reasons for the success of the Taiwan system are presented. In Taiwan, agencies and their functions are integrated into a single operational system which has been highly responsive to farm information needs and has served agriculture well. Farmers are involved at all decision levels of the system, the agricultural services attract and retain personnel with agriculture backgrounds, scarce

resources are used judiciously, and different parts of the information system are linked and coordinated. This system illustrates a farm information system based on local experience and field testing of research, integrated into an on-going organizational system.

185. **Lionberger, H. F.** 1974. Organizational issues in farm informational systems for modernizing agriculture. *Journal of Developing Areas*, 8, 395-408.

Information flow / Technology transfer

Examines the continuing supply of scientific information that farmers need for modernizing agriculture. A diffusion system must disseminate and integrate new knowledge into individual farming operations. The degree of functional differentiation and organizational specialization that best serves farmers is clearly related to the current state of agricultural development in a given country and the manner in which other support to agriculture is managed. Information systems themselves require integration into specific adopting situations; thus, the mere transplant of a system and its organization from one country to another should be avoided.

186. **Lowdermilk, M. K.** 1981. Promoting increased food production in the 1980's: Approaches to agricultural extension in different production systems. Paper presented at World Bank Symposium, January 5-9, 1981, on Promoting Increased Food Production in the 1980's, Washington, D.C. and revised for DAC Workshop on Linkages of Agricultural Research and Farmers, Paris, France, May 13-15, 1981. 38 pp.

Extension / Agricultural research / Linkages / Developing countries / Technology transfer / Information flow

Provides a state-of-the-art understanding of the critical issues and lessons about agricultural extension programs and the role of extension in different agricultural

production systems. Identifies the major components of various extension approaches and describes a process to strengthen the linkages between agricultural research and farmers who are the target audience as well as the basic building block of all farming systems. Concludes with several suggestions of ways to improve existing extension systems.

187. **Maalouf, W. D.** 1983. International experiences in agricultural extension and its role in rural development. Rome: Food and Agriculture Organization of the United Nations. Paper presented at the Regional Seminar on Extension and Rural Development Strategies, Serdang, Selangor, Malaysia, May 16-20, 1983. 14 pp.

Extension / Management / Training / Linkages / Rural development / Developing countries

Presents a broad overview of agricultural extension in the developing world including the status of agricultural extension, common problems, and approaches and methodologies. Rural development is discussed in detail, including methods and strategies commonly used. The role of agricultural extension as a facilitator in the process is included. Discusses the organization of extension services, training, management of services, and the necessary linkages of the various components necessary for rural development.

188. **Maji, C. C., Haque, T.** 1979. Efficiency of agricultural extension in technology transfer and income generation before and after the green revolution in India. *Indian Journal of Agricultural Economics*, 34(4), 1-11.

Technology transfer / Extension / Green revolution / India

Examines the role that extension has historically played in transferring a given technology and increasing farm income in a state and compares its effectiveness among states with comparable technologies and

within each state over time. Identifies areas which are relatively deficient in extension services and suggests suitable policy measures. Examines the effectiveness of agricultural extension in an ex post manner using multiple regression as the analytical tool. Tests the hypothesis that technological innovations in the late 1960s have increased the efficiency of agricultural extension. Results indicate: (1) expenditure on agricultural extension significantly contributed to the growth of fertilizer consumption in 7 of the 13 states pre-Green Revolution; (2) the insignificant role in the remaining six states suggests lack of adequate support from agricultural administration; (3) the marginal efficiency of extension was found to be higher in some areas, but was not observed in the majority of states under study; (4) agricultural extension appears to have made a significant contribution to the spread of HYV's in 10 out of 13 states; (5) the marginal productivity of extension, in terms of gross value of output per hectare of gross cropped area, has increased substantially in the post-Green Revolution period in 8 out of 13 states.

189. **Malone, V. M.** 1983. Human resources management: A constraint to successful extension services in international development work. In J. B. Claar and L. H. Watts (Eds.), *Knowledge transfer in developing countries: Status, constraints, outlook* (pp. 35-38). Urbana, IL: INTERPAKS, Office of International Agriculture, University of Illinois at Urbana-Champaign.

Extension / Human resources / Management

The factor of lack of human resources to manage extension services is herein examined as a constraint to extension's function as an effective knowledge transfer agency. The author believes that the human resources, the agents of change, are affected by many social system factors, and if these factors are ignored, little or no transfer will take place. Reasons for the continuance of this constraint are discussed including the

difficulty of identifying the problem and the use of inappropriate intervention strategies.

190. **McClymont, D. S.** 1982. The diffusion of innovations among farmers: A reassessment. *Zimbabwe Agricultural Journal*, 79, 187-198.

Technology transfer / Communication

Examines various models, from the classical to the economic, for the diffusion of innovations. Suggests a more practical approach to the research into the communication of technical information to farmers and the analysis of the diffusion of innovations. Reviews much of the literature in the area of diffusion of innovations.

191. **McDermott, J. K.** 1982. Concepts in technology transfer for small farms. In H. W. Kerr, Jr. and L. Knutson (Eds.), *Research for small farms* (pp. 23-26). (Miscellaneous publication no. 1422). Washington, DC: U.S. Department of Agriculture, Agricultural Research Service.

Technology transfer / Extension / On-farm testing / Technology development / Small farms / Farming systems

Discusses a concern that terminology currently used in agricultural research and extension is obsolete and clearly inadequate. Indicates that this condition reflects, in part, the lack of conceptualization and the weakness of the concepts upon which we now depend, as well as the traditional nature of the agricultural research and extension establishment. Notes that the problem is especially serious in international work and is becoming serious even within the tradition.

192. **Miller, P. A.** 1982. Social consequences of technology in the improvement of peasant agriculture. In *Proceedings of the Third International Conference on Goat Production and Disease*, January 10 to 15, 1982 Tucson, Arizona, U.S.A. (pp. 319-327).

Scottsdale, AZ: Dairy Goat Journal Publishing.

Technology transfer / Social change / Developing countries

Discusses aspects of technology transfer and the interaction with traditional agriculture. The text is divided into four primary sections. The first examines technology transfer and rural development in terms of inappropriateness with western development models for use in developing countries and the successful union of research and farmers needs in the U.S.A. The second portion deals with the social impacts of rice and wheat high yielding varieties (HYV's) since the 1960s. Identifies resulting problems including reinforcement of traditional inequities in land distribution where institutional reform was absent, lower prices and better access to suppliers to urban populations without improvement in the overall food and nutrition situation. The third part deals with the social factors in traditional agriculture including small holder systems, animal agrosystems and the role of ruminants. The last section concludes that many developing countries have had negative social consequences from substantial incorporations of science-based technology into their rural sector primarily because technical innovations have out-paced institutional changes.

193. **Molnar, J. J., Clonts, H. A. (Eds.)**. 1983. Transferring food production technology to developing nations: Economic and social dimensions. Boulder, CO: Westview Press. 175 pp.

Technology transfer / Sociological analysis / Economic resources / Planning / Agricultural policy / Developing countries

Addresses the social, economic, and policy problems associated with introducing new agricultural and aquacultural technology to developing countries. Examines three general aspects of planning for technology transfer and considers methodologies that enable effective integration of social and economic factors. The first section of the

book covers problems of planning at the national and regional levels, emphasizing methods and models for macroplanning under conditions when resources are limited. Subsequent sections, focusing on planning at the local level and on constraints on the technology transfer process, cover a broad range of topics, among them production and marketing decisions by small farmers, conflicting objectives of planners and producers, constraints on resource allocation within the production unit, and strategies for training extension workers, researchers, and project planners.

194. **Moris, J. R., Hatfield, C. R.** 1982. A new reality: Western technology faces pastoralism in the Maasai Project. In Report of an exploratory Workshop on the Role of Anthropologists and Other Social Scientists in Interdisciplinary Teams Developing Improved Food Production Technology (pp. 43-61). Los Banos, Laguna, Philippines: International Rice Research Institute.

Technology transfer / Sociological analysis / Range management / Tanzania / Case studies / Technology development / Management

Provides a discussion of the role of the social scientist in the development and implementation of the technologies with the Maasai project in Tanzania to give some understanding of the constraints to success. First discusses two interrelated technologies: scientific and managerial. Explores the various roles played by the social scientist in these technologies over the project's lifetime. Discusses the conflicts that arose from these tasks.

195. **Murthy, A. S.** 1981. Social and economic constraints in the generation and transfer of agrotechnology. In Management of transfer of farm technology (pp. 85-97). Hyderabad, India: National Institute of Rural Development.

Technology transfer / Constraints / Economic sociology / Extension

Emphasizes the international nature of research. Technology developed in one country often moves to another. Suggests that many international centers are the origin of partially developed technology which may be completed by several national programs. Classifies constraints as organizational related to research and the social and economic situation. Emphasizes the need for overhauling extension, training, and coordination.

196. **Nagel, U. J.** 1979. Knowledge flows in agriculture: Linking research, extension and the farmer. *Zeitschrift fur Ausländische Landwirtschaft*, 18, 135-150.

Information flow / Agricultural research / Extension

Using the "dissemination and utilization of knowledge" concept from Havelock, knowledge flows are viewed from a systems point of view. The agricultural knowledge system (AKS) consists of three major subsystems: the research subsystem as the generator of knowledge; the dissemination subsystem as its transmitter; and the user subsystem as its integrator into the stock of agricultural practices. Proper functioning of the AKS depends upon the solution of six functional problems: need identification, generation of knowledge, operationalization, dissemination, utilization, and evaluation of experiences. Discusses organizational issues in view of the three subsystems and the flow of knowledge through these organizations.

197. **National Workshop on Management of Transfer of Farm Technology (Hyderabad: Nov. 9-24, 1979).** 1981. Management of transfer of farm technology. Hyderabad: National Institute of Rural Development. 233 pp.

Technology transfer / India / Innovation adoption

Explores and illuminates the role of new technology in increasing the output from India's many and diverse farming systems.

Shows clearly that though more productive agricultural practices and new technology may be a necessary condition for rural progress, they are not of themselves a sufficient condition. Most of the papers deal with specific experiences of research or extension agencies in the transfer of technology, but some are useful reviews of progress in a certain sector. The first section includes six papers which provide a conceptual frame for understanding the process of technology transfer. Section II is comprised of actual experiences of agencies attempting to transfer technology and reviews of national or regional progress in a particular agricultural or allied sector. The concluding chapter attempts to set the observations gleaned from the workshop in sequence and perspective.

198. **Nobe, K. C.** 1983. Organizational constraints to greater extension involvement in Agency for International Development-funded agricultural programs in less developed countries. In J. B. Claar & L. H. Watts (Eds.), *Knowledge transfer in developing countries: Status, constraints, outlook* (pp. 22-30). Urbana, IL: INTERPAKS, Office of International Agriculture, University of Illinois at Urbana-Champaign.

Extension / Management / Agency for International Development / Developing countries

Examines the paradox that although USAID has in recent years sought involvement of university faculty, AID funded opportunities for extension oriented faculty have declined. This situation is seen to be changing. The author feels that whether the change will become a long-term reality or if opportunities for involvement will decline depends on two factors: (1) the degree to which extension can expand its traditional role of delivering farm inputs and related technical knowledge to farmers to include delivering an accurate assessment of farmer output response to policy-makers in LDC government agricultural agencies; and (2) the ability of U.S. university-based extension

personnel and central university administrators to select new opportunities for successful performance in the LDC arena. Organizational constraints to effective U.S. involvement in LDC's are outlined and the need for a major change in the extension function is highlighted. Extension must expand beyond a single product approach to a strategy where extension's product encompasses a farmer's total system. Recommendations are given which are felt to be important for increasing success in achieving a viable future role for extension in AID-funded agricultural programs.

199. **Onazi, O. C.** 1982. Role of the extension specialist in the transfer of agricultural technology: The Northern Nigeria experience. *Agricultural Administration*, 9, 229-238.

Technology transfer / Feedback / Nigeria / Extension / Technology development / Linkages

Examines the role of the extension specialist in facilitating the flow of research results to farmers and obtaining feedback of farmers' problems for use in research. Refers to Northern Nigeria. Emphasizes that research in agriculture is of little value unless the results reach the users and are effectively utilized by farmers. Notes that the concept and organization of an extension and research liaison service to facilitate the two-way research/feedback flow is necessary. Extension specialists' responsibilities are identified. Need for improving information flow in Northern Nigeria is based on the fact that agricultural research and output in that country is probably twenty years ahead of the farmer. Yet, after nearly two decades of experience with an appreciably improved extension service, the country has not attained the goals and objectives of a sustained economic growth in the agricultural sector.

200. **Oyer, E. E.** 1984. Agricultural research and technology transfer for food production: What strategies are appropri-

ate? In M. Drosdoff (Ed.), *World food issues* (pp. 65-71). 2nd ed. Ithaca, NY: Center for the Analysis of World Food Issues, Program in International Agriculture, Cornell University.

Technology development / Technology transfer / National research programs / International agricultural research centers

Discusses factors and strategies necessary in developing countries to increase food production by agricultural research and technology transfer. Notes that factors affecting these issues include: (1) available physical and biological resources as they promote or constrain food production; (2) the milieu for the initiation, development, testing, and delivery of new and improved technology appropriate to a given environment (local research and extension institutions); (3) government policies relative to incentives for farmers to produce more food; and, (4) existence of regional and international institutions to facilitate the generation and transfer of technology. Strategies identified as appropriate to the transfer of technology are: (1) the indigenous capability to understand the technology to be transferred; (2) adequately trained extension agents; (3) availability of researchers to modify the technology to fit local conditions; (4) ability to generate technology in situ; and (5) on-going farmer training.

201. **Patel, N. T., Parmar, D. S.** 1979. Contribution of extension services in agricultural production. *Indian Journal of Agricultural Economics*, 34(4), 49-54.

Extension / Evaluation / India

Examines the level of significance of extension services and the marginal contribution of extension services to increased agricultural production in Gujarat State (1976-77). In addition, the marginal contributions of extension services are compared for the high and low productivity areas of the state. Results of the regression analysis indicate that extension

investment has played a significant role in increasing agricultural production only in the high productivity areas, while in the low productivity areas it has played an insignificant and even negative role.

202. **Perraton, H., Orivel, F., Jamison, D. T., Wolff, L., Jenkins, J.** 1983. Basic education and agricultural extension: Costs, effects, and alternatives. Washington, DC: World Bank. 285 pp. (World Bank staff working papers no. 564).

Extension / Malawi / Education / Lesotho / Mass media / West Africa

The papers in this volume examine the evidence about the methods, costs and effects of agricultural extension and basic education and about the use of mass media for extension and education. The first two papers review the literature on the effectiveness of agricultural extension and on the use of mass media. Three case studies follow. All are of institutions which have used mass media, but in widely different ways. They are the Agricultural Information Service of the Ministry of Agriculture in Malawi, the non-government organization INADES-Formation in West Africa, and the Lesotho Distance Tracking Centre.

203. **Perraton, H., Jamison, D. T., Orivel, F.** 1983. Mass media for agricultural extension in Malawi. In Basic education and agricultural extension: Costs, effects, and alternatives (pp. 147-201) (World Bank staff working papers no. 564). Washington, DC: World Bank.

Mass media / Extension / Malawi

Reports the results of research concerning the role of mass media in providing information to Malawian farmers. After describing the various types of information services available to farmers, the paper assembles available information concerning media effectiveness and costs. The paper's analysis of costs found, not surprisingly, dramatic differences in the costs of dif-

ferent ways of reaching farmers. Estimates that mobile vans (film and puppet shows) cost about 44 times as much per contact-hour as radio, and extension agents cost 55 to 80 times as much as mobile vans. Economics from mass outreach are evident. What is less clear is how best to make mass media complementary to face-to-face methods.

204. **Rao, R. C.** 1972. Communication linkages in transfer of agricultural technology. *Economic and Political Weekly*, 7, A-157-170.

Technology transfer / Linkages / India / Communication

Examines the communication linkages relevant to the transfer of agricultural technology in India with a view to identifying the deficient areas and their effect on the transfer process. Focuses on the communication between the research and extension groups in terms of: (1) the channels in use for internal communications vis-a-vis external or inter-agency communication; and (2) the circumstances for, and content of, these two types of flows of communications. Outlines the various approaches that could usefully reshape the environment for communication linkages and emphasizes the need for a basic change in terms of projecting the farmer as the end-user and reference point in the entire communication system for technology transfer.

205. **Ray, A. K., Atteri, B. R., Sen, A. C., Mathur, P. N.** 1979. Quantitative and qualitative impact of training and visit system on different groups of farmers: A case study of Hooghly District, West Bengal. *Indian Journal of Agricultural Economics*, 34(4), 11-21.

T & V system / Innovation adoption / Small farms / India

The study examines: (1) changes in the cropping pattern and cropping intensity after the introduction of the Training and Visit (T and V) system on different farm sizes; (2) changes in productivity and labor

employment patterns due to the adoption of the T and V system on different farm sizes; (3) compares the marginal productivity of different inputs within and without the T and V system; and (4) studies the extent of adoption of different improved practices before and after the implementation of the T and V system. Results of the study indicate that before the implementation of the T and V system, most of the cultivable area was under traditional crop varieties, but after the system had been introduced, cultivation of HYV's increased. The impact of the system was found to be more on the small holdings than on the large. The study clearly indicates that T and V type extension has a significant positive impact on the farming economy of Hooghly district.

206. **Richardson, E. V.** 1983. Knowledge transfer in less developed countries. In J. B. Claar & L. H. Watts (Eds.), *Knowledge transfer in developing countries: Status, constraints, outlook* (pp. 39-41). Urbana, IL: INTERPAKS, Office of International Agriculture, University of Illinois at Urbana-Champaign.

Technology transfer / Diffusion of research / Irrigation / Developing countries

Presents some of the problems facing knowledge transfer through extension in developing countries. The author feels that a major problem is the modeling of the extension services in these countries on that of the Cooperative Extension Service in the U.S. To change farmer practices in these countries takes a more active program than the passive approach of the U.S. system. This problem is illustrated in the context of a country's ministries of irrigation and agriculture. Necessary steps to address this problem are outlined and discussed. They include: (1) extension workers actively working with farmers; (2) multi-disciplinary field research and extension teams; and (3) increased coordination between related ministries.

207. **Rogers, E. M.** 1983. *Diffusion of innovations*. New York: Free Press. 3rd ed. 453 pp.

Technology transfer / Innovations / Innovation adoption

Synthesizes the roughly 3,100 publications now existing on diffusion research and advances one's understanding of the diffusion of innovations in theoretical terms. This 3rd edition is broader in scope than the previous two (*Diffusion of innovations*, 1962, and *Communication of innovations*, 1971) and takes into account the context of innovations. Deals with the issues of where innovations come from and how their origins affect their diffusion. The author updates his earlier work on attributes of innovations and the rate of adoption and on innovator categories. Considers the greatly increased interest in the innovation process in organizations. Discusses the limitations of the linear model of communication and proposes an additional convergence model which more accurately describes certain types of diffusion. Concludes with a chapter on the impact of consequences of innovations by examining equity issues.

208. **Roling, N.** 1982. Alternative approaches in extension. In G. E. Jones & M. J. Rolfs (Eds.), *Progress in rural extension and community development*. Vol. 1: *Extension and relative advantage in rural development* (pp. 87-115). Chichester, U.K.: John Wiley.

Extension / Objectives / Developing countries

In many developing nations, serious efforts are being made to develop agricultural extension services into systems which can serve the broad masses of small agricultural producers, instead of only a few high-access farmers. Objectives have shifted to providing income-generating opportunities to small farmers; to increasing equity in rural areas; to broaden integrated rural development; or to organize rural people so as to allow them to carry their own development.

Discusses the elements of the extension process. When extension objectives change, the other elements must also change because the elements form an interconnected whole. Aims to systematically explore the implications of a change in extension objectives for the other elements of the process.

209. **Roling, N.** 1984. Appropriate opportunities as well as appropriate technology. *Ceres*, 17(1), 15-19.

Appropriate technology / Technology transfer / Extension / Farming systems

Reviews how the agricultural extension agent has dealt with the process of technology transfer and the categories of farmers affected by the diffusion process. Discusses CIMMYT's model of grouping rural populations into homogeneous target categories to develop appropriate technologies and the influence it has had on the process of technology development. Points out that strategies intended to assist small farmers depend as much on the creation of appropriate opportunities as on the creation of appropriate technologies.

210. **Roling, N. G.** 1979. The "logic" of extension. *Indian Journal of Extension Education*, 15(3/4), 1-8.

Extension / Linkages

Suggests that extension must take into account both needs and means in its activities and that needs and means must be made to meet in order to be effective. Extension and agricultural research have so far been largely means-oriented. Describes three types of approaches to extension. Concludes that more needs-orientation must be built into extension and lists the implications of this needs orientation.

211. **Sachs, R. E. G.** 1981. Functions and training of agricultural extension officers: with special regard to the Zambian case. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development*.

Vol. 2: Experience in strategies for planned change (pp. 131-140). Chichester, England: John Wiley.

Training / Extension / Zambia

Four questions are dealt with concerning training of agricultural extension offices, particularly in regard to the case of Zambia. (1) Whether the formal teaching function gives the same grounding in general extension field work as a more informal type of agricultural education? (2) What type of practical and theoretical training is needed to meet the particular qualifications of extension personnel, especially in a developing country? (3) What kinds of formal and informal training is suitable in establishing and maintaining knowledge and practical skills in an integrated manner? (4) What is the situation like in a given area, particularly in Zambia and in similar situations elsewhere in Africa?

212. **Schulz, M.** 1981. Extension services in Ethiopia. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development*. Vol. 2: Experience in strategies for planned change (pp. 189-212). Chichester, England: John Wiley.

Extension / Methodology / Ethiopia / Administration

Critically examines the strategies of the Extension Programme and Implementation Division (EPID) of Ethiopia before and after the political revolution. The minimum package approach was developed as the guiding program concept. Discusses a number of problem areas and criteria with respect to their impact on organizational effectiveness, including institutional arrangements, size of organization, availability of qualified manpower and extension methodology. Expresses doubt as to whether a model can be made to work well which tries to integrate both development functions and institutions within the structure of the Ministry of Agriculture. EPID's extension methodology can develop in three ways: (1) agents working with smaller groups; (2) involvement

in farm management and planning; and (3) use of mass media in combination with personal communication methods.

213. **Shingi, P. M., Fliegel, F. C., Kivlin, J. E.** 1979. Agricultural technology and the issue of unequal distribution of rewards: An Indian case study. Urbana, IL: Department of Agricultural Economics, University of Illinois. 29 pp. (Staff paper, series S, rural sociology no. 79 S-12).

Technology transfer / Social change / Innovation adoption / Equity / India / Utilization

Examines the long-run effects on the diffusion of agricultural innovations, especially a key question in adoption and development research: Does a higher level of adoption of improved technology contribute to greater or lesser equality in distribution of social and economic "rewards" over time? Examination of this question is based on data drawn from interviews with 228 farm operators in Maharashtra, India. The first interview took place in 1967 and the follow-up interview in 1973. Analysis is focused on changes in equality of reward distribution among them over the six years. Results of the data indicate increased inequality in volume of production over the six years, not necessarily attributable to differences in utilization of agricultural technology. Inequalities in material well-being have decreased. Concludes that for this sample, and in the absence of radically improved production technology, the impact of induced change in production inputs and practices is such as to decrease inequality in rewards over time. Analysis also covers access to information through extension contact and the mass media.

214. **Sigman, V. A., Swanson, B. E.** 1984. Problems facing national agricultural extension in developing countries. Urbana, IL: International Program for Agricultural Knowledge Systems, Office of International Agriculture, University of Illinois at

Urbana-Champaign. 16 pp. (INTERPAKS series no. 3).

Extension / Developing countries

Many problems exist that prevent agricultural extension systems from functioning effectively and facilitating agricultural development. This study examined 59 third world extension directors' perceptions of these problems facing extension. Nine problems were selected for study: technology, linkage, technical training, extension training, mobility, equipment, teaching aids, organization and other problems. Directors rated the seriousness of each problem and also rank-ordered the problems in relation to each other. Ratings and rankings are reported. Also investigated was whether or not these directors' perceptions were similar or different among countries and regions with varying per capita income levels. The study concluded that directors of national extension systems view lack of mobility, extension training, communication and teaching equipment and organizational problems as the most serious. Results indicated that there exists a difference between extension directors' views and development literature's treatment of the seriousness of specific problems. Most notable is the difference between the constant emphasis in the literature on technology and linkage problems and the moderate emphasis given to these problems by directors of extension.

215. **Singh, A. J., Bhullar, B. S.** 1979. A study into the nature and impact of agricultural extension in the Punjab state. *Indian Journal of Agricultural Economics*, 34(4), 35-39.

Extension / Evaluation / India

Examines the nature and extent of different extension services available to farmers in Punjab State (1974-75) as well as the impact of extension inputs on productivity in agriculture. The design of the study was multistage stratified random sampling with weights assigned to different items of extension input (mass media, visits by extension

officers, visits to extension agencies, training). On the average, each farmer visited the extension agencies 5.80 times a year, was visited 9.42 times, only 22% of farmers received training, 28% purchased daily newspapers, 86% listened to radio programs for the rural population, and 68% visited the university. Production function analysis was conducted both with and without extension inputs. The regression coefficient of the extension input was found to be 0.18 which was significant at the 5% level.

216. **Singh, K. N.** 1976. Communication strategy for transfer of agricultural technology. In S. Dasgupta & M. G. Bhagat (Eds.), *New agricultural technology and communication strategy* (pp. 271-292). Bombay, India: National Institute of Bank Management.

Technology transfer / Communication / Innovation adoption / Linkages

Examines communication strategy in India and its role in transferring agricultural technology. Notes that several Indian agencies communicate technologies but often their efforts are not coordinated with other agricultural activities. Indicates that three systems are necessary for technology development, dissemination and integration: (1) the research system; (2) the linking system; and (3) the client system. Discusses factors that influence the communicators' ability to communicate and relates them to the Indian situation. Notes that farmers' needs are changing, and that they are not only seeking more technical and sophisticated information, but they are also becoming more cost conscious and business minded. Notes that credibility of communication channels varies according to the progressiveness of the villages and farmers.

217. **Singh, K. N.** 1981. The need for a communication strategy for rural development. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development. Vol. 2: Experience in strategies for planned*

change

 (pp. 15-31). Chichester, England: John Wiley.

Communication / Linkages / Agricultural development / Social behavior / Innovation adoption / India

An overview of several empirical studies conducted in India which looked at communication patterns. The primary focus of the paper concerns the relationship between the linking system (agricultural extension) and the client system (farmers). Gives special attention to the problems of communication with rural people. Also included is some discussion of the function of the research system in the research-linking-client relationship. Other topics discussed include the communication process, problems of intra-organizational communication, communication patterns and progressiveness in villages, the adoption process and communication, and the need for a communication strategy.

218. **Singh, Y. P.** 1981. Problems in transfer of agricultural technology. In *Management of transfer of farm technology* (pp. 49-68). Hyderabad, India: National Institute of Rural Development.

Technology transfer / Utilization / Technology development / India

Discusses the production, dissemination and utilization of technology, and observes that the natural as well as cultural environment affects technology. Credits the Indian agricultural research system as the major determinant of productivity change in Indian agriculture. Discusses the hierarchical mode of the dissemination of agricultural research. Concedes that determinants of the adoption or production are client orientation, environment, the technology itself, and communication variables. Concludes that technology transfer has been strangled by various non-technological factors.

219. **Sofranko, A. J.** 1984. Introducing technological change: The social setting. In B. E. Swanson (Ed.), *Agricultural*

extension: A reference manual (pp. 56-76). 2nd ed. Rome: Food and Agriculture Organization of the United Nations.

Technical progress / Social behavior / Innovation adoption / Technology transfer / Extension / Developing countries

The chapter starts from the premises that technological change is required for agricultural development, and that a gap exists between the levels of technology available and in use in most developing countries. The issue thus becomes one of addressing the obstacles preventing farmers from changing their behavior in general, and adopting new technologies in particular. The focus throughout is on the real and presumed socio-cultural impediments, the relationship between these impediments and infrastructural requirements, and the requirements for understanding how to implement change at the farm level. The author discusses several concepts for understanding rural culture, looks at obstacles to agricultural change, discusses ways of reducing resistance to change, compares strategies for introducing change in agriculture, and details some of the dimensions of the role of the extension worker. The emphasis throughout the chapter is on applied social change, namely what should extension workers know about rural culture and behavioral change principles to affect change among third world farmers.

220. **Solomon, D. D.** 1981. Characteristics of local organizations and service agencies conducive to development with special reference to farmers' organizations. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development*. Vol. 2: Experience in strategies for planned change (pp. 157-178). Chichester, England: John Wiley.

Farmers' associations / Communication / Linkages

Identifies eight features of local (especially farmers') organizations for comparative review of selected research and field studies as well as more prescriptive guides

to action. These are: (1) membership and leadership; (2) management of alienation and grouplessness; (3) access to training and education; (4) channels for communication of innovations and change; (5) mechanisms to mobilize resources; (6) access to markets; (7) access to power and influence; (8) other linkages and levels of organization.

221. **Stavis, B.** 1979. *Agricultural extension for small farmers*. East Lansing, Mich: Department of Agricultural Economics, Michigan State University. 81 pp. (MSU rural development series, working paper no. 3).

Extension / Small farms

Emphasizes the structural context of extension through which the innovations are selected and communicated. The first section examines some definitional problems with the concept of extension and reviews some of the historical background. The second part explores methodological problems in making clear-cut assessments of extension activities. The third section indicates why extension programs do not always help the rural poor. The fourth section explores ways of designing extension to meet more directly the needs of small farmers. Administrative systems which place some powers at the central level and others at the local level which give power to groupings of farmers and which assure more feedback from farmers seem better. The fifth part highlights the role of group organization in facilitating extension programs. The final section summarizes the argument and suggests pilot projects to give the generalizations more concrete form adapted to specific conditions.

222. **Stevens, H.** 1980. Problems of agricultural extension in Africa. *Training for Agriculture and Rural Development*, 1980, 23-37.

Extension / Training / Africa

Explains the differing French and British

backgrounds to extension activities in African countries. Considers training problems for extension agents which are common to many countries in Africa. Three broad conclusions are reached: (1) extension is one aspect of a global agricultural policy, and participation of farmers can be strengthened by extension work only so long as the overall policy serves the interests of farmers; (2) coordination of field activities must take place at district levels; and (3) regional seminars are needed for similar ecological regions, and bilingual seminars would help in coordinating activity of French and English speaking countries.

223. **Swaminathan, M. S.** 1980. Role of national programs in linking research and development. In V. Kumble (Ed.), Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer, 28 August - 1 September 1979 (pp. 179-182). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology development / Technology transfer / Linkages

Identifies the need for a dynamic research base as an essential component for launching and maintaining an agricultural development program capable of working toward the goals of more food, income, and jobs from available resources. Notes that while international centers can act as catalysts of change, only a strong national program can ensure sustained advance. Emphasizes the fact that location-specific research must develop an economically viable technology for each production system, and that its probable impact must be assessed to prevent new and unexpected pest, disease, or soil problems. Views as an immediate task the need for cooperation among research, extension, and development agencies to that the gap between actual and potential yields may be bridged.

224. **Swanson, B. E., Rassi, J.** 1981. International directory of national extension

systems. Urbana, IL: Bureau of Educational Research, University of Illinois at Urbana-Champaign. 203 pp.

Extension / Directories

An update of the 1975 International Directory of Agricultural Extension Organizations and Extension Training Institutions. Objectives of the study, and this resultant publication, were to facilitate exchange between national extension programs and to provide longitudinal data from which to analyze changes that have occurred in participating organizations. Presents information concerning over 100 countries. Focuses on staffing patterns, distribution of staff by program area and sex, and the organization of the various agencies. Provides such additional information as year organized, source of support, program objectives, and client group served. Includes not only extension but also data relating to rural youth programs, home economics, and family planning programs. Data was collected from July, 1980 to January 1981.

225. **Swanson, B. E.** 1983. The role and contribution of agricultural extension. In J. B. Claar and L. H. Watts (Eds.), Knowledge transfer in developing countries: Status, constraints, outlook (pp. 14-21). Urbana, IL: INTERPAKS, Office of International Agriculture, University of Illinois at Urbana-Champaign.

Extension / Agricultural development / Small farms / Developing countries

Defines agricultural extension and extension's relationship with agricultural development goals. Presents the viewpoint that if agricultural policy is not consistent with these goals, it is very difficult for extension to operate effectively. Extension's prevailing objectives in most countries have been built on the goal of production efficiency and an approach based on diffusion theory. This approach is examined critically as it has tended to result in a concentration on the technical needs of the larger, more progressive farmers and ignored

the majority of small, subsistence farmers. The result has been a worsening of the income disparities between these two groups. Suggestions are presented for reorienting extension's goals so that it can simultaneously pursue working to increase national agriculture production and also to facilitate broad-based agricultural development. The article concludes with examples of different ways technology transfer efforts are organized and the implications of these methods for agricultural extension.

226. **Swanson, B. E. (Ed.)**. 1984. *Agricultural extension: A reference manual*. 2nd ed. Rome: Food and Agriculture Organization of the United Nations. 262 pp.

Extension / Technology transfer

Provides a historical, developmental, and conceptual context for understanding agricultural extension and its role in the agricultural development process. Describes the methods, procedures, and techniques for carrying out extension programs. Discusses the organizational considerations of extension programs such as administration, finance, and evaluation. Emphasizes the need to prepare and up-grade extension workers and support staff as a professional team of educators, communicators and specialists.

227. **Swindale, L. D.** 1980. Problems and concepts of agrotechnology transfer within the tropics. In V. Kumble (Ed.), *Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer*, 28 August - 1 September 1979 (pp. 73-81). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology transfer / Institutions / Economic situation / Social behavior / Constraints / International agricultural research centers

Discusses agrotechnology transfer among countries or between regions within countries in terms of constraints and problems

over and above those associated with the diffusion of innovations. Site-factor constraints include appropriateness of the transferred technology, and an awareness of social, economic and institutional factors. Identifies seed-centered technology as having the fewest constraints and as being a major mean for agrotechnology transfer. Notes difficulty of transferring new soil management or cropping systems technology, and identifies stratification of the environment through soil or climate classification as an essential element, as is a national capacity for agricultural research. Notes the role of the international agricultural research centers in transferring and creating awareness of the existence of technology and its acceptance.

228. **Timmer, W. J.** 1982. *The human side of agriculture: Theory and practice of agricultural extension (with special reference to developing rural communities in the tropics and sub-tropics)*. New York: Vantage Press. 223 pp.

Extension / Rural development / Social behavior / Developing countries

A condensation of seminars held by Timmer during his term of office as an international advisor for groups of senior agricultural officers in developing countries. Focuses on rural development policy in general and agricultural extension in particular. With the aid of case histories, it demonstrates that peasant farming must be considered as an organic whole of farm work and life. Consequently the extension worker is concerned not only with the promotion of agricultural production, but also with the enhancement of the economic, social, and cultural conditions in the rural communities concerned. Stresses the need to investigate and evaluate needs, motivations, and value attitudes of rural people before deciding on a course of action.

229. **Warboys, I. B.** 1983. *Some aspects of technology transfer on farming systems*.

International Journal for Development Technology, 1, 59-69.

Technology transfer / Mechanization / Appropriate technology / Development policy

Examines some examples of technology unsuited to farming systems in the less developed countries. Examples include the introduction of tractors in East Africa and certain aspects of mechanizing rice production in Asia. Examples are also given of some promising developments of indigenous technology in Asia and West Africa. Attention is also drawn to some of the undesirable effects of both national and international policies on mechanization transfer, especially when it is linked to foreign aid. Notes that institutional barriers, arising from existing structures for aid, trade and education, can impede the development and spread of more appropriate technologies in the less developed countries. Indicates that appropriate technology for a given situation, whether imported or locally developed, can be considered to be a particular form of technology which is in harmony with the prevailing socioeconomic conditions and management expertise. Emphasizes that machine compatibility with its working environment is just as important as its function. Indicates that this will require a new approach to training and education of engineers and technologists in the less developed countries, and that such experts will play a greater role in the planning and execution of schemes using mechanization.

230. **Watts, L. H., Claar, J. B.** 1983. Knowledge transfer for agricultural development: History, limitations, importance. In. J. B. Claar & L. H. Watts (Eds.), Knowledge transfer in developing countries: Status, constraints, outlook (pp. 3-13). Urbana, IL: INTERPAKS, Office of International Agriculture, University of Illinois at Urbana-Champaign.

Extension / Agricultural research / Farming systems / Linkages / Diffusion of information

Briefly examines several models of extension used in the world, the U.S., French, British and Chinese. Respective histories and orientations are covered. Addresses the problem of why donor-funded university projects are not usually successful and why this is so serious for LDC's. Also looks at current trends in research and extension systems. The question—how to secure significant expansion in farm output at a reasonable or optimal cost—is examined from three viewpoints: (1) how people make changes (diffusion research); (2) the contribution of mass media and what can be learned from experience; and (3) the elements of effective extension programs. Concludes with a discussion of farming systems research and farming systems research/extension, and some thoughts for the future, including suggested research approaches.

231. **Watts, L. H.** 1984. The organizational setting for agricultural extension. In B. E. Swanson (Ed.), Agricultural extension: A reference manual (pp. 20-39). 2nd ed. Rome: Food and Agriculture Organization of the United Nations.

Extension / Organizations / Linkages / Policy

Organization is a way of ordering necessary relationships among the components of the agricultural knowledge/technology transfer process. Extension is but one of these components, all of which support agricultural development. Extension's job is to inform, advise, and educate in a practical manner, and this job is the basic consideration in determining the most appropriate organizational structure. Other factors also influence the organization of extension systems. Extension is supported by such essential components as research, policy and infrastructure, and by various agencies, or functions performed by agencies within the total system. These agencies, together with extension, contribute to agricultural development and are interdependent and mutually reinforcing. They become increasingly ineffective as they compete as separate

bureaucratic functions. Given this, the article examines the essential components and functions of a well-organized agricultural development program. Included are research, extension, agricultural education, marketing, policy and planning, input supply, credit services and material and capital transfer. Delineates some appropriate linkages between these. Also examines environmental factors as these, too, affect the effectiveness of agricultural extension to contribute to agricultural development. These environmental factors include political, economic, socio-cultural, agro-ecological, and the administrative/organizational environments.

232. **Webster, B. N.** 1980. Linkages for transfer of technology. In V. Kumble (Ed.), Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer, 28 August - 1 September 1979 (pp. 269-273). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Technology transfer / Linkages

Examines the more traditional concepts of technology transfer in agricultural development and identifies the multidimensional nature of the linkages required to sustain a dynamic applied knowledge system. Emphasis is given to the internal transfer of technologies and the greater relevance of those indigenously generated. Notes the importance of the human element at all levels, emphasizing the cardinal role played by proper linkages with education and training institutions in the preparation of cadres of

"human links" in the transfer chain.

233. **Woods, J. L., Cook, J.** 1984. Observations on training needs of T & V systems in the Asia and Pacific Region. Bangkok, Thailand: UNDP Asia and Pacific Programme for Development Training and Communication Planning. 5 pp. Prepared for the Government of Indonesia and World Bank/UNDP/FAO Asian Workshop on Agriculture Research/Extension Linkages, Denpasar, Bali, Indonesia, March 18-25, 1984.

T & V system / Training / Asia / Pacific islands

Outlines the examples where UNDP/DTCP staff have assisted with training for implementation of the training and visit system in Asian countries. Enumerates some areas in which training might be made more effective for T & V schemes.

234. **Woods, J. L., Gecolea, R. H., Veltman, M.** 1978. An organizational analysis of agricultural extension and related programmes in Bangladesh. Bangkok, Thailand: UNDP Asia and Pacific Programme for Development Training and Communication Planning. 33 pp. (RB no. 360).

Extension / Organization of work / Bangladesh

Presents an organizational analysis of the agricultural extension system and related programs in Bangladesh through a series of analytical charts. Based on the analysis issues or areas of concern that may require more study and decision making by government and international agencies are identified.

Technology Utilization

235. **Andrew, C. O., Alvarez, J.** 1982. Adoption of agricultural technology: Developments in agro-economic thought. *Social and Economic Studies*, 31, 171-189.

Innovation adoption / Economic sociology / Utilization

The evolution of socioeconomic thought concerning the diffusion of innovations started with a debate about the relative importance of social and economic factors in the adoption of hybrid corn and hybrid sorghum in the United State during the 1928-1941 period. Sociologists and economists agreed that an array of factors, not too well understood, and varying from one farm and farm area to another, stimulate adoption. The literature on the Green Revolution of the 1960's added new dimensions to the debate by considering not only adoption and production, but a host of other conditions such as markets and income distribution. The very nature of the adoption process tends to favor early adopters with favorable social and economic characteristics. Those less fortunate fall behind because they are unable to assume the added production costs and the risks associated with the potentially higher returns from the new technology. These new findings point to the necessity of formulating technological packages based on integrated socio-economic research where the entire decision environment of the farmer is considered.

236. **Ashby, J. A.** 1982. Technology and ecology: Implications for innovation research in peasant agriculture. *Rural Sociology*, 47, 234-250.

Diffusion of research / Socioeconomic organization / Innovation adoption / Agroclimatic regions / Utilization / Nepal

Raises several questions about prevailing conception of adopters and adoption behavior. Specifically, the author argues that research has failed to take into account variations in farming environments, natural physical parameters, and the social organization of resources as factors influencing

peasant farmers' adoption behavior. More attention ought to be given to location specific constraints, characteristics and requirements of specific technologies, and to the general issue of whether identical technologies are equivalent innovations in different agro-climatic environments. Drawing on data from several villages in Nepal, the author shows that rates of adoption are location specific, that is, influenced more by agroclimatic conditions and socioeconomic organization than by inter-village differences in propensity of innovate. Ecological suitability and varying levels of farm resources have a direct effect on technology utilization.

237. **Bartlett, P. F. (Ed.)**. 1980. Agricultural decision making: Anthropological contributions to rural development. New York: Academic Press. 378 pp. (Studies in anthropology).

Decision making / Risks / Uncertainties / Agricultural development / Agricultural policy / Social anthropology / Developing countries

Detailed examination of farmer's decision making concentrating on the developing world. Working within the framework of economic anthropology, the volume explores agricultural decision making from three vantage points. The first is concerned with theory and methodology and discusses the use of formal models such as the cognitive versus statistical behavior models of decision making. Also examined are approaches such as the attentive and preattentive aspects of agricultural decision making, measurement issues in evaluating alternatives available to farmers, the role of risk and uncertainty and farmer's responses to them, and the tools to study decision making over the life-cycle of the household. The second aspect is concerned with the patterns of agricultural choice within a rural community, examined within this section are the impacts of non-agricultural alternatives on agricultural decisions. The causes and effects of traditional sharecropping agreements, and the

importance of economic stratification and differential access to resources. The final portion looks at the implications of decision making research for agricultural development policy and explores the decision making context of aid programs.

238. **Berry, R. A., Cline, W. R.** 1979. Agrarian structure and productivity in developing countries. Baltimore, MD: Johns Hopkins University Press. 248 pp.

Farm size / Agricultural structure / Utilization / Productivity / Developing countries

"Intensive Hypothesis Tests", examines in detail comprehensive data from six countries which confirm the negative relationship between farm size and output per unit of land area available. The countries include India, Brazil, Colombia, Pakistan, Malaysia and the Philippines. The authors note that the negative relationship holds even when the influence of land quality is removed, either by including the price of the land in the analysis (the direct method) or by considering patterns on irrigated versus unirrigated land (indirect method). The fact that smaller farms were also supported by estimating social factor productivity which shows that total social factor productivity declines as farm size rises. Tenancy was also examined in relation to reduced productivity. Data from Brazil, the Philippines and India gave no support to the hypothesis that sharecropping reduced land productivity.

239. **Burfisher, M. E., Horenstein, N. R.** 1983. Incorporating women into agricultural development planning: A methodology. In B. L. Greenshields & M. A. Bellamy (Eds.), Rural development: Growth and inequity, contributed papers read at the 18th International Conference of Agricultural Economists (pp. 161-165). (I.A.A.E. occasional paper no. 3). Aldershot, Hants, England: Gower.

Agricultural development / Innovation adoption / Women / Nigeria / Development projects / Planning / Methodology

Provides a methodology that incorporates gender differences in the farm household into development project planning. Provides a quantitative comparison between a development project using conventional planning methodology based on the aggregated farm household and a planning methodology in which project impacts are disaggregated by sex. Focuses on gender role differences relating to labor, income, and financial obligations among one ethnic group in central Nigeria and the implications of these differences with respect to the ability and incentive of each sex to adopt technologies introduced by an agricultural development project.

240. **Byerlee, D., Harrington, L.** 1983. New wheat varieties and small farmers. In B. L. Greenshields & M. A. Bellamy (Eds.), Rural development: Growth and inequity, contributed papers read at the 18th International Conference of Agricultural Economists (pp. 87-92). (I.A.A.E. occasional paper no. 3). Aldershot, Hants, England: Gower.

Innovation adoption / Equity / India / Utilization / Small farms / Developing countries / Mexico

Supports the hypothesis that the poor have benefited substantially from the introduction of new high-yielding wheat varieties. Summarizes evidence on only one aspect of the distribution of benefits from new wheat varieties, the distribution of benefits to poor producers relative to larger producers. Discusses conceptual issues in analyzing these benefits and presents empirical evidence from Mexico, India, and other countries where the new wheat varieties are widely used.

241. **Carlson, J. R., Dillman, D. A.** 1983. Influence of kinship arrangements on farmer innovativeness. Rural Sociology, 48, 183-200.

Innovation adoption / Kinship / Decision making

Although the focus of the research is on farmers in the United States, the authors explore a frequently neglected aspect of adoption, namely how family characteristics influence utilization decision. They question the typical view of farmers as "individualistic actors", and instead direct research toward kinship arrangements, extended family networks, and group reinforcement for adoption decisions. The research centers on adoption of soil conservation practices in the Palouse area of Washington and Idaho. The findings demonstrate a definite link between kinship arrangements and adoption behavior: (1) farming with other relatives introduces additional information and opportunities for innovation; (2) two generations farming together tend to be more sensitive to future implications of production technologies. The research is limited to one area and one type of innovation (soil erosion), but it does raise the important issue of how the social organization of production affects adoption decisions.

242. **Chamala, S., Ban, A. W. van den, Roling, N.** 1980. A new look at adopter categories and an alternative proposal for target grouping of farming community. *Indian Journal of Extension Education*, 16, 1-18.

Technology transfer / India / Innovation adoption

Offers an analysis of the conventional literature on adoption practices and adoptive categories. Examines the theoretical basis, and the empirical validity of adoption categories, as well as the extension worker's reliance on adoption categories for the dissemination of information in development activities and in research. Observation has led to the conclusion that adopter categories which can be empirically identified have been erroneously used in practice while the theory on which they are based is questionable. Draws attention to some of the dysfunctional effects of this largest grouping and the trickle down strategy used in extension for rural development. The analysis calls for a different approach to the categorization of

the farming community. The main aim is to start with the people and then categorize the social system according to some important variables which will result in a homogeneous target group being isolated for specific extension activities.

243. **Cloud, K., Overholt, C.** 1983. Women's productivity in agricultural systems: An overview. In B. L. Greenshields & M. A. Bellamy (Eds.), *Rural development: Growth and inequity, contributed papers read at the 19th International Conference of Agricultural Economists* (pp. 166-171). (I.A.A.E. occasional paper no. 3). Aldershot, Hants, England: Gower.

Women / Productivity

Identifies the literature relevant to understanding women's productivity in agricultural systems and proposes a coherent framework for examining women's productive activities. Delineates the factors that influence women's participation and productivity in agricultural systems.

244. **Crouch, B. R.** 1981. Innovation and farm development: A multidimensional model. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development. Vol. 1: International experience in communication and innovation* (pp. 119-134). Chichester, England: John Wiley.

New South Wales / Innovation adoption

Outlines the various types of adoption of farm practices scales that have been employed as a measure of the relative rates of adoption of technological innovations by farmers. The major problem in using an adoption scale has been the degree to which the developed scale measures the innovativeness dimension. Demonstrates that unidimensionality does clearly exist and shows the theoretical and practical implications. Draws on data from an interdisciplinary study on the factors determining the adoption of agricultural innovations in the wool growing industry of New South Wales. Possession of a

predictive model of farm development such as described by Crouch enables research and extension workers to know the likely direction farmers will take in developing an agricultural enterprise.

245. **de Janvry, A.** 1978. Social structure and biased technical change in Argentine agriculture. In H. P. Binswanger and V. W. Ruttan (Eds.), *Induced innovation: Technology, institutions, and development* (pp. 297-323). Baltimore, MD: Johns Hopkins University Press.

Technical progress / Socioeconomic organization / Institutions / Argentina

Examines Argentinean structural deficiencies in economic and political organizations that have resulted in failure to translate the latent demand for biological and chemical technology into effective demand. Large landowners play a dominant role in economics and politics, preventing the factor endowments that characterize the smaller land holders from becoming an effective source of demand for biological and chemical technology. Underscores the need for a more detailed examination of the ways in which social structures determine technical biases. Social and institutional changes that can resolve the current stagnation in food production should be explored.

246. **Feder, G., Just, R. E., Zilberman, D.** 1982. Adoption of agricultural innovations in developing countries: A survey. Washington, DC: World Bank. 65 pp. (World Bank staff working papers, no. 542). Also published in *Economic Development and Cultural Change*, 33, 1985, 255-298.

Technology transfer / Models / Innovation adoption / Developing countries

Reviews various studies which have provided a description of and possible explanation to patterns of innovation adoption in the agricultural sector. Covers both empirical and theoretical studies. Highlights the diversity in observed patterns among various

farmers' classes as well as differences in results from different studies in different socioeconomic environments, and reviews the attempts to rationalize such findings. Special attention is given to the methodologies which are commonly used in studies of innovation adoption and suggestions for improvements of such work through the use of appropriate econometric methods are provided.

247. **Feder, G., Slade, R.** 1984. Contact farmer selection and extension visits: The training and visit extension system in Haryana, India. *Quarterly Journal of International Agriculture*, 23, 6-21. (World Bank reprint series no. 301).

T & V system / Linkages / Extension / India / Methodology

Deals with some aspects of the interaction between extension agents and farmers in the T & V method of extension. This system has been adopted by many developing countries and incorporates several special features. One of these is the selection of individual farmers to act as regular contacts with extension workers. Analyzes the selection of these farmers, taking the system introduced into Haryana, India in 1979 as an example, and investigates their interaction with extension agents. After a general description of the T & V system, the paper describes the study area, analyzes the characteristics of the contact farmers (farm size, caste, education, ownership of tubewells, etc.), and examines the contacts of selected and non-selected farmers with extension agents.

248. **Fliegel, F. C.** 1984. Extension communication and the adoption process. In B. E. Swanson (Ed.), *Agricultural extension: A reference manual* (pp. 77-88). 2nd ed. Rome: Food and Agriculture Organization of the United Nations.

Communication / Utilization / Innovation adoption / Extension / Feedback / Equity

Reviews two general approaches to adoption and the communication strategies which follow from them. First, adoption as a function of individual farmers' predispositions to be innovative calls for primary extension contact with the most innovative in expectation of a trickle-down effect. And second, a focus on situational constraints to adoption, with the consequent potential for increasing inequity among farmers, calls for a bottom-up communication approach with accompanying stress on design of technologies appropriate to resource-poor farmers. Whichever strategy is chosen, several principles of communication are constant: a need for audience differentiation and design of messages suited to particular audience segments, and a need for active pursuit of feedback on technology performance to permit both technology redesign and information program adaptation.

249. **Gladwin, C. H.** 1979. Cognitive strategies and adoption decisions: A case study of non-adoption of an agronomic recommendation. *Economic Development and Cultural Change*, 28, 155-173.

Innovation adoption / Decision making / Mexico / Case studies

Aims to show that it can be of great advantage to the design of a rural development project if the cognitive strategies which lie behind farmers' decisions to adopt new technology are understood. This is done by using a case study of an agronomic recommendation of the Plan Puebla in Mexico which did not diffuse. Of the 1973-74 recommendations, the one to increase the number and change the timing of fertilizer applications was the nonadopted recommendation. The theory of choice used in this study assumes that people choosing between two alternatives do not make complex calculations of the overall worth or utility of each alternative. Instead people tend to use procedures which simplify their decision making calculations.

250. **Gotsch, C. H.** 1972. Technical change and distribution of income in rural areas.

American Journal of Agricultural Economics, 54, 326-341.

Technical progress / Tubewells / Income distribution / Developing countries / Bangladesh / Pakistan

Examines impact of technology on income distribution by looking at the introduction of tubewells in two areas, the Comilla District, Bangladesh and the Sahiwal District, Pakistan. Tenure patterns differ in the two areas with holdings in the Comilla District being smaller and more equally distributed, while the Pakistan holdings are larger with over 50 % operated by tenants. Tubewells were purchased individually or in partnership by almost 50 % of the cultivators in the Sahiwal District, while less than one % of individuals were able to do so in the Comilla District. Village cooperatives were formed in the Comilla District to install and manage the tubewells. It appears that the private tubewell will be a source of increasing income inequity in Pakistan, while in the Comilla District there will be a tendency to maintain the relatively egalitarian distribution of income that currently exists. A conceptual framework is suggested within which the distributive effects of technical change can be examined. The four components of the framework are: (1) the characteristic of the technology; (2) the absolute magnitude and relative distribution of productive assets (especially land); (3) the types of institutions and organizations that visit at the local level and the distribution of their services; and (4) social customs and tradition.

251. **Gotsch, C. H., McEachron, N. B.** 1983. Technology choice and technological change in third world agriculture: Concepts, empirical observations and research issues. In B. G. Lucas & S. Freedman (Eds.), *Technology choice and change in developing countries: Internal and external constraints* (pp. 29-62). Dublin, Ireland: Tycooly International Publishing.

Technical progress / Economic sociology /

Systems analysis / Pakistan / Public sector / Private sector / Innovation adoption

Examines the interaction of technology and the surrounding socioeconomic structure at several different levels. Divided into three sections, the paper first develops a broad conceptual framework in which various pieces of the problem can be located. Notes that the basic ideas draw on Ruttan and de Janvry but have been extended to include the private sector and the linkage between industrialized and developing countries. Section 2 relates the conceptual "system" to a detailed discussion of technology choice and technological change in Pakistan agriculture. Emphasizes an analysis of the sequence of induced mechanical innovation and the efficiency with which demands from the farmer's point of view were translated into supplies of improved inputs. The third section juxtaposes the conceptual framework of the first section with data available in Pakistan to suggest research priorities. Notes that much more is known about how technology influences its economic and social environment than how these factors determine the direction of research and development expenditures.

252. **Harriss, B.** 1972. Innovation adoption in Indian agriculture--the high yielding varieties programme. *Modern Asian Studies*, 6, 71-98.

Innovation adoption / High yielding varieties / India

Examines the adoption of high yielding varieties (HYV's) in India, especially in the context of microscale planning within the high yielding varieties program. The author found the planners working to implement acceptance of HYV assumed that innovated inputs are adapted simultaneously and at the correct levels of intensity when, in fact, this does not occur. Adoption rates vary greatly between innovations and between areas; position of innovations in low on the acceptance curve; by 1969 only an average of 12 percent of all participants adopted correct acceptance of fertilizer, pesticide

spraying, nursery cultivation of paddy and improved plowing practices. In addition, it was found that it is not the same 12 % who adopt all improved practices. Reasons given for not using improved inputs are: input cost, lack of control over irrigation, excessive risk, lack of information, not enough labor, and unavailability of inputs. Of these, the first three are most important. Lack of rainfall and adequate storage facilities are additional barriers to adoption.

253. **Harwood, R. R.** 1981. Agronomic and economic considerations for technology acceptance. In N. R. Usherwood (Ed.), *Transferring technology for small-scale farming* (pp. 35-47). (ASA special publication no. 41). Madison, WI: American Society of Agronomy.

Innovation adoption / Small farms / Technology transfer / Economic resources / Agronomic characteristics

Delineates the major agronomic considerations for technology acceptance as follows: (1) It must be correctly targeted to a physical and biological environment where it will be productive; (2) It must be relevant to the type of farming system it is to fit. Small scale farmers have requirements for specific types of technology not presently being well researched; (3) If the technology is destined for farms where resource use is high, the requirements for proper fit into the system are extremely rigid. Lack of fit to one element (for instance, low palatability or low feed value of a crop residue in a mixed crop-livestock system) will partially offset any gain made in yield and will reduce the likelihood of acceptance. Economic considerations involve not only the productivity and eventual profit from the new technology, but the level of resources it requires. Where possible, advantage should be made of external production inputs in order to realize full farm production potential. It is realized, however, that a large segment of the presently bypassed farmers will have minimal access to capital inputs in

the foreseeable future. Suggests that more attention should be given to low cash-flow technologies for resource-limited farms to be used as a stepping stone to future commercialization, and as a supplement to cash inputs once commercialization has occurred.

254. **Huffman, W. E.** 1974. Decision making: The role of education. *American Journal of Agricultural Economics*, 56, 85-97.

Decision making / Education / Diffusion of information / Extension

Study examines the contribution of education to production both as an "allocative effect" and as a "worker effect". An allocative effect is based on the decision-making process and refers to an individual's ability to acquire, decode, and sort market and technical information efficiently. Worker effect refers to education's effect on technical efficiency, or the ability of the more educated worker to produce more from a given set of inputs. The study focuses on a single aspect of allocative ability: adjustment of Midwestern U.S. farmers to the changing optimum quantity of nitrogen fertilizer in corn production. The hypothesis that rate of adjustment can be explained by economic variables; the rate is positively related to education of farmers, availability of information (agricultural extension), and scale incentive to be informed (acres of corn) is supported by the results. It is also noted that education and extension serve as substitute sources of allocative efficiency.

255. **Jamison, D. T., Lau, L. J.** 1982. Farmer education and farm efficiency. Baltimore, MD: Johns Hopkins University Press. 292 pp.

Innovation adoption / Korea Republic / Malaysia / Thailand / Prices / Education

Complements earlier studies by reviewing existing literature on the relation between farmer education and farm efficiency. The authors then are able to confirm these earlier findings—which strongly suggest that

more educated farmers are more productive, particularly where new inputs and methods are available—by using new techniques to examine new data sets from Korea, Malaysia, and Thailand. Price data from Thailand are used to test the effect of education on the ability of a farmer to adjust the prices and composition of his output to the prevailing prices. Chapter 7 entitled, "Education and the Adoption of Innovation", pp. 195-222, presents an analysis of factors that determine the adoption of chemical inputs by Thai farmers. The role of education and agricultural extension is stressed. A sample of 275 farms were studied of which 184 did not use chemical inputs and 91 did use chemical inputs. Statistical analysis indicated that both the level of education of the head of household and the availability of agricultural extension have positive and statistically significant effects on the probability of adopting the technology using chemical inputs. The analysis also indicated that more than four years of education is necessary before it affects the probability of adopting the new technology. Age was also found to be a positive factor in adoption, the greater the age, the greater the probability of adoption. It was also found that a 10 % increase in the price of output results in an increase of between two and three percentage points in the probability of adoption. Similarly, a 10 % increase in the wage rate results in an increase of two to four percentage points toward adoption. An increase of 10 % in the input price decreases the probability of adoption by between one and two percentage points. Increase in the quantity of land area also increased the probability of adoption.

256. **Johnson, A. W.** 1981. Individuality and experimentation in traditional agriculture. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development. Vol. 1: International experience in communication and innovation* (pp. 109-117). Chichester, England: John Wiley.

Social behavior / Innovation adoption

Discusses the danger in adopting or being influenced by generalizations. Ethnographers and anthropologists have portrayed peasant societies as highly uniform social groups, conservative in nature, inflexible when considering new ideas which embody risk-taking or change. These generalizations have misled change agents to believe that people within a subsistence economy do not deviate from narrow, socially imposed paths, do not experiment with new ideas, do not operate as individuals, etc. The author's research from Brazil and evidence cited from other sources show this belief by change agents to be erroneous. The peasant farmer undoubtedly feels safer using his traditional crops; however, there is a willingness to modify cultural practices gradually as experience is gained. Unwillingness to adopt is related to unknown consequences of total dependence on a relatively untested crop.

257. **Jones, G. E.** 1969. The adoption and diffusion of agricultural practices. *World Agricultural Economics and Rural Sociology Abstracts*, 9(3), 1-34.

Innovation adoption / Information flow / Technology transfer / Bibliographies

An extensive review of articles, research and case studies on innovation, adoption, the adopter's perception of the innovation, diffusion within a social system, and communication channels. The 468 item bibliography covers published works up to December, 1966. Throughout the review the main concepts in the various adoption/diffusion processes are linked with specific citations in the extensive bibliography.

258. **Just, R. E., Zilberman, D.** 1982. Stochastic structure, farm size, and technology adoption in developing agriculture. Berkeley, CA: Giannini Foundation of Agricultural Economics, University of California. 37 pp. (Working paper no. 227).

Utilization / Innovation adoption / Farm size / Risks / Developing countries

Examines the role of farm size and technology adoption in developing countries under risk aversion. Develops a local mean variance approximation of expected utility based on farmers' individual wealth. This approximation is used to examine how technology adoption differs among farms of different size depending upon risk considerations. Produces a model illustrating the dependence of technology adoption behavior on risk aversion and indirectly on wealth (farm size) tractable for empirical purposes.

259. **Leagans, J. P.** 1979. Adoption of modern agricultural technology by small farm operators: An interdisciplinary model for researchers and strategy builders. 50 pp. (Cornell international agriculture mimeograph, no. 69).

Technology transfer / Small farms / Innovation adoption / Models

Summarizes a new approach to research on behavioral response to technical innovation and determines ways in which to accelerate such a response. Supportive data are taken from 12 Ph. D. dissertations written over a 10-year period in extension education at Cornell University. Focuses on the reasons why farmers with small holdings in low production areas adopt or fail to adopt recommendations for the use of modern agricultural production technologies. The results of the theses are synthesized and presented in a summary form, a view of the influential variables is developed, and an innovative theory and research design are characterized.

260. **Meyers, L. R.** 1982. A sociological approach to farming systems in Kenya. Ithaca, NY: Department of Rural Sociology, Cornell University. 119 pp. (Cornell international agriculture mimeograph 94).

Innovation adoption / Risks / Agricultural credit / Social behavior / Kenya

Investigates the determinants of acceptance or nonacceptance of agricultural credit programs on the basis of data accumulated in

the semi-arid Machakos District in Kenya. While it is often assumed that farmers use credit inputs if they feel that the likely benefits warrant the risk of possible losses connected with the proposed technology, it is found that credit acceptance might well be governed by the ability to bear the risk of credit, which is in its turn a function of access to resources, usually off-farm income.

261. **Navarro, L. A.** 1977. Dealing with risk and uncertainty in crop production: A lesson from small farmers. Turrialba, Costa Rica: Centro Agronomico Tropical de Investigacion y Ensenanza. Paper presented at the Symposium on Risk and Uncertainty in Decision Processes of Small Farmers in Less Developed Countries held during the AAEA-WAEA joint annual meeting in San Diego, California, July 31 through August 3, 1977. 27 pp.

Innovation adoption / Uncertainties / Technology development / Risks / Adaptation / Small farms

Describes the methodology used by the Department of Tropical Crops and Soils at CATIE to conduct research towards the generation of production technologies appropriate to the conditions of small farms. Notes the conclusions drawn about the decision processes followed by small farmers with regard to what, how much and how to produce, soil preparation, seeding or planting, use of fertilizer, weed control, diseases and insect control, harvesting, and product handling. Research focused on these concerns because small farms are the most numerous in Central America and produce most of the area's basic grain crops, using technologies which are often classified as traditional and archaic. Despite efforts to transfer improved technologies, small farmers have been reluctant to adopt them, mainly because they perceive them to be inappropriate for their particular conditions and resources and because the element of risk involved is too strong.

262. **Orivel, F.** 1983. The impact of agricultural extension services: A review of the

literature. In Basic education and agricultural extension: Costs, effects, and alternatives (pp. 1-57). (World Bank staff working papers no. 564). Washington, DC: World Bank.

Extension / Bibliographies / Evaluation

Provides a review of the literature on the effectiveness of agricultural extension services worldwide. Shows that evaluators of the internal effectiveness of extension services are generally critical claiming that extension services have poor performance, reach only a small portion of farmers (those who are better off), have wrong objectives, and are of little help to the agricultural sector as a whole. The author argues that this diagnosis may be excessive, that evaluators often have irrelevant evaluation criteria, and that historically the situation has substantially improved. Evaluators of external efficiency, mainly economists, show much more positive results. Those who use aggregate data find high social rates of return to investment in extension services and high correlations between extension services and agricultural productivity, but the methods used tend to overestimate the specific impact of extension services. Those who use farm-level data obtain mixed results, about half with significantly positive regression coefficients but of low value, and the other half with nonsignificant regression coefficients.

263. **Rao Lingamneni, J.** 1981. Communication channels/sources in the innovation-decision process: A comparative view of US and Indian diffusion research. In B. R. Crouch and S. Chamala (Eds.), Extension education and rural development. Vol. 1: International experience in communication and innovation (pp. 147-153). Chichester, England: John Wiley.

Innovation adoption / Communication / Information flow

A research review of empirical innovation diffusion studies in the USA and India which indicates significant differences in the relative importance of communication channels

/sources by function in the innovation-decision process in more and less developed countries. Explores the significance and diversities of these differences and presents a categorization scheme to illustrate the differences. One of the main differences noted was the importance of interpersonal communication in the Indian studies. Change agents, using demonstrations, appeared to be the most popular communication channel/source, while in the U.S., more use was made of electronic and print media channels.

264. **Rolling, N. G., Ascroft, J., Chege, F. W. A.** 1981. The diffusion of innovations and the issue of equity in rural development. In B. R. Crouch and S. Chamala (Eds.), *Extension education and rural development. Vol. 1: International experience in communication and innovation* (pp. 225-236). Chichester, England: John Wiley.

Innovation adoption / Equity / Diffusion of information / Kenya

Describes a field experiment in Kenya which shows that extension programs need not be confined to progressive farmers. In the Kenyan project, not only was 100% adoption obtained from participants, but it also had an immediate three-to-one diffusion effect for each farmer directly reached.

265. **Ryan, J. G., Binswanger, H. P.** 1980. Socioeconomic constraints to agricultural development in the semi-arid tropics and ICRIAT's approach. In V. Kumble (Ed.), *Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer, 28 August - 1 September 1979* (pp. 57-67). Patancheru, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Innovation adoption / Constraints / Agricultural development / Technology development / International agricultural research centers

Discusses ICRIAT's evaluation of socioeconomic constraints to agricultural

development. Identifies purpose of the efforts to better formulate research priorities and to improve the efficiency of "marketing" new technologies to farmers. Lists constraints, including variations in population densities, heterogeneity of semi-arid tropics resource endowments, role of risk in farmer's decision-making, marketing institutions, human institutional requirements, and efficiency and equity concerns in research resource allocation. Notes its necessity for close collaboration among scientists from many disciplines.

266. **Sheridan, M.** 1981. Peasant innovation and diffusion of agricultural technology in China. Ithaca, NY: Rural Development Committee, Center for International Studies, Cornell University. 83 pp. (Special series on agriculture research and extension no. 4).

Utilization / Technology transfer / Innovations / China / Methane / Non-formal education

Describes some of the methods which have supported creative contributions from rural people in the process of agricultural development in China. Begins with an analysis of the system of peasant innovation and then examines the principles supporting peasant innovation. Presents a case study of the use of methane gas in brigades in Szechuan as an example of an integrated multipurpose appropriate technology project which illustrates peasant innovation. Considers diffusion methods among peasants and concludes with a discussion of innovative forms of nonformal education and methodology transfer.

267. **Singh, S. N.** 1976. Adoption of technology and its consequences. In S. Dasgupta & M. G. Bhagat (Eds.), *New agricultural technology and communication strategy* (pp. 293-299). Bombay, India: National Institute of Bank Management.

Innovation adoption / Decision making / Technology transfer / Communication / Utilization

Discusses various factors necessary for technology adoption to occur. Identifies three factors necessary for agricultural development: technology, communication and the willingness of farmers to adopt the new technology. Emphasizes the need to make credit available to farmers so that lack of capital will not hinder adoption of technology. Also identifies factors affecting adoption rate, including attributes of innovation, type of innovation decision made, communication channels, social systems, and promotional efforts made. Notes that communication channels should be chosen considering the purpose of communication and the recipient of the message. The receiver's stage in the adoption process, nature of social systems, consequences of innovations, and adoptions all have an affect on communication channels, making the choice of media important.

268. **Sofranko, A. J., Fliegel, F. C., Sharma, N. C.** 1976. A sociological analysis of some broader developmental implications of vertical integration in agriculture: Indian and Ghanaian data compared. *Agricultural Administration*, 3, 285-303.

Utilization / Innovation adoption / Vertical integration / India / Ghana

The authors examine the general question of whether the forced utilization of modern agricultural practices on a highly specialized cash crop (tobacco) has any "spillover" effects onto other crops. A comparison of Indian and Ghanaian farmers, both tobacco growers and general farmers, on their use of a selected set of new practices led the authors to conclude that involvement in an integrated production system does have a spillover effect on other aspects of farming. Tobacco farmers were more likely to use modern inputs, including technical advice, on both their secondary cash crops and personal consumption crops than other farmers. A second aspect of the study was to examine the implications of involvement in a vertically integrated and tightly coordinated system on farmers' views of agriculture as an occupa-

tion, aspirations for children and values. The impact on values is negligible, but tobacco farmers did tend to hold a more positive view of agriculture and were receptive to their children becoming farmers.

269. **Subbarao, K.** 1983. Technology gap and the emerging size-productivity relationships following the adoption of new technology: An analysis of evidence from northwest and eastern India. In B. L. Green-shields & M. A. Bellamy (Eds.), *Rural development: Growth and inequity*, contributed papers read at the 18th International Conference of Agricultural Economists (pp. 67-72). (I.A.A.E. occasional paper no. 3). Aldershot, Hants, England: Gower.

Utilization / Innovation adoption / Institutions / Constraints / India

Hypothesizes that where the institutional framework (structure of land holdings, credit, and marketing institutions) is more favorable, small and large farms realize significant productivity gains, from adopting new seed and fertilizer technology. In regions where such a favorable institutional environment does not prevail, large farms realized proportionately more productivity gains than small farms. Implies that the interfarm inequity, in productivity gains is not as important in the institutionally well-endowed regions as in the poorly endowed regions. Tests the hypothesis by comparing two wheat growing regions—western Uttar Pradesh and eastern Uttar Pradesh. Concludes that if small farms are to retain their productivity advantage using the new technologies, urgent corrective action is needed for the toning up of institutional credit and input delivery systems.

270. **Summers, G. F. (Ed.)** 1983. *Technology and social change in rural areas: A festschrift for Eugene A. Wilkening*. Boulder, CO: Westview Press. 266 pp.

Technical progress / Social behavior / Rural areas

Begins with a discussion of the changing paradigms of technology adoption and diffusion, the social dynamics of public resistance and the question of social responsibility in an age of synthetic biology. In subsequent sections, it assesses the revolutionary effect of technology on agriculture worldwide and concludes that radically new public policies are essential; exposes the transformations of rural life and communities that result from the localized effects of technology and its use as a weapon in world-system politics; and critically examines the appropriate technology movement in developing countries.

271. **Swanson, B. E., Roling, N., Jiggins, J.** 1984. Extension strategies for tech-

nology utilization. In B. E. Swanson (Ed.), *Agricultural extension: A reference manual* (pp. 89-107). 2nd ed. Rome: Food and Agriculture Organization of the United Nations.

Extension / Technology transfer / Women / Utilization / Youth

Attempts to formulate a strategy for designing and implementing an extension program aimed at technology transfer and utilization. The main themes covered are: (1) specifying extension objectives; (2) identifying client categories; (3) formulating extension strategies; and (4) selecting appropriate extension methods. The focus is at the operational level of a provincial or district extension program, but the concepts also apply to the level of the individual extension worker.

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