International specialized media for agricultural mechanization in Asian developing countries.

AMA

AGRICULTURAL MECHANIZATION IN ASIA

VOL. III, NO. 1 · SPRING 1972

How to Grow Agricultural Machinery Industry

(II) Marketing Problems

FARM MACHINERY INDUSTRIAL RESEARCH CORP.

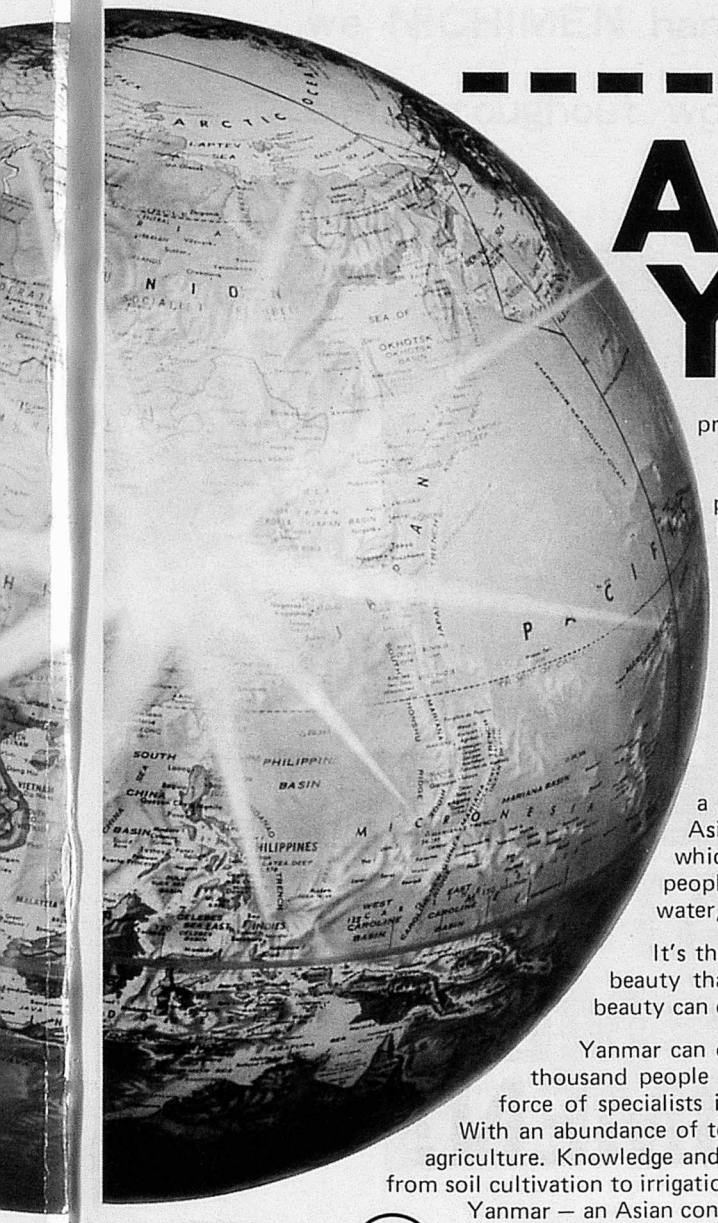
ASIA HAS LAND

ASIA HAS WATER

ASIA HAS ENERGY

ASIA HAS BEAUTY

ASIA HAS PEOPLE



----------AND ASIA HAS YANMAR

Millions of square miles of potentially rich, fertile land. The problem lies with that dangerous word "potentially."

Sometimes there's too much water, often too little. The problem; how to secure a stable, all-season water supply. By building drains, reservoirs, cisterns, canals, sluice gates and ditches. By pumping it from where it hinders to where it helps.

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Population is often a delicate subject to talk about in Asia, a dangerous subject because it is caught in the crossfire of Asian beliefs, traditions and values. But there's one factor upon which all seem to agree: the need for education. The need for people to teach and to learn how to use the land, the energy, the water, the machines, and the people.

It's the finest of all Asian traditions — that special Asian brand of beauty that's founded upon calm and the nearness to nature. But this beauty can only come from freedom — in freedom from want.

Yanmar can only try a bit to help a little. We are a dedicated group of ten thousand people trying to find better means for Asia to uncover its riches. A force of specialists in agricultural mechanization and rural system management. With an abundance of technology and products geared to the precise needs of Asian agriculture. Knowledge and machines that can help in all phases of rural development — from soil cultivation to irrigation to planting to harvesting to marketing.

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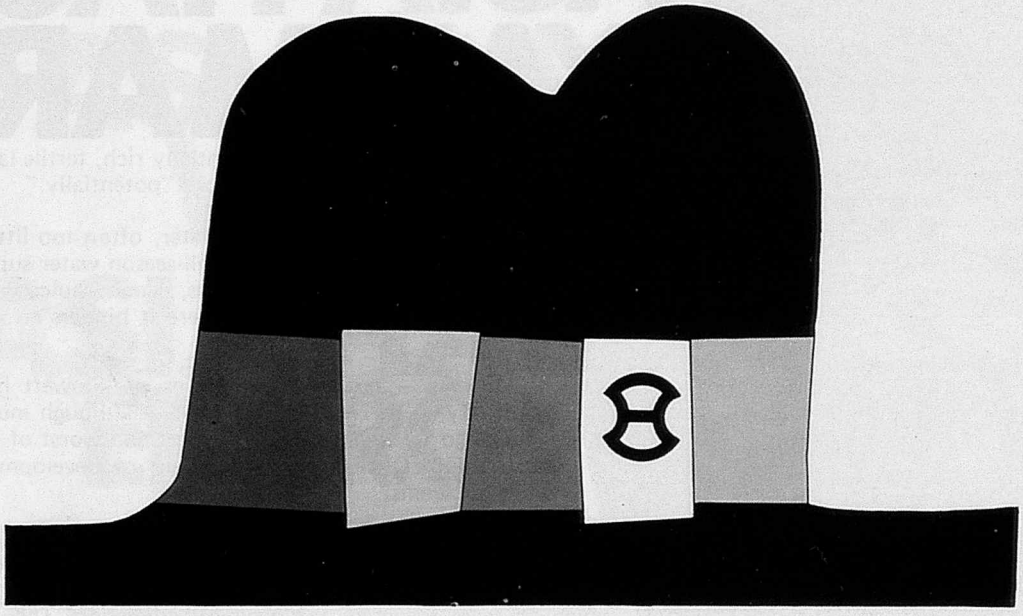
Overseas Operations Division: 4-chome, Yaesu, Chuo-ku, Tokyo, Japan Cable: YANMAR TOKYO Telex: No. TOK0222 2310



WHAT KIND OF MEN IS NICHIMEN?

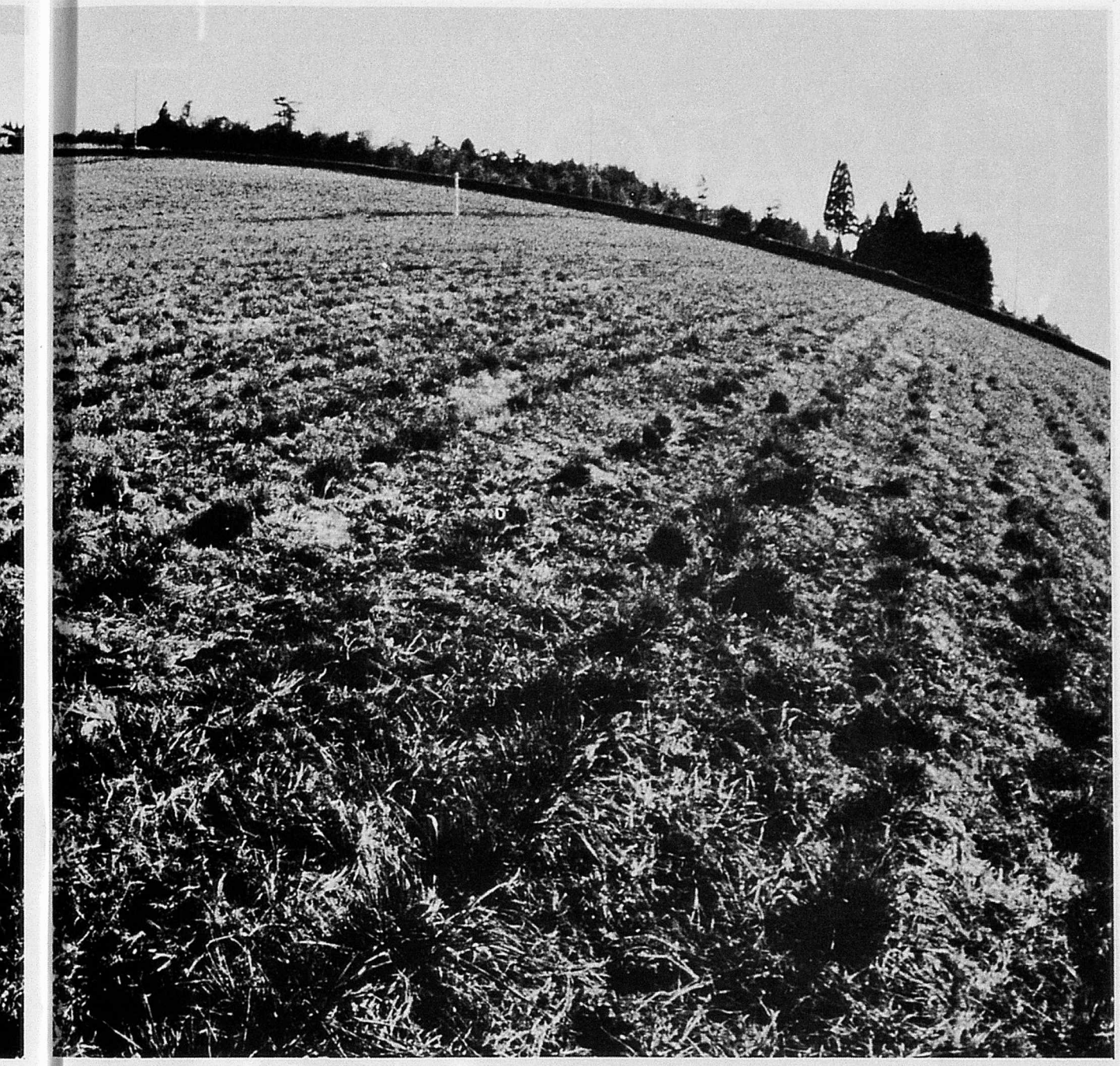
Man Tills the Earth's Soil in

"Mother Earth" blesses those who seek her blessings wisely. All human beings should be given an equal opportunity to enjoy the earth's blessings.

This concept of love for humankind and love for earth is the guiding principle on which the SATOH enterprise has labored for the past 50 years. All its agricultural machines and implements are built and developed on this lofty principle.

Among the many manufacturers of agricultural machines and implements in Japan, SATOH enjoys top popularity. Its 300 engineers and other technical experts devote their full time and energy to many research works.

Their main objective is to promote mechanized agricultural industry and achieve high-



All Countries of the World

est possible production. Their endeavors have finally succeeded in developing an integrated agricultural work concept from first to last.

Farming is the heart of every country. SATOH is aware of the conditions in your country and is at work to meet the requirements for the mechanization of agriculture that will best assist you.

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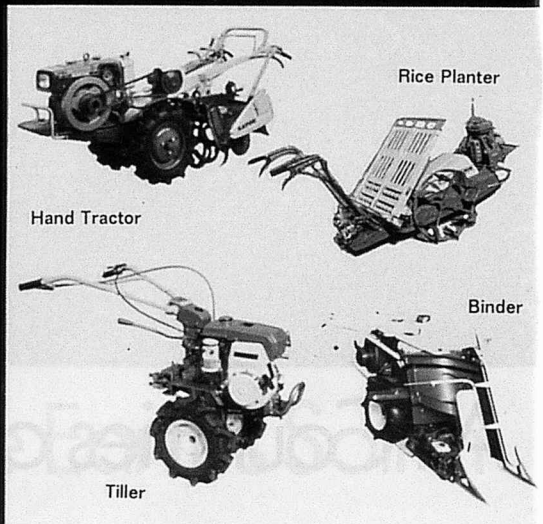
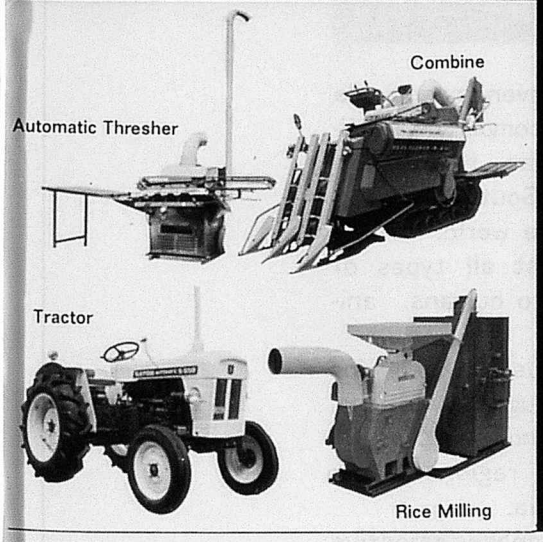
Let SATOH Study Your Agriculture N to Grow More



Study and preparation are the seeds of financial success that the SATOH organization have been happily planting and harvesting for others for over 50 years. After a through study of soil structure—with its assets and its limitations—a SATOH recommendation will give you a complete program for improving your agricultural yield. In some cases, farm implements, too, will be suggested as no two sections of terrain are identical. Improve your agricultural output with SATOH. It is a "growing" organization.

Needs and Help You Prosperous!



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Eat Away Your Profits

Are a Public Health Hazard

KILL 'EM DEAD

with

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How to Grow Agricultural Machinery Industry

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Edited by

YOSHISUKE KISHIDA

Director, International Dept. Shin-Norinsha Co., Ltd.

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Preface

It has passed just a year since the last April when we published "Agricultural Mechanization in South East Asia" for the first time. It is my pleasure that I can send you here "Agricultural Mechanization in Asia(AMA)—How to Grow Agricultural Machinery Industry (2), Marketing Problems". This is the sequel of the autumn number of the last year.

Many peoples are apt to understand the word, industry, only from the viewpoint of production. But no industry can exist without distributive organization. Neglect of the functions of distribution and marketing often incurs fatal results. Production and distribution are inseperable to develop industry.

Distribution is divided into two phases, products and information. In the case of agricultural machinery distribution, most of them are circulated concurrently through marketing system. It is farm machinery dealers that have informed farmers of knowledge of new farm machines, how to use them and how to increase farming management profits.

Bringing up of agricultural machinery dealers is most important for communication of agricultural machinery, promotion of after-sale-service and swift communication of farmers' needs to manufacturers.

In the beginning stage of agricultural mechanization where sales volume is small, the role of dealers, who inform farmers of knowledge of agricultural machinery, moreover inform manufacturers what machinery farmers want, is great. Market is expanded and manufacturers can produce increasingly by their efforts. Though situation is various in each country, the government should much more consider measures and support in the field of distribution.

I sincerely hope that this number will cause much research and argument on agricultural machinery distribution in developing countries.

Three persons—Messrs. A.M. Michael(India), M. Gurung(Bhutan) and B.K. Shrestha(Nepal)—take charge of co-operating editors from this number on. We want co-editors to form effective communication link for promoting agricultural mechanization in Asia.

Yoshisuke Kishida

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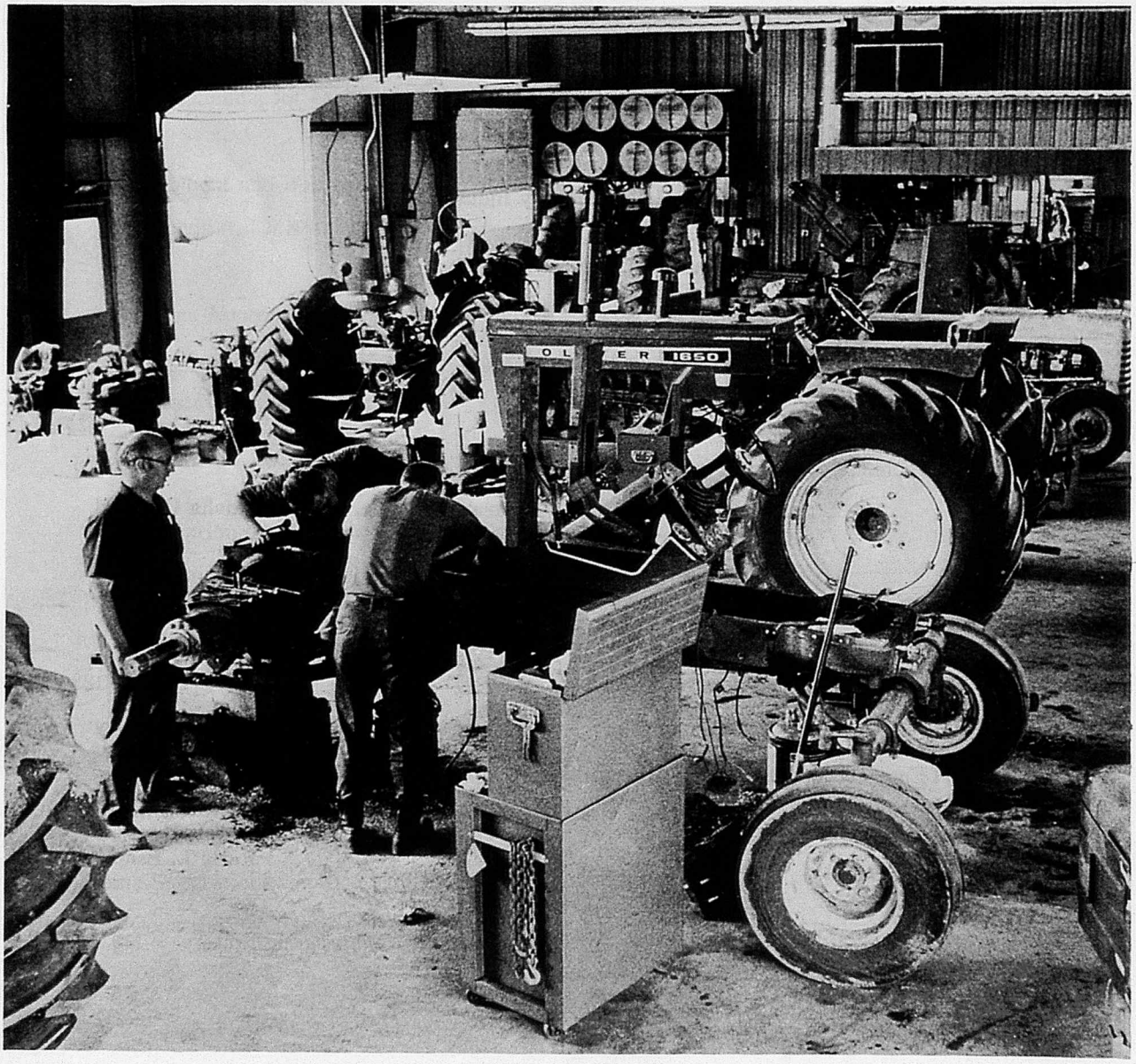
AGRICULTURAL MECHANIZATION IN ASIA

Vol.III No.1 Spring, 1972

marketing problems

of agr. machinery

The role of agricultural machinery dealers, who join manufacturers with farmers through sales effort, is very important for farming mechanization. We can approach this marketing problems from the view of management, trading, after-sale-service, finance, information, training, education and so on. The following articles will help us to understand the importance of distribution system for developing farming mechanization.



History of Marketing of Agricultural Machinery in U.S.A. and the Role of *NFPEDA*

by Charles R. Frederick
Executive Vice President
National Farm & Power Equipment Dealers Association
2340 Hampton Avenue, St. Louis, Missouri 63139 U.S.A.

Mechanization on the farm is vitally important. It is essential if we are meet the demand for more food and fibre resultiog from the constant increase in the world's population. It is essential if we are to raise the standard of living of those who bear the burden of farming without the benefit of modern machines and equipment. It is essential if we are to produce more food and fibre with fewer man-hours of labor.

Agriculture is the oldest of all industries. Its practice extends back to prehistoric times. The oldest records indicate that simple tools and primitive machines were devised by agricultural workers to aid them with their tasks. Thus, for many centuries, agriculture developed as an art in the practice of which the worker manifested great skill in the use of a number of hand tools such as the hoe, the simple plow, the sickle, the scythe, the cradle, and the flail. The energy to operate these primitive tools was obtained largely by human muscular effort, although some animals -- notably the ox and the horse -- were also pressed into service, particularly to operate the plow.

The Farm Equipment Dealer was Born

In general, the commenemts that follow are based principally upon the development of the farm equipment retailing industry in the United States. The writer hopes they may be of interest to you.

The introduction of farm machines is a development of comparatively recent origin. 200 years ago the early American farmer would have been perfectly at home with the tools used by Egyptian farmers 2500 years before his time. This early American farmer, after plowing the land with a small plow (sometimes made of wood) drawn by an ox, sowed the grain by hand, reaped the crop with a sickle, and threshed it with a flail.

The independently-owned and operated dealer has played a significant part in the acceptance and use of farm equipment.

In earlier times a farmer would get a blacksmith to forge a tool according to the farmer's specifications. If the tool worked well, he would tell other farmers who would get the blacksmith to make them similar tools. The blacksmith might devote most of his time to the production of this tool or tools, in effect becoming a small manufacturer.

It is recorded that the blacksmith displayed his tools under the spreading chestnut tree. When he had a surplus on hand he sought outlets for their sale. For a number of years in America, the hardware dealer was the principal outlet for the sale of farm machines and equipment. But as machines became more complicated there developed a definite need for specialized knowledge about the application of those machines and mechanics specially trained to service them. Thus was born the farm equipment dealer as he exists today.

The farm equipment dealer has been responsible for the assembly and setup of many farm machines (not all are completely assembled when the dealer gets them), their preparation, demonstration and servicing. He has had the responsibility for merchandising. He has taught the farmer how to operate and use the equipment. But he has done more than just these things. It may well be that the greatest group contribution to the farmer's knowledge of farm

equipment serviceability has been made by local farm equipment dealers; men who had sufficient faith to invest their time, energy, talents and capital in the distribution of farm tools; who demonstrated their efficiency and who, in many cases, arranged for credit for the farmer so the machinery could "pay for itself" in labor saved or money earned.

The Most Important Local Retailer

The dealer must know each customer's problems: Whether he operates a general farm, a dairy farm, a fruit orchard, a livestock farm, a grain farm or what have you. Otherwise he cannot talk intelligently as to the machines best suited to the farmer's needs. It is well to remember that the farmer is not interested in buying a tractor for pleasure or the ornamentation of his farm. He is much more interested in **what it will do** over a period of yeras than how it is made or made or why it is painted this or that color -- however attractive such colors may be in the catalogs or on the display floor.

The successful dealer must base his sales presentation on the actual needs of each individual prospect. But success in farm equipment retailing demands more than salesmanship, despite the fact that sales are the very life-blood of any business. Many top-notch implement salesmen have gone bankrupt due to lack of managerial abilities.

Despite the help of factories in increasing production of well-engineered equipment, and the added facilities of wholesalers, branch houses and parts depots, the most important factor in distribution still is, as it always has been, the local service retailer. Unlike many manufactured products, farm equipment must of necessity be sold to rural customers; and distribution requiring assembly, installation, repair or other service must be made from nearby local stores or service shops.

In these stores of local farm equipment retailers -- the **one place only** where a complete line of farm equipment may be found -- lines have been selected to meet the needs of the community all based on the judgment and experience of the dealer upon whom the ultimate customer or user depends for satisfactory service.

In the country in which the writer lives, the farm equipment retailer has played a most important role in the miracle of food production and farm advancement. Rightly, he can be proud of his contributions to the success of American agriculture. A few facts will confirm this statement.

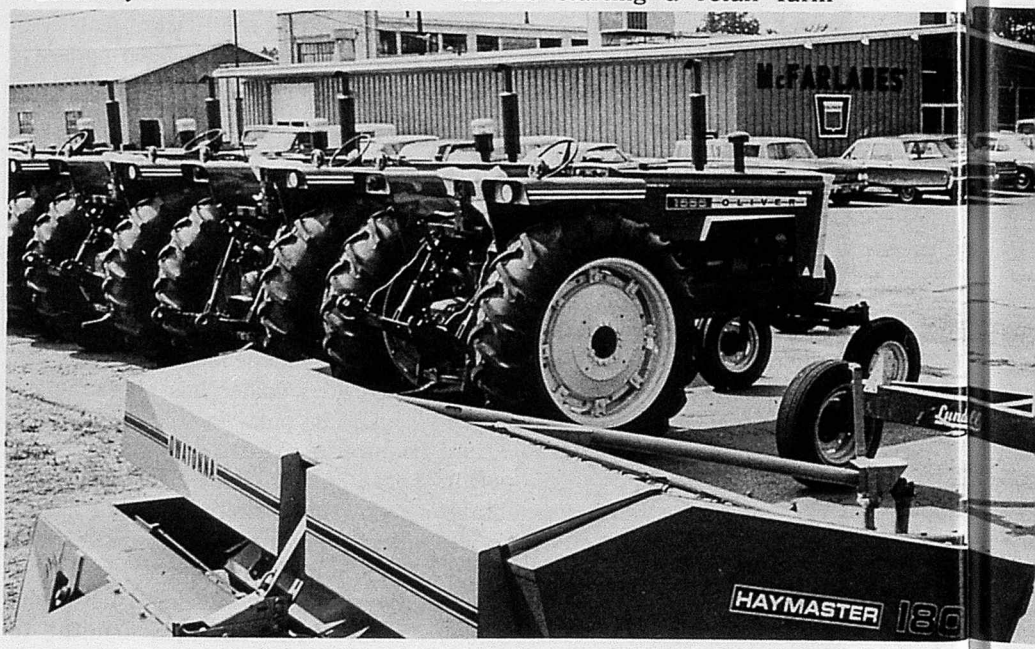
The farmer has been able to feed a land that is increasing its population at a rate of 200,000 every 24 hours, and he is doing it on the same number of acres that were under cultivation 25 years ago when we had 50 milliom less mouths to feed. It is anticipated that he will be asked to expand his output by another 35 percent within the next 12 years, just to meet domestic food needs.

Certainly the farmer's efficiency is determined by the extent of his association with other back-up specialists: the plant and livestock geneticist, the agronomist and the chemist, the university and its technological services, financial institutions, and farm equipment manufacturers. But the farm equipment dealer can be invaluable because of his accessibility to the farmer.

Much is said about the revolution in agriculture -- it is occurring all over the world. By 1980 the new mouths to be fed in the world will require an additional 300 billion tons of grain or its equivalent. This is near the present total production of the United States, Canada, and Western Europe combined. Farm equipment manufacturers must provide the developing nations of the world with the tools matched to each nation's evolving farm technology. And herein lies the need -- and the opportunity -- for farm equipment dealers who will be prepared to sell and service these tools.

Essential Points for Successful Business

Before starting a retail farm



The Exterior of a Dealership

equipment business a man should carefully analyze the requirements for success. To achieve a measure of success a man must have, as has been pointed out, a knowledge of the kind of agriculture prevailing in the area which he will serve. He must know the farm equipment that will be needed for this kind of agriculture. He must select the right lines of equipment and accessories. It is essential that he has faith in the products he will be selling; to know their value and importance to the farmer-buyer, how they will serve his needs. He must arrange for an adequate amount of capital. He must properly locate his business, and choose a good building layout. He must learn the basic principles of sound business management. He should develop skill in selecting employees and training them. He must determine how large an inventory of parts he will carry, and develop plans to control that inventory. And certainly he must take all the steps necessary to insure that machinery and equipment can be and will be repaired -- promptly and satisfactorily.

Financial records provide dealers with a sound measuring device for business. They may serve to give a profile of a dealer. Here are balance sheet figures and operating averages for dealers in the United States reporting for the year 1970. They show figures and percentages on the amount of money the average dealer has invested in his business, and the operating results:

BALANCE SHEET

ALL DEALERS

		% of Total Assets
ASSETS		
Cash and Government Bonds	$ 14,844	4
Accounts and Notes Receivable	42,287	13
Finance Reserves and Other	6,626	2
TOTAL	$ 63,757	19
INVENTORIES		
New Equipment	$ 151,225	45
Used Equipment	32,850	10
Repair Parts	42,070	12
Other Lines	6,552	2
Total Inventories	232,697	69
Total Current Assets	$ 296,454	88
Fixed Assets	$ 32,868	10
Other Assets	7,991	2
TOTAL ASSETS	$ 337,313	100
LIABILITIES AND WORTH		
Current Liabilities	$ 196,266	
Long Term Liabilities	27,211	
Total Liabilities	$ 223,477	
Net Worth	$ 113,836	34
TOTAL LIABILITIES AND NET WORTH	$337,313	

FINANCIAL OPERATING AVERAGES FOR ALL DEALERS

SALES:	AVERAGE Amount	% Sales
New Equipment	$ 313,442	52.98
Used Equipment	105,440	17.82
Total New and Used	418,882	70.80
Repair Parts	107,151	18.11
Service Labor	36,484	6.17
All Other Lines	29,092	4.92
TOTAL SALES	591,611	100.00
MARGINS:		
New Equipment	32,279	10.29
Used Equipment	4,485	4.25
Total New and Used	36,764	8.77
Repair Parts	29,519	27.54
Service Labor	11,642	31.90
All Other Lines	6,377	21.92
TOTAL OPERATING MARGIN	84,302	14.24
Less Total Expense	84,250	14.24
NET PROFIT ON SALES	52	.00
Other Income	18,065	3.05
NET OPERATING PROFIT OR LOSS(Before Income Taxes)	18, 117	3.05
EXPENSES:		
Salaries - Officers, Owners	12,223	2.07
Salaries - Office Employees	4,659	.79
Salaries - Salesmen	8,091	1.37
Salaries - Partsmen	8,274	1.40
Salaries - Other	2,360	.40
TOTAL SALARIE	35, 607	6.02
Rent or Lease	3,140	.53
Heat, Light, Power, Water	1,685	.28

Telephone and Telegraph	1,636	.28
Store & Office Exp., and Postage	2,349	.40
Shop Supplies and Equip. Repairs	2,465	.42
Car and Truck Expense	4,806	.81
Travel and Sales, Demonstrations	1,484	.25
Advertising	2,994	.51
Taxes - Payroll and Property	6,615	1.12
Dues & Subscriptions	237	.04
Insurance (Except Group)	4,191	.71
Legal and Auditing	841	.14
Group Insurance	1,369	.23
Repairs - Building & Fixtures	961	.16
Depreciation	3,957	.67
Bad Debts	1,401	.24
Interest and Bank Charges	4,148	.40
After Sale Expense	3,486	.59
Miscellaneous	878	.15
TOTAL EXPENSES	84,250	14.24

Origin and Historical Change of *NFPEDA*

These figures, incidentally have been taken from *the Cost of Doing Business Study* conducted by the National Farm & Power Equipment Dealers Association. (This organization is financed by the support of dealers, and is not subsidized by government.) It is just one of many services developed by the Association.

The National Farm & Power Equipment Dealers Association traces its origins back to February 5, 1889, when eight implement dealers from the state of Kansas met in Kansas City. These dealers had been there buying merchandise for their customers' spring needs. All of them had met problems of one kind or another with local wholesalers or distributors.

They discussed their problems and concluded that many of these inconveniences might be remedied if they would from an organization which could present their ideas to the other branches of the trade more forcefully than could be done individually.

Accordingly, they called a meeting of Kansas implement dealers on February 20, 1889. Eighteen dealers responded to the call, and on that date the Kansas Retail Implement Dealers' Association was organized.

Word of this new trade association spread; and in the four years following the founding of the Kansas Association, nine other associations were formally organized.

In each of these areas dealers were encountering trade problems common to all other areas.

On September 20,1900, eighteen delegates from five of the associations met to effect the establishment of a national organization. The National Federation of Implement Dealers Associations was formally organized on that date.

In 1939, directors of the National Federation felt the urge to render even greater service to the trade. Following consultation with the affiliated associations, a special planning committee recommended the rerganization of the association, the broadening of its scope of activities and the employment of a full-time Executive Secretary.

The committee's recommendations were unimously adopted at the October, 1939 annual convention, the conversion of the "Federation" was ratified by the sixteen constituent associations, and on March 9, 1940 the organization became officially the "National Retail Farm Equipment Association." Offices were established in St. Louis, Missouri.

In 1955 the National Association moved into its own newly-constructed office building at 2340 Hampton Avenue in St. Louis. At the October, 1962 annual convention the name of the organization was changed to the "National Farm & Power Equipment Dealers Association," thus recognizing the changing character of many dealers' operations.

Aimes and Objectives of *NFPEDA*

Today there are 31 affiliated associations in the United States and three Provincial associations in Canada serving a total of 11,800 dealer-members.

The aims and objectives of dealer associations are summed up in the Bylaws of the National Association which states its purposes to be:

1. To promote the general welfarm of farm and power equipment dealers;
2. To foster cooperation and fair practices between manufacturers, distributors, retailers and farmers;
3. To encourage and support equitable practices and methods within the industry;
4. To aid in the commercial and industrial advancement of farm and power equipment retailing;
5. To serve agriculture generally, and particularly to promote the increase of food production through the introduction of new and improved machinery and to raise the standards of those engaged in agricultural pursuits;
6. To compile and disseminate information, data and knowledge to its members;
7. To aid and protect its members collectively in any and all of their proper business relations; and
8. To do all things properly within the scope of an association of farm and power equipment retailers.

These aims and objectives have been realized to a remarkable

degree by both state and regional associations and the National Association. This is evident from the recongnition that has been accorded, both inside and outside the industry.

For many years the National Association and the state and regional associations have conducted an active dealer-manufacturer relations program. In 1961 the "Declaration of Objectives for Farm and Power Equipment Retailing" was adopted in the conviction that any sound program which strengthens retailers also serves to strengthen the other segments of the industry. Farmers cannot hope to expect from other than successful dealerships the type of service they need and rightfully demand. Manufacturers and other suppliers are completely dependent upon dealer-distributors who can and will operate profitably year after year.

Service and Function of *NFPEDA*

As stated previously, the number one aim and objective of the associations is: "To promote the general welfare of farm and power equipment dealers." To most effectively accomplish this objective, the associations for more than a half-century have carefully studied the needs of their dealer-members. As a result, they have designed, developed and made available more than twenty-five general and specific services.

It is not feasible to attempt to list or describe in detail all of these services that are now available. Some of these programs are general in nature and provide benefits to the industry as a whole. Others are of a specific type and are furnished to members only upon request.

Since 1946 dealer-members, through their dues support, have had direct representation in Washington, the nation's capitol. The value of this service has been proved many times through the years.

The state and regional associations represent their membership effectively before state legislatures and agencies of the state governments. Many associations maintain permanently a legislative committee. Only through the associations can the voice of the farm and power equipment dealer be expressed effectively to law-making and governmental agencies.

The dissemination of information on a variety of subjects of importance and interest to dealer-members is one of the association's principal functions. The National Association publishes *Farm & Power Equipment,* a monthly magazine, and most of the affiliated associations publish monthly bulletions. From time to time, special bulletins are issued that are designed to assist the dealer in his management and merchandising operations.

Ever since trade-ins became a factor in the sale of new equipment, the Association has been compiling and blishing the *Official Guide - Tractors and Farm Equipment.* Nationwide dealer

The Interior of a Dealership showing Repair Parts & Accessories on Display

surveys are conducted to determine resale values of tractors and other major machines. Prior to 1961 the Guide contained a section listing the principal items of light industrial equipment, but due to the increasing number of dealers handling equipment, it became necessary to publish separately the *Industrial Equipment Guide.*

In 1939 the secretary-managers of a number of the affiliated associations collaborated in developing the first uniform accounting system for farm equipment retailers' use. It is complete in every respect and provides the information necessary for good management. Supplemental forms of various types have been designed and made available to dealer-members though the associations.

Many assotiations offer their members bookkeeping schools at which competent instructors train bookkeepers and inform management about the proper use of figure facts gained from the association's accounting system. Some affiliated associations maintain one or more trained auditors on their staffs. These staff employees are available for periodic audits during the year and for rendering such additional assistance as may be needed by the dealers whom they serve.

Serve as the "Voice of Dealers"

A recent development is the Electronic Accounting Service in which monthly statements, in complete detail, are prepared and General Ledgers are maintained and updated from journal data mailed in by dealers or association accountants. Statements and ledgers are printed on an electronic computer, bound in an attractive cover, and mailed back to the dealer -- all within a matter of days after receipt of transaction summaries from the dealer. The operating statements contain departmental percentages and ratios. Percentage relationships of margins, expenses and profits to sales are computed and printed, giving the participating dealer not only a clear "dollar and cents" picture of his business, but the important percentage measurements as well.

The annual Cost of Doing Business Study is considered by many to be one of the associations' outstanding services.

Through the years the associations have made available to dealer-members business management clinics, sales clinics and shop management clinics.

Many special booklets have been produced by the association covering such subjects as "Labor Relations," "Selling Farm Equipment," "Advertising Guide," and "Building Planning Guide," all of which are of immense value to the dealer-member and his employees.

The National Association and each of its affiliated state and regional associations hold an annual convention. Many of the state conventions feature exhibits of merchandise and shop equipment.

At these conventions thousands of dealers gather together to "talk shop," listen to outstanding business talks on vital, current subjects and to enjoy the hospitality and fellowship that is always a part of a trade convention.

Many associations hold group meeting during the year. These are conducted in strategically selected locations throughout the association area in such a manner that a maximum number of members can attend with a minimum amount of travel.

In some association areas "dealer clubs" meet at intervals throughout the year. Through these opportunities for personal contact, dealers may become better acquainted with their neighboring dealers. Developing a more friendly relationship between competing dealers is another reward of association membership.

It has been said that "association membership doesn,t cost -- it pays." It would be extremely difficult, if not impossible, to place a monetary value on a dealer membership in a retail farm and power Equipment association.

The farm equipment industry has made giant strides during the last halfcentury, Financially it has prospered. Its prestige in the public eye has risen higher with each passing decade. Business ethics and practices have become more mature.

Such things don't "just happen." The National Farm & Power Equipment Dealers Association and its affiliated associations serve as the "voice" of farm and power equipment dealers. As such, they are heard. Services are projected for the future, as well as being vital for present needs.

A trade association, in reality, is a non-profit, voluntarily-joined organization of business competitors which has been formed to serve its membership, its industry and the public, in dealing with mutual problems. And, in the retail farm and power equipment industry, the ASOOCIATIONS SERVE .....EFFECTIVELY, EFFICIENTLY AND ECONOMICALLY.

■ ■

Product Planning for Developing Nations

by
Dr. C. J. Mackson and C. T. Hausmann

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The far reaching problems of Agriculture in developing nations have led many government to reject the concept of rapid, high level menchanization especially in regions where the problems of over population and displacement of farm labor is acute. The basic problem is that rapid mechanization cannot come about on a wide-spread besis without an accompanying increased industrialization and urbanization. A well planned domestic product development program must accompany a meaningful mechanization program to provide a systematic transfer of labor, a greater per-capita productivity and increase profits for a growing economy.

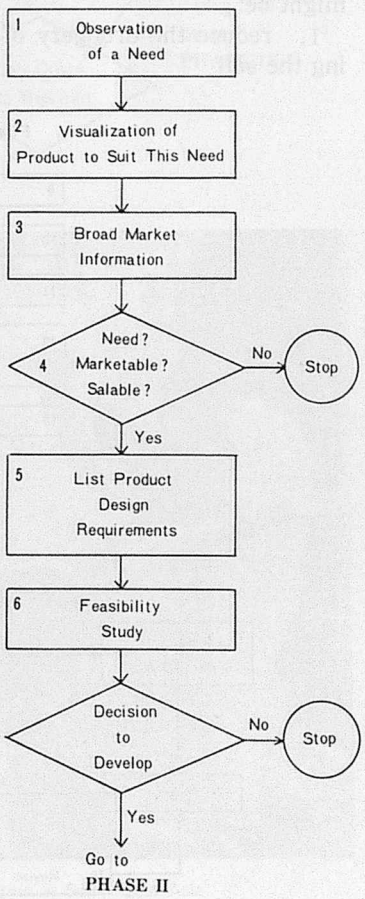
But how does one go about developing a successful new product? The accompanying flow chart outlines the basic procedure for recognizing a need, developing and marketing a new product. The system consists of four distinct phases: Phase I, product Formulation, Phase II, preliminary Design, Phase III, Final Design and Phase IV, Design of the Manufacturing and Marketing Systems, Each phase requires somewhat different skills, training, and experience, but in the case of a small operation and limited resources most functions could be performed by a single man with a broad engineering backgroung. For example, let us consider a tillage machine for developing nations and see how the flow chart would wark and what job qualifications would be necessary.

Phase I, Product Formulation, involves the systematic formulation of a new product idea. First, someone must come up with a good idea. But who will it be, and how will it be done? The job requirements call for a man who is familiar with the people, the conditions, and the job to be done. Sales and Service people and the farmers themselves will often be a good source for new product ideas but the job is by no means restricted to any one category. By observing the practices and routine activities of a given group, the first block on the flow chart, the observation of a need, can be completed, In the example, the need could be stated; develop an inexpensive tool which would reduce the drudgery of tillage functions.

Once the need is clearly stated a visualization of the product must be formulated even though a great deal of transformation will take place before Phase I is complete. Never-the-less, this step (2) will provide a direction and a foundation for further examination. The first visualization might be a modified garden tractor with a gasoline, two wheels, a complete line of tillage equipment, and perhaps a PTO which would be rugged and reliable yet at a cost that farmers can afford.

In step 3), broad market information is collected. For example, in most developing nations farm-

Phase I Product Formulation



ers have little or no capital to invest and are usually untrained in the care and maintenance of power machiery. All the pertinent economic and cultural characteristics should be examined. Available or required financing, servicing, and educational requirements will all help define the characteristics and needs of the people to whom the product must be sold. Survevs, questionnaires, and interviews with knowledgeable people in the related areas are techniques which can be used in this step.

The first major decision is made at this point (4). The product idea must meet two basic requirement; first, there must be a sufficient need to justify the development, and second, the problems related to selling, marketing, and servicing the product must be resolvable.

With this information the product design requirements can be listed (5). In the example these might be:

1. reduce the drudgery of tilling the soil
2. increase productivity to make a profit on the capital investment for the farmer
3. be cheap enough for the farmer to afford
4. be simple enough for the farmer to maintain and operate.

Only the broad, overall requirements should be stated so that the result is a flexible yet clear statement of the problem.

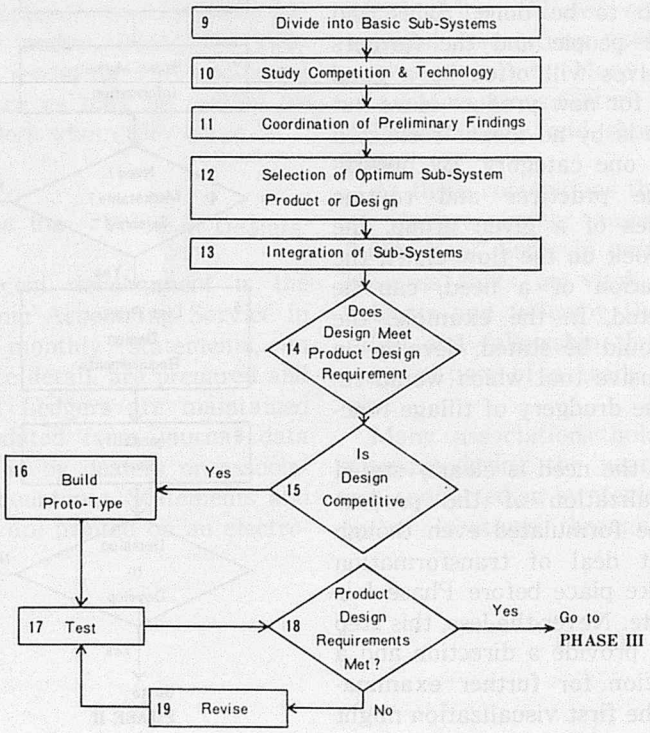
The feasibility study, Step (6) on the flow chart, will involve the examination of the technical and economic factors related to the financing and development of the product idea. The following areas should be considered: available technology and components, facilities required, new machinery and labor requirements, competition and probable manufacturing costs. The best possible estimate of the difficulties in product development and production costs must be formulated from the limited information available at this point. This function will require a person who is familiar with the areas of product design and manufacturing. For the tillage machine, much information is available to predict performance and development problems but the cost, training, and maintenance problems will need to be studied. This will usually be true for most product planning in developing nations the process is one of utilizing available technology at a practical cost rather than advancing it.

On the besis of the information collected to this point, a major decision on whether to commit the funds for the development must be made. If the indications are positive, and the decision is made to commit funds, we proceed to

Phase II, the Preliminary Design. Phase II is concerned with examining alternatives, selecting the optimum design, and developing a working model. These functions require design and engineering skills.

The product must first be broken down lnto basic sub-systems for individual attention (9). For the tillage machine these subsystems will be the power source, the drive train, the chasis, the controls, and the tillage tools. A good way to begin the study of sub-systems is to evaluate competitive products which perform similar functions (10). By examining the good and features, customer acceptance and produt design requirements, the design engineer can quickly become familiar with the latest techniques and practices. New designs, modifications and available standard components should be examined for their performance and suitability. Each sub-system is studied in this manner either simultaneously or successively. The compatibility of the suggested sub-systems is then evaluated (11) so that the alternatives can be evaluated. The optimum sub-system design (12) will then become a function of cost, performance, and compatibility with related

Phase II Preliminary Design



sub-systems,

Now the optimized designs can be combined (13) mi and the necessary changes made to provide a single system for the solution to the problem. The complete design is then evaluated to insure that it meets product design requirements (14) and is reasonably competitive (15).

A proto-type of the design can now be constructed (16), tested (17), and evaluated under actual or at least representative environmental conditions. The proto-type is evaluated in light of the original objective of the product, design requirement and performance (18). It can be revised (19) and re-evaluated as necessary.

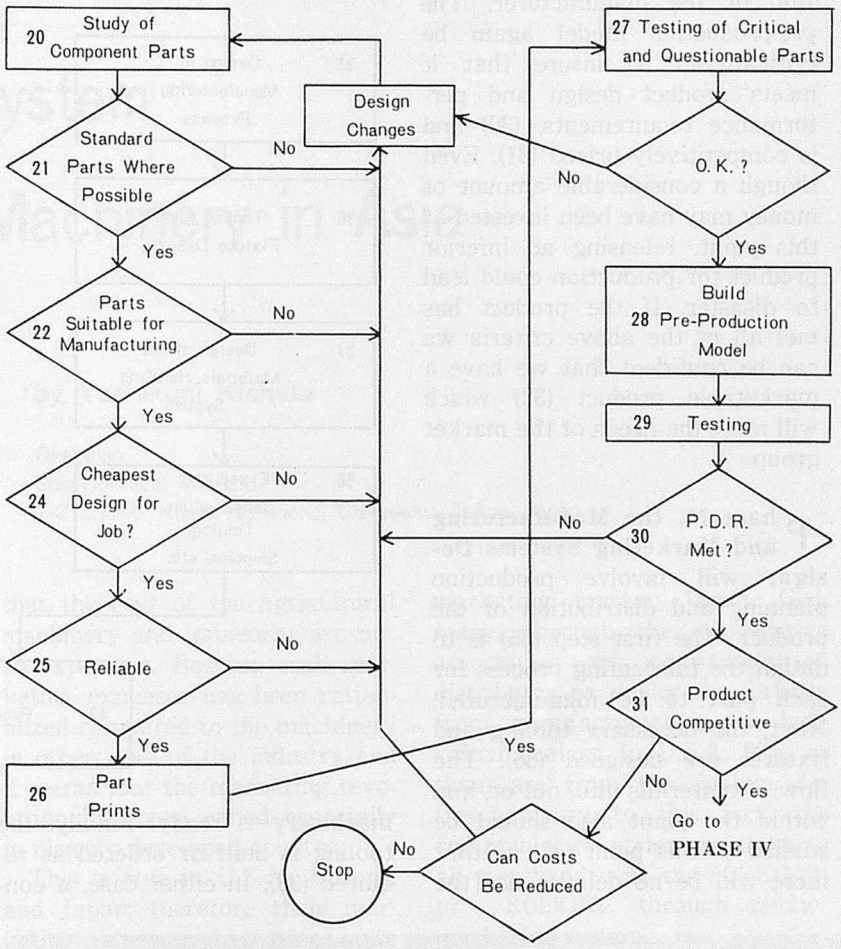
After evaluation and modification is completed the product will go into

Phase III, the Final Design. The besic purpose of this phase is to examine and modify the proto-type model to meet manufacturing and reliability standards while maintaining performance. The least expensive combination of components, processing, and materials must be determined. This function will require a person with manufacturing experience.

Each part must be studied in detail (20) so that standard parts (21) and construction (22) can be used whenever possible. The cost of manufacturing these parts (24) and reliability (25) will play a vital role in determining the competitive nature of the product. New designs should also be investigated for possible patents. Manufacturing pritnts are prepared (26) as preparations begin for the design of necessary tooling and hardware (33). Critical parts are usually tested under severe conditions to insure reliability and customer satisfaction (27).

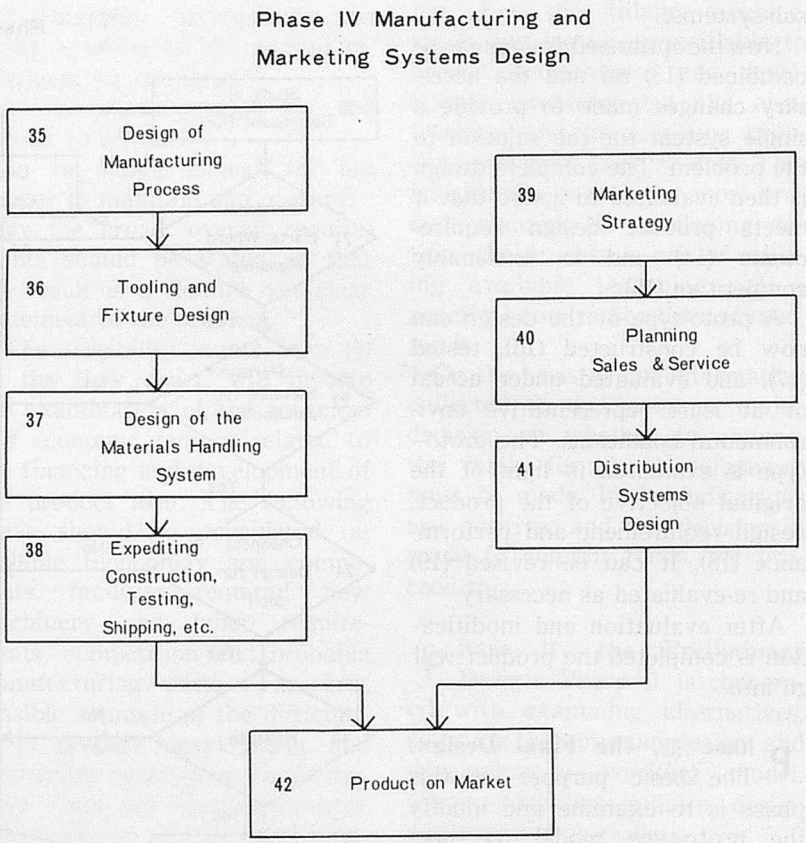
Finally, a pre-production model is built (28) for final testing (29). Making design changes at this time could not only save the developer a lot of money in costly

Phase III Final Design



Technical Training of a Rice Milling Machine in South East Asia

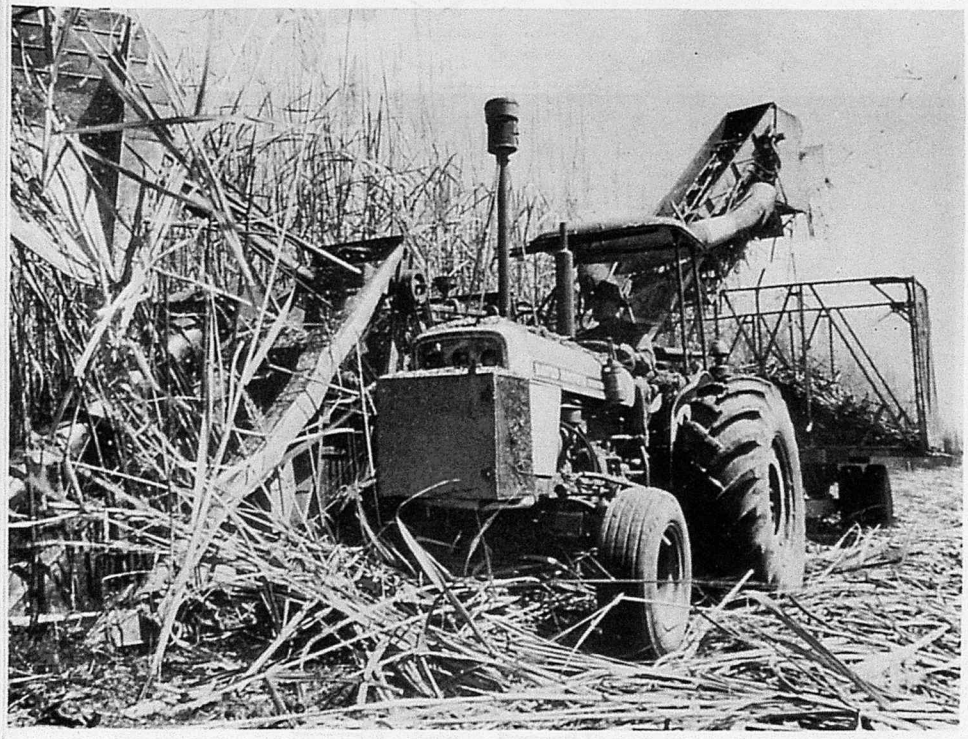
tooling and design changes, but also make or break the reputation of the manufacturer. The pre-production model again be criticallyzed to insure that it meets product design and performance requirements, (30) and is competitively priced (31). Even though a considerable amount of money may have been invested at this point, releasing an inferior product for production could lead to disaster. If the product has met all of the above criteria we can be confident that we have a marketable product (32) which will meet the needs of the market group.



Phase IV, the Manufacturing and Marketing Systems Design, will involve production planning and distribution of the product. The first step (35) is to design the fabricating process for each part to be manufactured. Next, the necessary tooling and fixtures are designed (36). The flow of materials into, out of, and within the plant also should be studied at this point (37) so that there will be no delays once the machinery is ready. Finally, the tooling is built or ordered as required (38). In either case, a considerable amount of follow-up work will be required.

While the plans for manufacturing the product are proceeding, final plans must also be made for the distribution, sales, and servicing of the product. A market strategy (39) will need to be developed which will include advertising, training, and time and place for introduction. The necessary sales and service people (40) will need to be trained and brochures, warranties, instructions, etc. established. Plans will also need to be finalized for stock piling and shipping the product and spare parts (41).

Finally, production may begin and hopefully show a satisfactory margin of profit from what now has become a sizable investment of time and money. The job can not be considered complete, however, because even a successful new product will have to be modified, improved and continually updated to promote market penetration and expansion. ■ ■



Sugar Cane Harvesting with a D B Tractor

Establishment and Improvement for Marketing System of Agricultural Machinery in Asia

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The Role of Agricultural Machinery and Implements Dealers

The problem which usually happened between the production and comsumption is considered to be the cause of the unexpectedly high expenditure which happen in the process of marketing and manufacturing.

They say that, with the growth of the democracy and its technological advancement, are become such close contact each other. I mean, the commodities and their marketing system. There has been a little improvement each year.

Why is the marketing expenses such high, relates the fact that there are import-export taxes besides these marketing expenses.

Just think about such cost that has been added from the original cost of the commodities which we consume!! For example, the price of the metals such as watcher and jewels which are made from minerals and stones, are primarily consist of shipping or transporting charges. That is why the iron are sold 20-30 fold higher than the original cost which is actually $160-$170 per ton.

Considering such fact it has been said in the word market that the cost of the agricultural machinery and implenent are not so expensive. Besides, such marketing expenses has been rationalized compared to the machinery in other area of the industry and it seems that the marketing revolution has been ended especially in already developed country.

This is true in U.S.A., Europe, and Japan; therefore their marketing expenses has been quite inexpensive due to the well balanced service structure of the manufacturers and dealers. It is no doubt that these success of today for promoting the agricultural mechanization has depended upon the effort of the people who were involved in the marketing system.

I consider the following three to be possible marketing system in Soth East Asian countries:

(1) Carry out the marketing system through agricultural cooperation (cooperative association), because of insufficient capital

(2) Manufacture makes simple inplement and put them on the market

(3) To sell through each agencies, differentiating domestic and imported merchandice.

There are many cases for marketing system; Japan, Germany, through the cooperative association or commercialized distributor or dealer, or directly from manufacturers to the individual dealers. In U.S.A. 99% of them are from the dealers. On the contrary to this fact, the communist countries are carrying all merchandise to the SOVKHOZ or KOLKHOZ through public marketing system.

When they are compared, their service system such as training operating technique and general services, the commercialized sales technique by dealers seems better than that of public organization. (in communist world)

Of course, there have been a few deficiencies in the dealers side, especially in the begining; such are, taking unfair margin or giving very poor technical teaching of operating machineries to the farmers, etc. (EX: U.S.A., Europe, Japan)

But today, these deficiencies have decreased almost to none, and improved idealistically because of the earnest effort, aiming the perfection of the service and the improvement of the function of the body through organizing union by thess dealers.

Particulary, in U.S.A. whole

sales structure between manufacture and user (consumer), have been eliminated. Thus these machineries have been sold directly from manufacturer to the dealers. Now the whole sale store covers several states.

According their situational differences, each countries are devising and modifying their marketing system which would reduce the marketing expenses accordingly.

Here, lies the essential problem of marketing, that is to say, its function, and how should how should marketing system be organized.

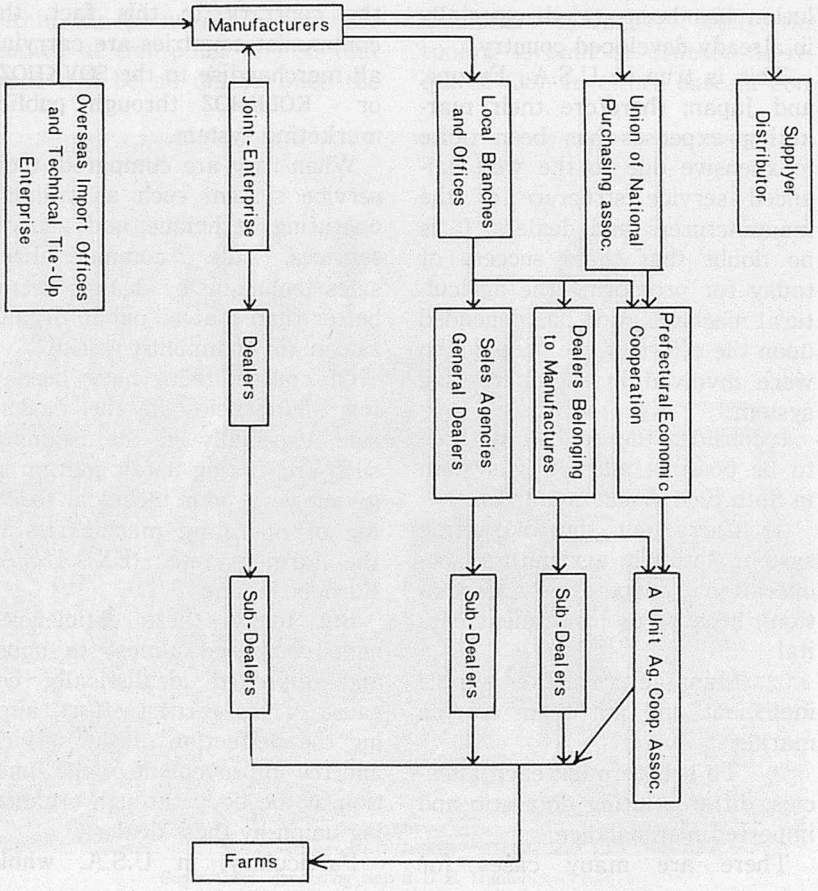
The Pattern and Characteristics of the Marketing System

(a) The character of marketing system through public body

The problem of the payment for the manufacturers or the loan for the farmers are not so easy to settle down with commercialized marketing system because of the lack of the sufficient funds. In order to have some economic assistance in such cases, agricultural cooperative associations or governmental agent would be able to take such responsibilities. The only fault in that system is that the living expense of the members of such or such organization are guaranteed their work efficiency, which might lead to have them less in making effort to contact with the farms and listening their complains as well as making best effort for services after.

Thus even in the case of going to red figures, they, knowing that the goverment would take resposibility, might feel little obligation thus management itself seem to become so sloppy. There is the tendency that during the transitioanal period, such administrative conduct by goverment as the necessary step for establishing marketing system in the beginning. This would disappear soon after the commercialized marketing system with solid set up would take place instead.

The Map of Marketing Channel of Agricultural Machinery and Implements in Japan



(b) The character of the marketing system which belong exclusively to agricultural cooperative association

I am sorry to say that this system hasn't been so successful in world-wide point of view. In Japan's case, about one fourth of machineries are purchased through agricultural cooperative association, though the price are higher than a market price around 4—5 %.

For a long time, manufacturers have had responsibility for merchandizing, which include services after, training men to operate various machinerie, etc.

But, now local cooperative association having individual contact with the local dealer purchase the machineries at once, guarantee for payment and services after; normally the price is 5—10 % higher than that of regular price. (because of the commission by agricultural association)

In the sales structure of the agricultural cooperative association, the marketing expenses are about 30% which break down into 18% for agricultural cooperative association, and 12% for the cost of the training farmers by manufacturer's technician. Upon this reasons, the considerable distances from one farm to the other, make their services insufficient; that is why this 30% of marketing expenses seems quite expensive. A certain statistic shows that, the agricultural machinery purchased through commercialized dealer lasted about 20% longer than that of purchased through agricultural cooperative association.

In other word, this proved the inefficiency of merchandising of the agricultural cooperative association; such as technical assistance to the farmers, supplying spares and parts, and maintenance in general. Thus, some say that it is better to purchase through such commercialized dealers even though the price would be a bit higher.

Usually the marketing expenses include, besides these services mentioned above, the repair plant, store houses which keep spares and parts, and workers for these places, however such establishment on a self-paying basis are very few. They also must carry out training skilled workers for such services, nevertheless the problem is that trainees seem to quite so soon that they could not equip the skilled workers good enough to meet the demand.

This is especially true to Japan's case, that through "union of the national agricultual cooperative association" which purchase all kind of agricultural machineries and implements and also train people to be an skilled worker for technical field of the agriculture. Yet, after three years, about 70% of such trainees seem to quit or move into another places.

(c) **The pattern of commercialized dealers of agricultural machiney and implements**

In Japan, there have been a few types of marketing system existed, one of which is "manufacture — prefectural wholesale store — dealers". Before this she had also, the national representative for manufacturers, then to prefectural representatives then to the dealers. Another one existed was that, about 10 whol sales store, geographically divided, then to individual dealers.

Nowadays, the most of its structure is "manufacture — dealer". The characteristic and advantag svsthis marketing system is that individual dealer would do their best to merchandize; they would be willing to go out in the field to see how the machine is operating and giving them further advice and assistance which would profit to both dealers and farmers. Another important advantages of this marketing system is that they would buy the old machine back when farmers purchase the new model. Thus making the farmers burden relieve a little yet the cost of the automatic machineries are still so expensive that individual dealer has to help to raise funds for farmers by arranging bank loan or other financial assistance.

How Should Margine be Considered as the Marketing Expenses

Through my investigation, for the marketing system in many countries in the world, I woud assure you that the most recommendable marketing system is to establish this commercialized dealers. This operation should be limited within 20km in order to make the best service out of it. Secondly, it is necessary to have repair and fixing plant as well as giving technical advices to the farmers.

It is natural to have such idea that these marketing expenses seem so unnecessary (for consummer's point of view), ··· actually, in communist world the marketing expenses are not expensive but the manufacturers carry its heavy burden instepd thus···, let us reconsider the function of the margine.

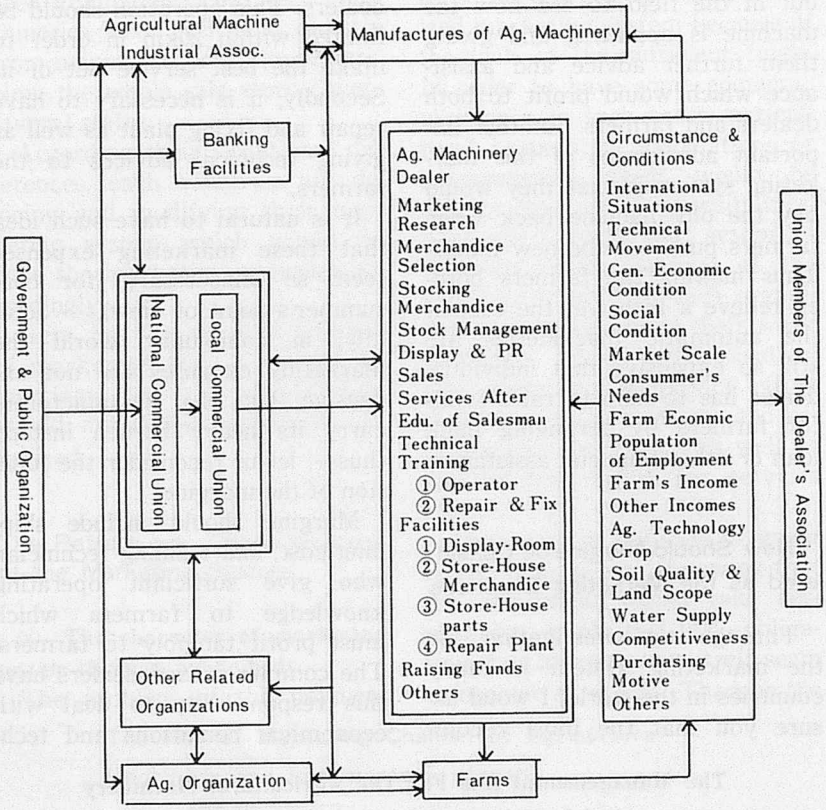
Margine should include shipping cost, and training technician who give sufficiant operating knowledge to farmers which must profit tangibly to farmers. The commercialized dealers have this responsibility to deal with economical conditions and tech-

The Managemental Aim For The Agricultural Machinery And Implements Dealer in Japan (1970)

Items \ Total Amt. of Capital	A – D Average	A 10,000 ~ 29,999	B 30,000 ~ 69,999	C 70,000 ~ 99,999	D 100,000 ~ 399,999	Loss	Average
Synthesis							
Turnover Rate of Operating Capital	1.6	2.1	1.7	1.4	1.4	1.4	1.6
Sales vs Operating Profit Ratio	2.6	2.4	2.0	4.5	2.4	2.5	1.4
Financial Affairs							
Total Capital vs Private Capital Ratio	22.7	25.3	22.0	36.7	15.1	9.0	19.6
Sales							
Sales vs Total Profit Ratio	24.0	27.1	24.0	24.2	21.4	19.4	22.9
Commodity Turnover Rate	6.5	7.6	7.8	5.4	5.3	6.4	6.5
Annual Gross Sales	132,263	46,394	82,385	130,583	245,646	243,950	159,338
Annual Gross Sales Per Sales Man	6,135	4,574	5,203	8,161	6,360	7,020	6,426
Sales vs Operating Expenses Ratio	21.4	24.7	22.1	19.7	19.0	21.9	21.5
Market Price Ratio	10.5	12.1	12.0	8.6	9.9	10.5	10.5
Labor							
Sales vs Labor Ratio	10.8	14.1	10.9	9.4	8.8	10.3	10.7
Monthly Labor Cost Per Person	47,100	56,600	48,000	63,400	41,300	56,200	50,200
Amt. of Tangible Fixed Assets Per Person	487	361	333	385	586	390	454
No. of Enterprise	26	7	6	4	9	8	34
No. of Average Employee	22	10	14	16	39	36	25

Source : Small and Medium Enterprise Agency,
"*Managemental Index of Small and Medium Enterprise 1970*"

The Relationship Between Marketing Organization for Agricultural Machinery and Implements and Its Union Members



nical ability of these farmers, and bring their ability through educational structure of agricultural mechanization. Reluctantly, we must admit that the fact, the proprietor of these commercialized dealers have no guarantee for living expenses, or pension which must be reconsidered.

However, this guarantee for the proprietor's living should not prevent from farmers from purchasing machineries; that is to say the profit gained by farmers in purchasing machineries should be always higher than the profit of the dealers.

Yet, this could be considered as the re-invested money for improving and developing better machineries and implements which eventually bring the profit to the farmers . (This might take a time for making them understood) This is one of the recommendable circulation of the agricultural mechanization.

In Japan,margine has been from 20%, however in special ceses such as training operation of the completely new machinery···for example, a planter···the marketing expenses would be considerably higher. (Here, again, the profit of the users shold be higher than that of the dealers) Repeatedly, as the technical adviser, the commercialized dealer should function in the follwing important conditions, such are;

(1) Quick supply for parts and spares

(2) Quick repairment inexpensively

(3) Give sufficient knowledge of the machinery to farmers

Besides these factors the dealers and their technician should go around often to check the conditions and its working effectiveness of the machine.

As I mentioned several times before, the biggest problem is the turnover rate of the capital. There must be some connection with banking facilities in solution to this problem. The partial payment by the farmers, assisted by some sort of loans untill the cultivation, etc., would be one of them. In the process of agricultural mechanization, the solid establishment of financial cooperation with government is indispensable. Additionally the commercialized dealer have to prepare for new demand from the user when they would start to use a new machinery, and information should be sent to the dealers or manufacturers for study.

Organizing the Dealers' Association of Agricultural Machinery

As the mechanization matures, producing more kinds of machineries and implements, make the body of the manufacturer to be complicated.

In such complicated body of the manufacturers, it is very difficult to assort or itemize a certen merchandice. There would be need for national organization of agricultural cooperative association for dealing with government offices for exchange of the informations and other related matters.

Both, in U.S.A. and Japan, there are prefectural dealers' association which has the central body and meet for inforrnation and related discussion. Their usual process for marketing — manufactures-wholesalestore-dealer have been changing to other form gradually. If a certain manufacturer has better marketing system of his own, he could sell directly to farms; Or with the cooperation of such large manufacturers other minor manufacturers would take a part in such organized body having some responsibility of their own. In these cases, the price would be higher normally, nevertheless the technical assistance or services after would be efficient and user might be profited much.

In Japan, when large manufac-

Union of the National Ag. C. Assoc. and Their Set-up for Repairing & Fixing & Fixing Plant

	plant				workers				
	unit ag. c. assc. service station				unit c. assoc.		union of pref. economic assoc.		
	no. of assoc.	plant	attestation plant	pref. plant	no. of. trainer	no. of. mechanic	trainer	mechanic	training center
total	6, 181	3, 106	398	173	10, 369	154	1, 183	147	4

Source : Research Reports from Agricultural Machinery Dept. in the Union of National Agricultural Cooperative Association

Number of the Dealers and Their Service Set-up

	no. of dealers	no. of comm. association member	ag. repair & fixing plant	no. of mechanics
total	11, 230	3, 065	984	16, 244

turers hold the marketing system of their own, they also establish their commercialized dealer's association, belonging exclusively to a certain manufacturer, and take care of financial problem through banking facilities, they do also deal with governmental matters. The only disadvantage of this system is that member must pay some fees to this association, and this fee might be a burden to some minor dealers. Yet, to have these dealers understood this would be a matter of time, and this fee would be fed back and increase their profit, is very important.

In U.S.A., even there is a standard for a book and association point out many places to be improved for the sake of the management, the dealers have been profited out of it. The same way, in Japan, after World War II., we reorganized and re-inforced the national dealers' association, as well as the individual dealer.

This dealers' association have close contact to the farmers, knowing their complains or demand therefore they could make not only appropriate proposal to government but also, they could submit a detail data of relevant problems such as cropping, or of climatic differences, etc. for further improvement. Thus, the government should have some feasible support to such association in order to re-inforce its marketing system.

This association as the contacting mechanizm should be solid enough to carry out just and fair management not so as tobe overcomed by manufacturer's selfinterest only. It is no doubt through these dealers, the manufacturers are getting necessary informations and the movement of the market.

Not like cars, there is a demand season for agricultural machinery and implements could be sold; in fact, the manufacturers are producing machinery and implements which could be sold within two months. Therefore; though these cost of machinery and implements are not so expensive, but dealers must have enough money for stocking such demand season. They must cooperate with some banking facilities for this reason.

Whenever the government policies for agricultural mechanization change; for example, government might recommened or request the large four-wheeled tractor for common use or small tractor, for a few farm's use, the manufacturers or dealer's association must observe newtrality even if, the governmental plan might not seem so optimum, or some individual dealer might propose some detailed analysis of the problems.

The Amount of the Production and Sales of the Agricultural Machinery and Implements

unit : one hundred million yen

	purchasing amount per farm	purchasing amount per ha.
1960	14. 8	14. 5
1961	19. 3	18. 7
1962	21. 6	20. 4
1963	21. 2	20. 2
1964	23. 7	22. 2
1965	26. 9	24. 9
1966	31. 8	29. 1
1967	38. 1	34. 7
1968	48. 7	44. 2
1969	54. 0	49. 3
1970	54. 8	50. 5

In the second volume of this series, "How to grow agricultural machinery industry", I stated that the necessity for recognizing the importance of the marketing system as a part of agricultural mechanization. Unfortunately, these dealers funds are so small which doesn't have any political power. Thus they believe themselves that they do just shipping and transporting merchandise, and forget to reconize themselves as the essential body for promoting agricultural mechanization.

This agricultural mechanization as well as agricultural policy, must become one of the systems therefore; never to forget that the marketing system is the back bone of the agricultural mechanization. ■ ■

A Systems Approach to Technical Training in Developing Countries

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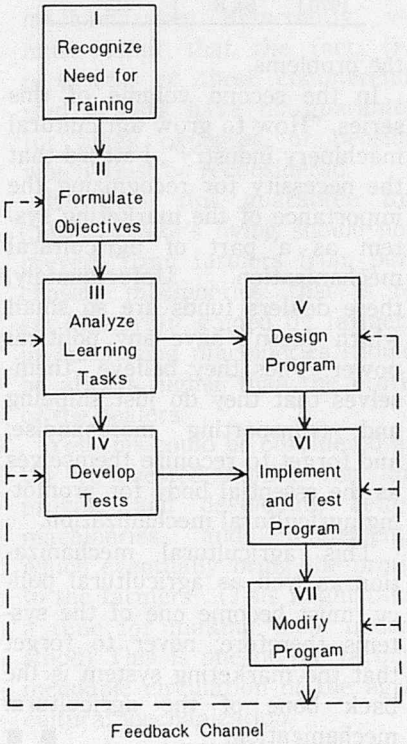
The increasing accumulation of abandoned, broken down and deteriorating engine--powered agricultural equipment encountered in developing countries emphasizes the problems involved in the effective transformation of subsistence agriculture into a market oriented economy. Why have these conditions developed with such an alarming regularity and what are the causative factors? It is the authors' opinion that the overriding factor, almost without exception, has been the inability to adequately train the operators and supervisors how to operate, maintain and apply these complex mechanical devices in an efficient and economical manner. The reason training programs fail is the lack of a carefully prepared and presented course of instruction based on a precise structured learning and training environment called SLATE.

Fig. 1 Teaching Program System



The magnitude and complexity of the skilled level training problem in developing countries is not readily understood nor clearly recognized. If the problem were simple, it would have been solved long before now. The mechanization of agriculture would be progressively expanding at an increasing rate and would be a positive contributing factor to growth in each nations overall development. Unfortunately, this is not the case and the search continues for a reliable way to introduce modern equipment and technology into hand and animal--powred cultures and to teach men how to become directors rather than producers of power.

Define Training Needs & Formulate Objectives

Recently at Michigan State University, a systems engineering approach was applied to the problem of developing a training program to teach mechanical skills and attitudes. This concept breaks the seemingly unmanageable problem into smaller, less complicated steps which can be discreetly evaluated and managed. By tackling the problem in this manner, the many unknowns associated with trainee in an accelerated structural living environment are dealt with more easily. This article outlines how the systems approach can be used to design and test a technical training program for trainees with low levels of education and/or mechanical experience.

The basic system suggested for the design testing and subsequent re-evaluation and a training program is shown in **Figure 1.** The initial paragraphs briefly describe each separate step. Later in the article a method of rearranging this sequence of basic steps is discussed which makes the system more convenient to use under varying conditions.

The purpose of Step One (Define Training Needs) is to identify the equipment and/or processes to be introduced which require the support of a training program. It is assumed that the requirement to mechanize selected agricultural production operations has been established and action taken to obtain modern agricultural power units and im-

plements. The intelligent use and care of a medium size diesel powered four-wheel farm tractor is the objective of the training program descrbed in this article. Although the tractor is used as an example throughout this paper, the reader should bear in mind that the systems approach has a much broader application, and may be used to design any training program which has the objective of teaching new skills and attitudes to peple.

In Step Two (Formulate Objectives) the objectives of the training program and basic associated tasks are stated in precise terms. It was determined that eight objectives must be met to adequately train a tractor operator. These are stated in terms of what the trainee is expected to know or to be able to do after the completion of training. Note that the following objectives have been ranked in ascending order according to their relative complexity and difficulty. This is the order in which they appear in the instructional program.

1. Become acquainted with the tractor.
2. Prepare the tractor for work (prestarting checks).
3. Start and warm up the engine.
4. Operate and maneuver the tractor.
5. Operate the tractor in a safe manner.
6. Manage the tractor-use good judgement.
7. Use the tractor as a multi--power source.
8. Use the tractor in productive farm operations.

Identifying the multiplicity of tasks of related to each of these objectives is a more complex undertaking. The planner will find many of these tasks in the equipment operators manual. The remainder are selected based upon the planners knowlege of the equipment, the task to be performed, the operating conditions and his experience as a teacher.

To illustrate the nature of these learning tasks, those identified with the first two objectives are listed below. These were placed in a logical order and taught in the following sequence.

Objective No. 1— Become acquainted with the tractor.

a. Orientation
b. Tractor nomenclature
c. Principles of engine care
d. Internal combustion engine functioning
e. Principles of tractor operation
f. Preliminary driving
g. Power transmission
h. Common hand tools

Objective No. 2 — Prepare the tractor for work (prestarting checks).

a. Need for care and maintenance
b. Daily maintenance services (10-hour services)
c. Explanation of the fuel system
d. Checking and adding fuel
e. Servicing the sediment bowls
f. Explanation of the air system
g. Servicing the air precleaner
h. Servicing the oil bath air cleaner
i. Servicing the dry filter type air cleaner
j. Explanation of the engine lubricating system
k. Servicing the crankcase oil
l. Greasing the tractor
m. Explanation of the cooling system
n. Servicing the cooling system
o. Checking tires and wheels
p. The 50-hour maintenance services
q. Servcing the battery and electrical system
r. Keeping maintenance records

The reader can visualize how the objectives and tasks listed adove form the skeleton of the training program. The steps which follow add flesh to this skeleton until the program appears in its final form.

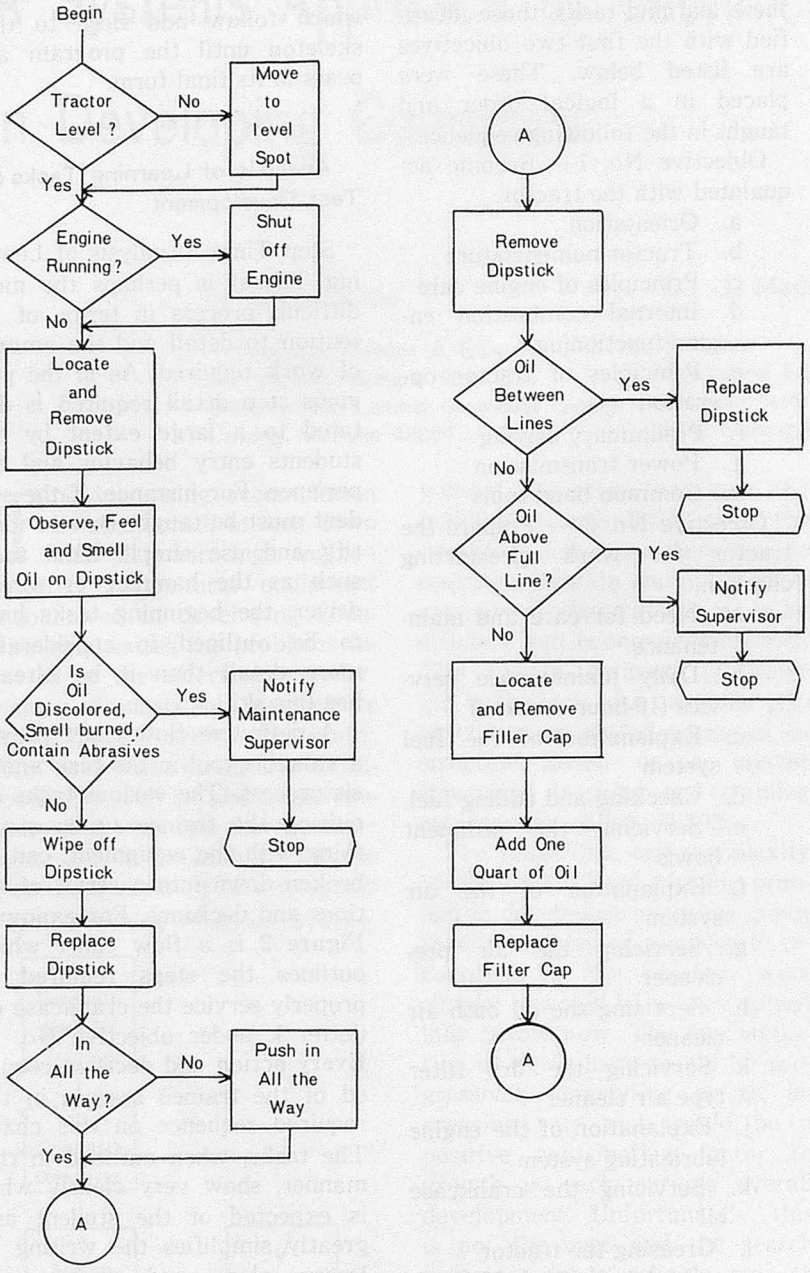
Analysis of Learning Tasks & Test Development

Step Three (Analysis of Learning Tasks) is perhaps the most difficult process in terms of attention to detail and the amount of work required. As in the previous step detail required is dictated to a large extent by the students entry behavior and experience. For instance, if the student must be taught how to identify and use simple hand tools such as the hammer or screwdriver, the beginning tasks have to be outlined in considerably more detail than if he already has this skill.

A definitive flow chart proved a valuable tool in the task analysis process. The various tasks requiring the trainee to do something with the equipment, can be broken down into a series of actions and decisions. For example, **Figure 2** is a flow chart which outlines the steps required to properly service the crankcase oil (letter k under objective No. 2). **Every** action and decision required of the trainee assears in the required sequence on this chart. The tasks, when outlined in this manner, show very clearly what is expected of the student and greatly simplifies the writing of lesson plans and preformance tests. The flow chart also insures that no important step or attitude is omitted from the training program.

Step Four (Test Development) is based directly on the training objectives outlined in Step Two and should be prepared concurrently. The planner prepares practical performance tests and other evaluating instruments which will be administerred before, during and after the instruc-

Fig. 2 Flow Chart···Servicing the Crankcase Oil



tional period. The flow chart developed in the task analysis step greatly simplifies this procedure. Test questions, performance criteria and examination procedures can be extracted directly from the flow chart and normally in the same sequence. A sample performance grading form on servicing the carnkcase oil, **Figure 3,** illustrates this point. The number of penalty points assigned reflects the relative importance of each response. Practical testing requiring the trainee to apply knowledge and skill shows clearly whether or not the student has met the course objectives. This type of evaluation is also less influenced by literacy levels. Written tests may be used to measure some training objectives but they must be designed to give an honest evaluation of the trainee's knowledge, skills and attitude as opposed to his ability to read and write.

Design Program & Implementation and Testing

The Instructional Program Design is carried out in step five. Here, as in the previous step, the flow chart provides the guidelines for the system design. Most of the lesson plan subjects as well as the sequence of instruction can be extracted directly from the flow charts. Perhaps the most important decision to be made during this step is the selection of a training method or methods. The student's entry behavior level is the major governing factor in making this determination. **Figure 4.** correlates the student's background knowledge and experience with the most suitable training method. Note that demonstrations and practical exercises are considered essential for training students with little or no technical background. After the methods of instruction have been selected, lesson plans and training aids are prepared to support the instruction.

The two steps just described, test development and program design, require one additional comment before proceeding. Each of these steps must be dealt with separately but concurrently as shown on the diagram in **Figure 1.** The natural tendency is to develop the test after the instructional program has been assembled or vice verse. If the test is developed after the lesson plans have been prepared, the possibility of neglecting the learning tasks developed in Step Three is very real. If this occurs there is little hope of measuring the student's ability to perform these tasks. On the other hand, if the test is prepared first the tendency would be to teach only the test without giving the trainee the ability to think through and apply the knowledge gained. There is certainly no harm in "teaching the test" if it truly represents what the trainee must be able to do on the job in real life.

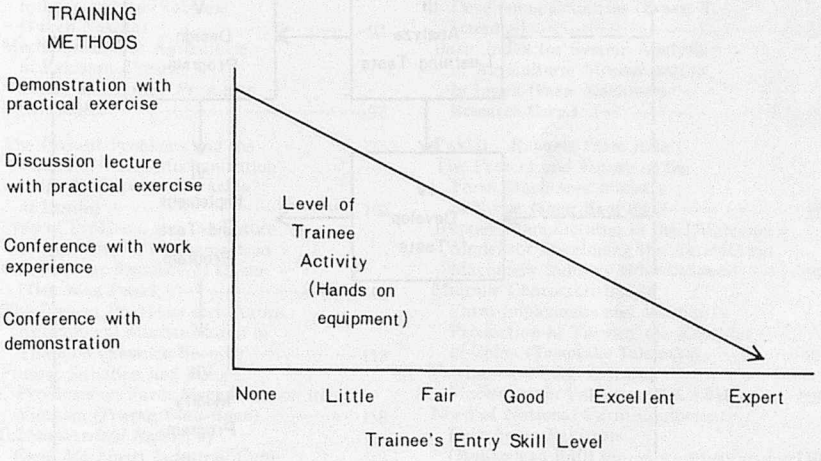
Implementation and Testing, Step 6, should be subdivided into two parts, a dry run students and a carefully controlled point test with actual student participation. A dry run is preferably of short duration covering only the highlights of each period of instruction. The training staff realistically plays the role of the student to detect flaws which were not apparent during the planning phase. Inadequate time allocated to subjects and unavailability and poor serviceability of training aids and equipment are examples of the types of deficiencies normally detected. Corrections can usually be made before students enter the program. This allows the instructor to concentrate on teaching and managing the instructional process rather than being forced to deal with these limitations and annoyances. Finally, the complete instructional program is presented to a group of students under actual training conditions. Tests given periodically throughout the teaching program and at the end determine how well the students were able to achieve the program's objectives. Throughout the instructional process, the teaching staff should note areas requiring improvement for future classes. This is best done by daily preparing a written evaluation with specific suggestions for change.

Fig.3: Sample of a Partial Performance Test for Tractor Operation "Servicing the Crankcase Oil"

	Student Response	Times Noted	Penalty Factor	Total Penalty
1.	Failed to check oil level	———	50	———
2.	Failed to move tractor to level spot	———	5	———
3.	Failed to shut off engine	———	50	———
4.	Failed to evaluate oil condition	———	5	———
5.	Failed to fully seat dipstick	———	5	———
6.	Did not hold dipstick horizontally after removal	———	10	———
7.	Read level incorrectly	———	10	———
8.	Failed to add oil when required	———	50	———
9.	Added too much oil	———	50	———
10.	Excess time beyond 600 sec.	——— sec × 1/4		
			Grand Total Penalty Points	———

In this example, if the student received 50 or more penalty points he failed to meet the objectives of this program with respect to this task only. A significant number of student failures would require a revision of the teaching program as outlined under step seven.

Fig. 4 Training Method vs. Trainee's Entry Skill Level



"Preliminary Date" for slight Adjustment

After the training course has been completed, an analysis is made using the observations made of the faculty to provide the data to modify and revise the program as needed. As indicated by the feedback channel in **Figure 1.** it may be necessary to change both the instructional and testing procedure. In some cases the course objetives and learning tasks may have to be re-evaluated if a serious deficiency becomes apparent. Extensive revisions could require a great deal of time and effort. Therefore, it is wise not to schedule succeeding classes too close together, especially when the program is just beginning Generally a course of instruction will have to be taught at least three to four times before it is sufficiently refined to do an outstanding job.

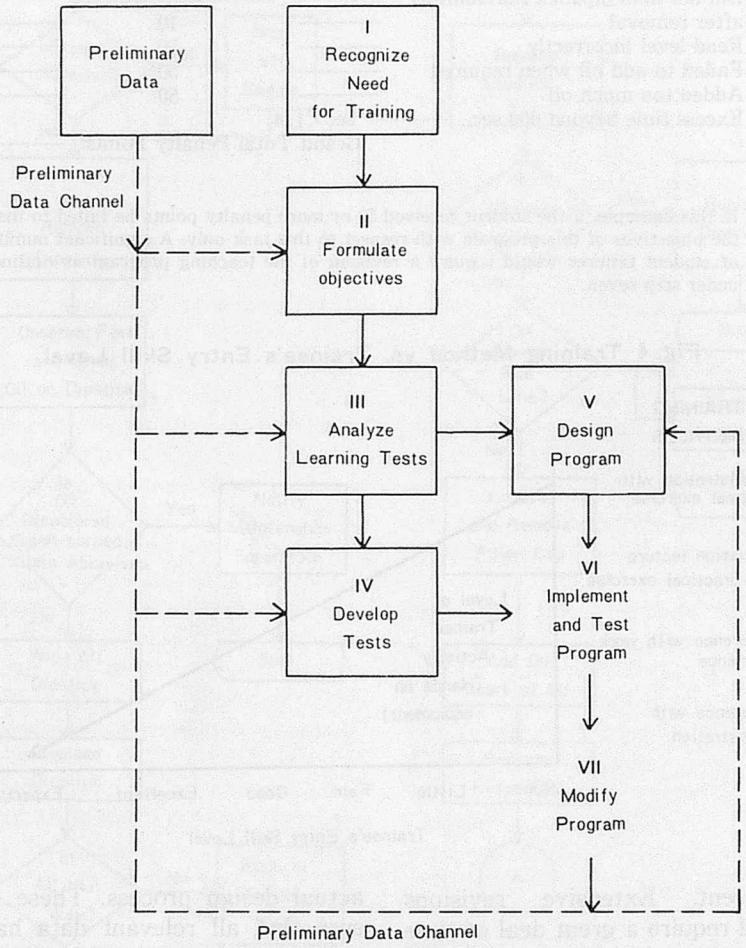
The system just described adequately meets the requirements of the program once it is in operation but it requires slight adjustments for application in the design phase. Initially, all decisions are made without the benefit of a functional feedback channel. Therefore, some preliminary steps must be taken prior to the actual design process. These ensure that all relevant data have been considered. This "Preliminary data" is obtained by carefully analyzing the prespective trainee, his environment and the equipment upon which the instruction will be conducted. The following questions, when answered in detail, provide the required "preliminary data" :

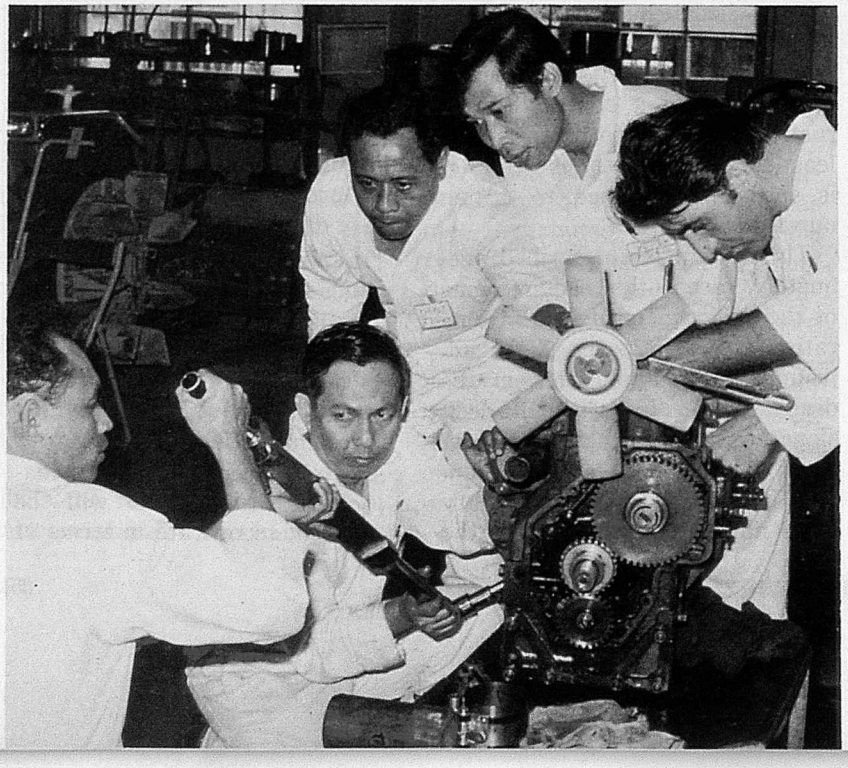
1. What are the characteristics of the trainee in terms of attitudes, skills and knowledge?
2. How are trainees to be chosen and who or what controls their selection?
3. How complex is the machine the trainee will be taught to operate in terms of

its operation, knowledge of the machine's functions, required manipulative skills and conditional attitudes?

4. What assumptions must be made which help to define the real training environment? The size of the facility, shop space, lighting, power, etc. are all essential considerations.
5. what is the trainee's environment and how will it enhance or detract from the useful application of his skills after graduation?
6. What are the opportunities for gainful employment after graduation and what type of follow-up, if any will be made by the training institution?

Fig. 5 Teaching Program System ··· the Design Phase





All of these questions, when answered in detail, protail, provide the "preliminary data" which will be used to initiate the design phase of the program. Note in **Figure 5** how "preliminary data channel" is used in lieu of the "feedback channel" during this phase of the program. One the first group of students have completed training, the preliminary data will need to be revised as the system generates its own feedback.

The systems engineering approach to technical training discussed in this article promises to be a valuable tool for the planner, educator, instructor, evaluator, manufacturer and employer. This step-by-step structured learning and training environment (SLATE) technique has the obvious advantage of unravelling and solving a complicated problem of knowledge and skill transfer. Very important is the fact that a large staff is not required to implement this systematic training plan. In developing countries, where qualified people are in short supply, this multiplier factor cannot be overlooked. The results of a pilot program at MSU and subsequent training experience prove conclusively that systems engineering can play important role in future mechanization efforts. How well training succeeds, however, is very dependent upon the quality of the training staff. Just as the best machine is no better than its operator, the best training program is no more effective than its instructional staff. ■ ■

BACK NUMBERS

AGRICULTURAL MECHANIZATION IN SOUTH EAST ASIA (Spring, 1971)

AGRICULTURAL MECHANIZATION IN ASIA (Autumn,1971)

〈How to Grow Agricultural Machinery Industry 〔1〕 *Production Problems* 〉

The Present Status and Problems of Marketing Farm Machinery in Korea

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Present Status of Korean Farming

Even though agriculture is still the most important industry in Korea, farmers still use manual and animal power to cultivate their small area of farm land. On the other hand, the government recently has successfully completed the First and the Second Five Year Economic Flan and the policy of industrialization; accordingly various industries have developed rapidly.

Therefore, the developing industries have brought about a rural migration to the urban centers of economic opportunity, the result of which has been a shortage of farm workers. As **Table 1** shows, the actual farm population has decreased from 1967. **(Table 1,2.)**

In recent years, the annual urban migration of rural youth (14-59 years old) was 2.6% as **Table 3** shows.

Therefore we firmly feel the neccessity of farm mechanization in light of the serious proportions of rural urban migration.

Table 1. Changes of Cultivating Area Unit: ha

Year	Cultivating Area			Farm household	Farm population	Cultivating area per houshold
	Total	Paddy field	Upland field			
1963	2,096,974.5	1,238,338.0	858,636.5	2,415,593	15,266,325	8.68
1964	2,189,106.1	1,271,649.6	917,456.5	2,450,308	15,553,019	8.98
1965	2,275,189.5	1,296,914.3	978,275.2	2,506,899	15,811,575	9.07
1966	2,312,187.0	1,297,838.0	1,014,349.0	2,540,274	15,780,706	9.10
1967	2,331,176.8	1,301,272.4	1,029,904.4	2,586,864	16,078,086	9.01
1968	2,338,088.6	1,300,061.8	1,038,026.8	2,578,526	15,907,664	9.07
1969	2,330,418.8	1,293,709.1	1,036,709.7	2,546,244	15,588,912	9.15
1970	2,131,527.5	1,205,023.1	926,504.4	2,487,646	14,431,914	8.57

Source: The Ministry of Agriculture & Forestry

Table 2. Wages of Farm Labour

Year	1962	1963	1964	1965	1966	1967	1968	1969	1970
Wages (won/day)	115	143	199	221	256	307	381	463	579
Index	51. 5	65.2	88.5	100.0	116.9	142.7	178.3	216.4	269.4

Source: The National Agricultural Cooperatives Federation

The Present Status of Farm Machinery Production in Korea.

During the Korean War (1950--1952) most of the farm machinery factories were damaged, but by 1968, there grew to be 236 factories, of which 77 were members of the Association of Farm Machinery.

In 1971, the association membership was reduced to 47, as the inefficient factories were closed down. The factory distribution status by province ownership, capital status, and number of employees are shown in **Tables 4,5,and 6.**

The small scale factories which have less than 100 employees and less than 10,000,000

Table 3. Decreasing Status of Farm Population
Unit: 1,000 person

Age / Year	Younger than14	14-59	Older than60	Total
1968	6,368	8,434	1,106	15,908
1969	6,262	8,218	1,109	15,589
Rate	01.7	02.6	0.3	02.0

Source: The Statistic Year Book, 1970 (The Ministry of Agriculture & Forestry)

won capital represents 68% of the total farm machinery factories in Korea. The large scale factories vhich has more than 200 employees supplies farm machinery through out the country. They also manufacture the professional products. For example the factory may specialize in the production of a certain engine for another company, or the large scale factory might produce agricultural machinery for governmental supply under the government's agricultural policy.

Such a factory that is dependent on the government has managed to exist because of the particular the government policy. However, if the policy were suspended or if planned funds are not received, there is the possibility that the factory will fail. The Korean farm is watching the trial stage of the farm machinery program.

Most of the factories in Korea are owned by an individual and most of the joint stock companies are owned by a family or by relatives. Thirty four perent of the 47 factories which are members of the Farm Machinery Association are joint-stock companies and 66% are individually owned companies.

In technical managment, some of the factories are cooperating with more advanced foreign companies in order to learn their developed techniques of manufacturing. Consequently, they are gradually raising their rate of domestic production. The items which are authorized by the Ecoonomic Planning Board under the policy of importation of foreign capital are shown in **Table 7.**

Reviewing the status of the farm machinery field since 1945 it seems it was difficult to produce new farm machinery because of the difficulty of purchasing raw materials, the low domestic demand, and the crudeness of production techniques. Only small farm tools such as the shovel, sickle and weeding hoe were produced at that time. From 1960 the government began to support the farm mechanization policy. As was said, the increasing production of farm machinery is partly due to the support of the governmental subsidy.

Consequently, power machines such as the power tiller, power sprayer, automatic thresher (etc.) are produced and supplied in Korea now. And furthermore, the government is planing to manufacture the small size tractor in the future. At the present, rapid improvement in quality and quantity of farm machinery is expected in Korea.

Table 4. Status of Capital Funds of Agricultural Machinery Manufacturers (Feb. 1971)

Unit: 1,000 won

Capital / Province	Below 5,000	5,001-10,000	10,001-50,000	50,001-100,000	Over 100,000	Total
Seoul		5	1	1	2	9
Pusan	1	2	1	1		5
Kyoung-gi	5	1				6
Kang-won						—
Choong-buk	2					2
Choong-nam	2			1		3
Chun-buk					1	2
Chun-nam	1	1		1		3
Kyoung-buk	3	2	4	1		10
Kyoung-nam		1		1	2	4
Che-ju		2	1			3
Total	14	14	8	6	5	47
Percentage	29.79	29.79	17.02	12.76	10.64	100

Source: The Association of Farm Machinery

Table 5. Factory Status by Number of Employees (Feb. 1971)

Unit: Person

Province	Below 50	51-100	101 150	151-200	201-300	Over 301	Total	Rate (%)
Seoul	4	1		1	1	2	9	19.15
Pusan	2		3				5	10.64
Kyoung-gi	5			1			6	12.76
Kang-won							—	0
Chong-buk	2						2	4.26
Chong-nam	2				1		3	6.38
Chun-buk		1				1	2	4.26
Chun-nam	1	1			1		3	6.38
Kyoung-buk	5	4			1		10	21.27
Kyoung-nam	1	1				2	4	8.52
Che-ju	1	1	1				3	6.38
Total	23	9	4	2	4	5	47	100.00
Percentage	48.91	19.15	8.52	4.26	8.52	10.64	100	

Source: The Association of Farm Machinery

Table 6. Factory Status by Form of Ownership

Classification	Number of factories	Percentage
Joint-stock company	16	34.05
Individual company	31	65.95
Total	47	100.00

Source: The Association of Farm Machinery

Table 7. Trend of Technical Cooperation with Foreign Companies

Domestic company	Foreign company	Item
Dae-Dong Co. Ltd.	Missubishi and Ford Co. Ltd.	Power tiller tractor
Dong-Yang Industrial Co., Ltd.	Iseki Co. Ltd.	Power tiller
Jin-Il Industrial Co., Ltd.	Yan-ma Co. Ltd.	Power sprayer

Source: Farm Machinery year Book (The Ministry of Agriculture of Forestry)

Table 8. Output of Important Farm Machinery in Korea

Year	1963	1964	1965	1966	1967	1968	1969	1970
Engine	5,083	10,620	10,120	3,860	5,820	8,200	7,600	11,933
Pump	2,251	14,301	20,500	3,825	6,710	9,300	8,300	13,699
Power-tiller	305	266	340	677	2,616	5,371	580	3,717
Plough	86,400	80,400	72,285	68,327	65,500	68,000	40,000	65,000
Power mist sprayer	560	2,030	1,645	997	1,982	2,026	11,990	14,010
Manual sprayer	38,366	58,440	45,000	49,500	67,000	75,000	46,000	73,093
Manual duster	5,500	7,500	980	500	350	300	300	-
High pressure sprayer	8,600	300	2,500	4,500	5,000	11,000	30,000	34,531
Power thresher	738	918	1,430	1,470	1,570	1,800	2,000	8,200
Manual thresher	30,103	22,861	32,500	30,700	32,000	29,500	17,000	4,238
Feed crusher	3,197	342	939	728	500	550	600	2,475
Sweet potato slicing machine	902	13,173	5,700	10,300	3,000	2,200	9,000	1,472
Fan	9,421	16,000	20,000	28,000	29,000	15,000	5,200	4,377
Straw rope machine	7,091	7,120	9,400	8,770	10,000	11,000	10,000	5,527
Straw bag machine	2,000	1,710	815	850	500	300	200	810
Huller	1,082	1,768	960	540	640	900	2,000	1,299
Rice polisher	1,200	800	900	500	900	1,000	3,100	974
Barley polisher	1,000	538	723	500	1,000	1,000	3,500	1,093
Miller	1,591	1,931	2,600	2,100	2,800	2,200	2,700	520
Hoe	33,700	64,712	85,000	123,700	125,000	130,000	140,000	67,450
Weeder	38,741	31,000	30,000	25,000	16,000	9,000	9,000	29,000
Rake	11,000	52,100	39,832	40,755	35,000	40,000	35,000	13,300
Shovel	1,008,977	2,508,481	1,352,300	1,450,000	1,350,000	1,660,000	340,000	493,648
Sickle	853,766	1,355,775	710,000	693,700	700,000	860,000	900,000	620,100
Fork	89,600	126,350	72,868	105,000	106,000	110,000	100,000	38,000
Hoe	2,000	4,000	5,000	80,000	50,000	20,000	50,000	35,500
Brick machine	538	117	50	90	90	500	300	30

Source: The Association of Farm Machinery

Supply of Farm Machinery

Before Word War II(1945), about ten kinds of developed farm tools such as plough, shovel, sickle, (etc.) were selected and supplied through the agricultural association. These tools were purchased jointly by the support of governmental, provincial or other subsidies and the agricultural extension agents taught the method their use in training courses. After while, the farm machinery factories were established and supply method of farm machinery was systemized. Therefore all kinds of farm machinery were sold at the general farm tool shop besides the governmental supply. The quantity and quality of supplying farm machinery improved. However, the supply of farm tools was rationed during World War II, as the materials necessary for manufacturing were controlled.

The depression of production and supply continued. To make matters worse, the communist aggression dealt a severe blow to the farm machinery industry. The depressive status continued until 1968.

At a beginning point from 1958, the farm machinery supply plan was established, and in the target year 1962, 3,269 threshers, 9,189 pumps, 2,252 engines, and 11,450 improved ploughs were supplied. During this period, the administrative agency established the supply plan, and the loans required for purchasing farm machinery were borrowed though the agricultural bank. Most of the farm machinery was supplied through the ordinary farm tool shop in that period. The kinds of farm machinery were all manual. There was no remarkable development. With the establishment of the National Agricultural Cooperatives Federation in 1962, the regular supply system began. And on the other side, the land Improvement Union helped in purchasing and supplying farm machinery. Thus the supply was activated and the kind of power source changed from manual to power. At the present, there is a two route supply system: the first one, the small farm machinery is supplied from the factory though the farm tool shop to the consumer and the second one, power machinery subsidized by the government is supplied through the National Agricultural Cooperatives Federation to the farmer.

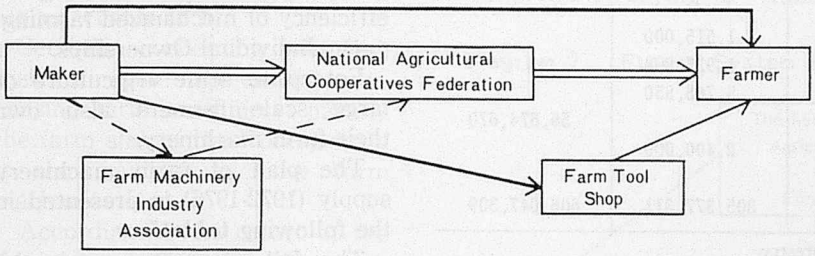
The Farm Machinery Industies Association is also taking charge of the assignment of material, the merchandising of farm machinery sales, and the contract purchasing of farm machinery. The leading supplier of the farm machinery,

Table 9. The N.A.C.F. Farm Machinery Purchases Unit:1,000 won

Year	1962	1963	1964	1965	1966	1967	1968
Amount	206,851	101,595	131,216	208,504	104,793	770,330	2,008,350
rate(%)	100	49	64	100	51	375	980

Source: The National Agricultural Cooperatives Federation

Diagram 1. Supplying System of Farm Machinery



the N.A.C.F., has been emphasizing the supply of the power sprayer and the power sprayer and the manual sprayer as **Table 9** shows.

The Farm machinery supply is shown in following diagram.

Most of the subsidized items, (farming tractor, power tiller, plough, power mist sprayer, manual sprayer, manual duster, and rear car) were supplied by the N.A.C.F. **(Table 10,11.)**

But the subsidy policy a part of the farm mechanization policy; The subsidy program for the power tiller in 1961 was the first attempt in subsidizing the sales of farm machinery and there after, other items were subsidized. **(Table 12.)**

The reason why the price of farm machinery has been relatively stable is that the government has given aid for production. **(Table 13.)**

On the other hand, even though the government has established a policy for the domestic production of farm machinery, a large amount of foreign farm machinery has been imported, because of the crudeness of domestic manufacturing techniques and the lack of capital. The number of imported farm machinery is shown in **Table 14.**

Table 10. Farm Machinery Supplied through the N.A.C.F.

	Quantity	Amount	Kind	Quantity	Amount
		(won)			(won)
Power tiller	2,288	822,273	Sickle	41,855	3,834
Power sprayer	7,000	295,764	Fork	2,148	450
Knapsack sprayer	24,205	93,556	Rake	260	41
Feed crusher	-	-	Hoe	977	130
High pressure sprayer	40,790	274,549	Sweet potato slicing machine	758	2,261
Weeder	4,971	2,365	Improved plough	1,998	4,778
Thresher	1,325	13,648	Hoe	3,897	492
Straw bag machine	-	-	Manual duster	14,361	603,145
Fan	209	621	Corn Husker	-	-
Shovel	9,653	2,141	Others	-	97,998

Source: The National Agricultural Cooperatives Federation

Table 11. Subsidy Classification of Farm Machinery Unit: 1,000 won

year	Price	Subsidies			
		Governmental subsidy	Local agency subsidy	Loan	Farmer's payment
1961	6,000,000	3,600,000			2,400,000
1962	158,217,120	91,395,446			66,821,674
1963	183,761,956	103,863,917		7,737,300	72,160,739
1964	199,064,755	47,638,377			151,426,378
1965	907,047,832	417,303,877			489,743,955
1966	258,142,292	96,806,899	4,201,740		157,133,653
1967	768,442,088	305,377,311	6,122,148	306,995,000	149,947,629
1968	2,193,309,125	835,687,077	39,315,205	558,734,831	759,572,012
1969	2,067,994,120	1,540,902,242	563,350	515,158,000	11,370,528
1970	3,622,207,400	1,429,993,400		1,428,958,600	763,255,400
Total	10,364,186,688	4,872,568,546	50,202,443	2,817,583,731	2,623,831,968

Source : The Report of Farm Mechanization, 1971.

The Future Plan for the Supply and Utilization of Farm Machinery

The Korean governmet has established a plan for the utilization of farm machinery.

1) The Co-operative Cultivation Association directed by farmers.

The government has planned to help establish about a thousand cooperative association in 1972. The cooperative association of farmers (such as rice cultivating community) is organized by the farmers, and will operate farm machinery which they alraeady possess, which they will purchase with the help of government loan or which they will buy with their own money.

2) Joint Utilization through Agricultural Organizations (The N.A.C.F., or The Iand Improvement Union).

The operating method of The National Agricultural Cooperatives Federation and the Land Improvement Union is to rent to the farmer the farm machineries which they already have purchased or these that will be purchased.

3) The Model Farm Mechanization District.

The Office of Rural Development and the National Agricultural Cooperatives Federation and the Agricultural Development

Table 12. Subsidies for Farm Machinery Unit: won

Item	1966	1967	1968
Tractor		11,798,623	22,193,629
Power tiller	32,000,000	213,646,904	440,585,010
Power mist duster	17,447,500	53,748,000	86,604,000
High pressure sprayer		14,571,900	
Power thresher	2,870,350	1,515,000	
Dryer(Farming)		1,927,998	
Seed seperator	9,408,000	5,768,850	
Perforator trencher			56,674,670
Rear car	31,589,449	2,400,000	
Potato crusher	3,491,600		
Total	91,806,899	305,377,311	606,047,309

Source : The Ministry of Agriculture & Forestry

Table 13. Trend of Farm Machinery Price Index

Classification	1963	1964	1965	1966	1967	1968	1969	1970
Selling price	76.7	96.0	100.0	106.1	121.5	142.3	162.4	191.4
Purchasing Price	68.1	86.5	100.0	112.2	127.0	152.2	167.7	193.1
Wage(in farm)	67.6	91.0	100.0	114.3	133.8	163.4	200.0	248.6
Farm machinery price	69.7	82.4	100.0	112.4	121.3	135.4	145.4	168.3

Source: The National Agricultural Cooperatives Federation

Table 14. Status of Imported Farm Machinery Unit Quantity: ton Amount: $ 1,000

Year	Farm machinery		Harvester		Tractor		Total	
	Quantity	Amount	Quantity	Amount	Quantity	Amount	Quantity	Amount
1965	40.1	60.9	10.2	17.0	30.9	22.0	81.2	99.9
1966	24.4	46.6	14.8	15.9	908.1	915.1	947.3	977.6
1967	367.7	594.4	15.9	48.2	1.7	3.8	385.3	646.4
1968	1,186.3	2,433,6	32.1	53.6	312.8	346.8	1,531.2	2,834.0
1969	293.1	273.9	21.1	37.8	536.1	1,559.6	850.3	1,871.3
1970	677.9	1,406,5	141.5	253.8	153.0	234.3	972.4	1,894.6

Source: The Ministry of Agricultural & Forestry.

Table 15. The Plan of Farm Machinery Supply Unit:1,000,000 won

Machinery \ Year	Function	Plan (1972—1976) Unit price	Quantity	Price	Subsidy	Loan	Farmers payment
		(won)					
Power tiller	Main dody		38,740				
	Plough		38,740				
	Rotary	380,000	38,740	14,721.2		10,304.8	4,416.4
	Trailer		38,740				
	Seeder	100,000	1,940	194		97	97
	Cultivator	50,000	3,900	195		97.5	97.5
	Cutter	80,000	1,940	156		78	78
	Lime-spreader	20,000	1,940	38		19	19
	Thresher	90,000	26,800	2,412		1,206	1,206
Pump		80,000	22,995	1,840.8		1,840.8	
Sprayer		150,000	13,500	2,025		1,012.5	1,012.5
Mist sprayer		42,000	84,300	3,540.6	144.9	1,770.3	1,625.4
Total				25,122.6	144.9	16,425.9	8,551.8

Governmental Subsidy 16,569 (Governmental Loan 4,800, Collection 2,700, Budget 9,069)
Source: The Ministry of Agriculture & Forestry

Cooperation shall determine the model district. All procedures, ploughing, soil preparation, fertilizing, and transporting will be done by farm machinery. These model districts will play an important role in demonstrating the efficiency of mechanized farming.

4) Individual Ownerships.

Enterprise scale argiculture or large scale farmers also own their farm machinery.

The plan of farm machinery supply (1972-1976) is presented in the following **table15:**

The following diagram is the future supplying system of farm machinery.

The above diagram is the future plan to be put in effect from 1972. The N.A.C.F. will assume the financial responsibility. Farmers will apply for loans at the municipal or county N.A.C.F. branch and they will receive a coupon which they can bring to the consigment sal shop of the municipal or county unit which has been built by the farm machiney makers. They will receive the farm machinery within 20 days. The coupon will be sent to the markers and the farm machinery will be hand to the shop. And the N.A.C.F. will pay for the coupon when the makers bring the coupon. The Ministry of Agriculture & Forestry arranged to organize the Committes of Farm Machinery by the municipal or county office and this committee will select farm machinery which is needed by farmers. The services after purchasing (repair, operating and management) will be handled by the manufacturers.

Problems of Marketing of Farm Machinery in Korea

There are three main problems in marketing farm machinery in Korea: production, supply and demand. First from the view point of production, the industrial technique level is low and capital

is small. Therefore it is difficult to develop new suitable machines for Korean farming conditions at a low price. For example, comparing the price of Korean farm machinery and that of Japan, the Korean price is substantially higher. **(Table 16.)**

Second, concerning demand, there are some difficulties in purchasing farm machinery: namely the farm size of the Korean farm is too small to achieve farm mechanization.

According to the report of the Agricultural Economic Research Institute, the optimum farm size for various kinds of machinery was reported as 40.7ha for ploughing, harrowing, and transporting with a tractor and 4.1ha for the same work with the power tiller.

But the size of a Korean farm is very small: Far below the above mentioned level, 33% of Korean farms have less than 0.5ha and 65% of Korean farms have less than 1ha.

Third, not only the small size of Korean farms, but also the income level of korean farmers is too low to buy farm machinery.

Forth, because land rearrangement is not done, mechanization of Korean agriculture is slow. And fifth, as the supply system is complicated, the supply costs prohibit buying a small amounts of farm machinery.

Even though there would still be many smaller problems, if the above mentioned problems were solved, farm mechanization in Korea would be much improved. ■■

Diagram 2. Future System of Supplying Farm Machinery

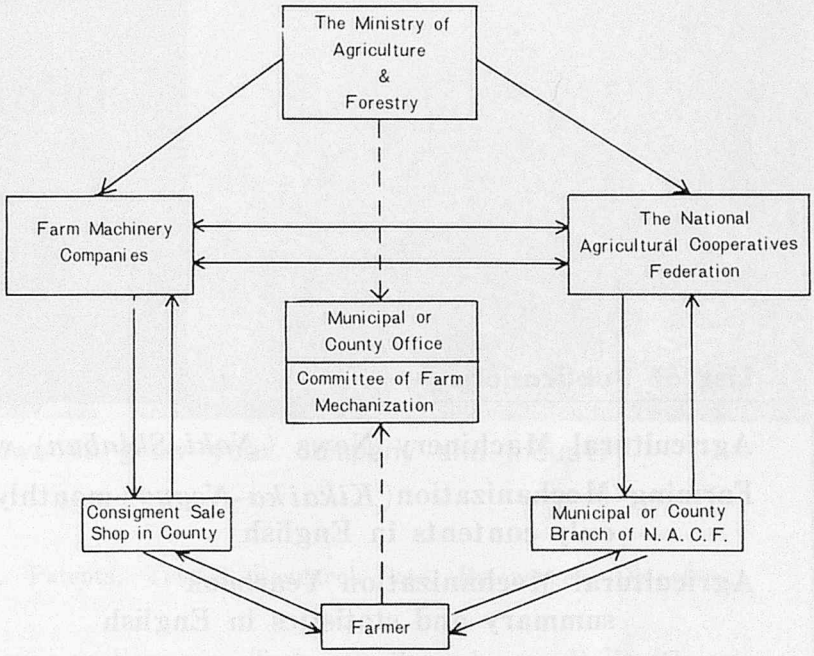


Table 16. Comparison of Price in Korean and in Japan

		1962	1963	1964	1965	1966	1967	1968	1969
price of power tiller (6 PS attachments included)	Korea	140,628	144,000	169,950	'206,000	219,090	236,612	241,547	241.547
	Japan	161,685	162.580	155,531	165,200	167,716	172,475	175,280	—
price of rice (80kg of polished rice	Korea	1,726	2,750	3,442	3,210	3,386	3,730	4,390	5,450
	Japan	6,625	7,294	8,369	9,036	10,057	11,008	11,720	—

Source: Prospects for Farm Mechanization in Korea (Agricultural Economic Research Institute, 1969)

CONTRIBUTORS WANTED

This publication, published twice a year, has an objective to promote Agricultural Mechanization in Asia as its title shows. Its readers consist of so many people in various fields such as farmers, dealers, manufacturers, researchers, government officials, students, etc. not only in Asia but also in the whole world. To enrich contents and to reflect many opinions, we want contributors for "**Agricultural Mechanization in Asia**". Articles, comments, investigations, reports and so on will be received with open arms. If you hope to contribute, contact us without delay.

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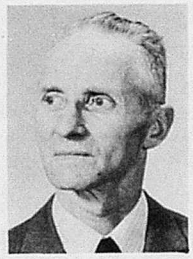
Mechanization as a Factor in Agricultural Change-Potentialities and Limits



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I. The Process of Agricultural Change in Developed Countries

Farm production has experienced three main phases: exploitation, balance of nutrients, increased fertility. In the third phase, now attained in highly industrialized, densely populated countries, a low percentage of the active population is farming. But this decreasing number produces food for an increasing population and surpluses, too-under given economic conditions and price and income levels. Four main currents can be discerned for this development process, which extended over about 150 years.

(a) *Production Techniques*

Bio-technical progress has improved seeds and animal breeds. Factory-made fertilizers and pesticides increased the yield of the improved varieties and thus yield per hectare, productivity of land. Feed concentrates raised the performance of animal husbandry. The larger harvests would never be harvested with traditional equipment and constant manpower. Mechanical-technical progress introduced equipment substituting human labour and draught animals. Thus, productivity of land was increased generally, not per hectare, since more human food was produced instead of animal energy. Tillage was accelerated and was executed more timely, fallow was dropped. More and higher harvests per time-unit were produced due to interaction of bio-and mechanical-technical progress. These two are not contradictory or mutually excluding, but interacting and interdependent.

(b) *Structure of The Farm*

The farms intensified production of primary produce and switched over to more animal produce. All other activities-processing, marketing, baking, production of implements— were transferred to outside agencies, be it commercial or cooperative. This division of labour was extended to the international level: animal feedstuff is imported for the so called soil-less production, petrol is imported for the tractors.

(c) *Socio-economic Changes*

Agrarian reforms of different types liberated the peasants from feudal bonds, deprived the smallholders of their plots and plunged them into the emerging industries. With the end of the feudal system unproductive payments were abolished and capital formation was promoted. The farming population began to decrease and warnings were released by eminent agricultural economists, lest further rural exodus might destroy the farming profession and the wealth of whole nations (Thaer, 1799). Industrialization and strong population growth started at about the same time. The peasant was increasingly drawn into the orbit of money and market economy. Exchange in kind and subsistence farming gave way for commercial farming even in the smaller units. Small farmers are winding up their holdings, the number of farms is decreasing. Land and capital is concentrated in fewer, but larger farms, though to a much smaller degree and at a lower pace than in the industrial sector.

The chain of causality of the partial processes and their quantitative contribution are not precisely defined, but the interaction of factors is established and ag-

reed:

Slow increase of farm output without industrialization.

No increase of farm output without industrial inputs substituting animals, men and soil.(*)

No increase of farm output without rural exodus.

The process took about 150 years to date and no end is foreseeable. Perhaps, humanity and particularly the farming population has to understand it as an endless chain reaction. The corollaries of this process are intentionally omitted here: human suffering, emigration, unemployment, slums of early capitalism in the large urban centres, social struggles for the recognition of the emerging proletariat.

(d) *Socio-psychological Change*

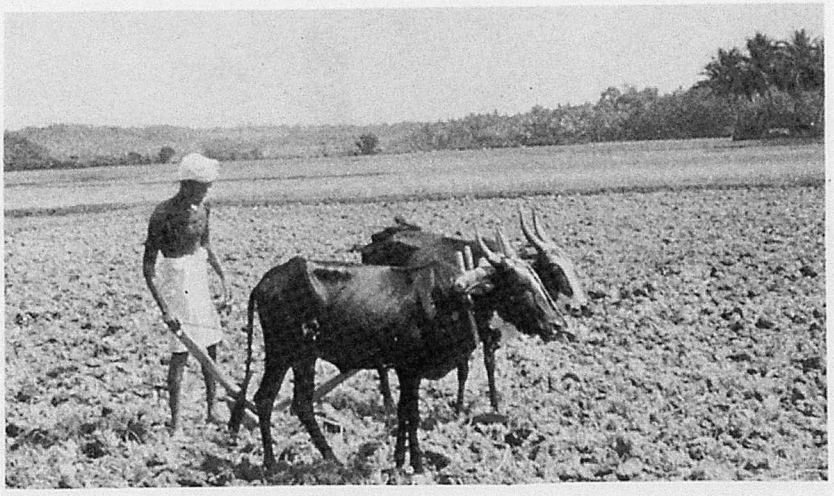
Unwittingly, not expressis verbis, even human thinking has been upset. No more complaints about rural exodus are put forward. Instead the desire is expressed for more social mobility of smallholders, farm workers and family labour. No more Malthusian theries-at least in the industrized countries; intead heavy efforts to reduce or contain production and to remove the surpluses. This radical change in mental reception has not come in a short-circuit or quickly, but with a long cultural lag. Human brain and behaviour adapts very slowly to social change, particularly when its pace is increasing. There was heavy opposition to re-thinking and attempts to turn the tide. This became particularly evident in economic and cultural recession and political crisis (Nazi-ideology of people without space, return to the land, settlement movements etc.). The process of understanding secular developments, of socio-cultural re-appraisal and finally of change of behaviour and attitude has known its ups and downs, its oscillations and its reactionary diversions.

2. The Starting Position in a Developing Country: India

The point of departure towards development is entirely different from industrialized nations and their present conditions, but not so different from those prevailing 150 years ago. The magnitude of the task in a country of 540 million people, though, seems overwhelming. The degree of industrialization is low, the population increases rapidly, open and hidden unemployment are endemic. There is no chance for mass-emigration; re-migration is flowing from many directions. But in a world of improved communications no islands of good old times are allowed. People themselves have new expectations and mesure their Governments by developmental achievements (Behrendt, 2). Given the physical needs of India's population, there is general agreement, that the country's resources in farming have to be developed and mobilized. The methods, however, are controversial. Specialist experts are proposing their field of work as the only or most suitable key to development: improved hand tools, inducement to thrift, better marketing, family planning, pumpsets for irrigation, tractors etc. The last-mentioned proposal for modernization arouses the strongest opposition.

Having poured a lot of development aid into India-according to the size ideas of their home countries, development advisers grow disappointed and begin to blame climate, innate laziness, lack of entrepreneurship and similar superficial reasons for the failures or insufficient success. The good harvests of 1967/68 and 1968/69 have relieved the economic distress somewhat. Complaints have receded and optimism about green revolution and economic break-through have taken over. Still nobody can say for sure, whether the good harvests were due to systematic human efforts and thus announce a steady upward trend, or to favorable weather and may be followed by bad years again. According to Indian statistics, crops have increased steadily, but slowly during the last 20 years, but at just about the same rate as population growth. In 1967/68, though, increase of farm production passed that of population considerably.

Laudable efforts are made to increase the inputs of seeds, fertilizers, water and this author accepts their basic importance. Foreign experts and advisers and a part of Indian economists oppose any mechanical inputs and warn against the adverse effects



Dry land is "Ploughed" with a tiny wooden stick, drwan by a pair of zebu-cows, the soil is opened, not turned. Man and animal would be too weak for real Ploughing, turning the soil by an iron plough.

of farm mechanization. Soil erosion, slaughter of bullocks, deficit of farmyard manure, decrease in milk production, unemployment are said to threaten the roots of India's bullock economy. The author, on the other hand, puts forward the thesis that mechanization can become one of the factors of technical, social, production and economic progress in stagnating Indian farming. Mechanical equipment-pumpsets, tractors, threshers, winnowers, rice-mills-is not seen as alternative to bio-technical progress, but as complementary and as one precondition for its full impact.

3. Benefits and Disadvantages of Mechanization

The author has discussed elsewhere(**) benefits and disadvantages of introducing labour-substituting machinery. Thus, the points shall be summarized here only without further evidence. Mechanization of the most labour-demanding, regularly operations would have the following main effects.

a. Relieve people and animals,

b. Speeding up and better timing of field operations. Thus, higher inputs of water and fertilizers and better soil conservation are called for,

c. Better tillage,

d. Decrease of fallow, increase of land reclamation,

e. Removal of draught animals becomes feasible. The remaining lot can be fed more adequately and produce more milk and meat. A more rational approach towards the taboo of the holy cow is promoted. This taboo was hitherto strengthened by the bullock economy,

f. Chance of social uplift for technically skilled farm labourers,

g. New tie between the cultivator and the money economy.

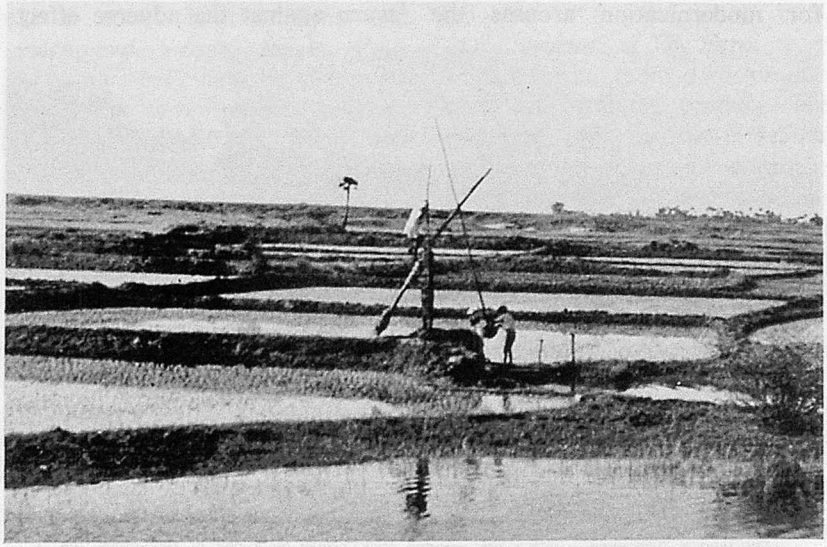
The principal disadvantages and problems are

a. The design is not adapted to tropical conditions (climate, humidity, paddy fields, poor skill). The design has to be tropicalized.

b. Drivers and mechanics lack training and experience. Service and repair facilities are slowly built up. The danger of breakdowncompelsthecultivatorstomaintain their draught animals. Training-cum-service-centres are necessary.

c. Small size of plots and of holdings makes private individual ownership of pumpsets and tractors (even power-tillers) unattainable for the vast majority of cultivators. Private commercial contractors might become tractor-lords, establishing an additional economic exploitation (besides landlord, moneylender and middleman). Tractor stations have therefore to be conceived as public service, be it in Government or cooperative form.(***)

d. Heavy investments are necessary, partly even in foreign currency for machine-tools, engineering know-how for tractors, fuel-refineries, storage etc.



Irrigation of paddy-fields by hand. Water is brought in a ditch and lifted in the higher paddy-field by a basket of palm-leafs and with the aid of a two-armed lever.

4. Size of the Task

For a demand analysis, on which to base production plans, three different points of departure are tried depending upon the role of the analysts and the economic situation:

a. The physical needs for mechanized farming, assuming rapid increase of food production as goal.

b. The physical possibilities of Indian industries and their foreseeable expansion assuming indigenous production or imports or a combination of production and imports.

c. The purchasing power of farmers.

The first approach reflects the hopes of agricultural and food planners, the second one the views of industrial and general economic planners, the third those of industrial managers. Thus, their projections will have to differ widely.

The assessment of tractor demand departing from the needs of farming calls for some assumptions regarding ownership and use of equipment. The lowest estimate according to the Egyptian pattern of individual holdings, but joint use of the village tractor would result in 1.07 million tractors. The Czechoslovak model of collective farming - 1 tractor per 41 ha - leads to a demand of 3.57 millions. The pattern of Western Germany - in-

dividual ownership and 1 tractor per 10.7 hagives a demand of 13.66 million units.

It is no wonder, how people reacted in Western Germany, then the author first tried to publish his very rough calculations in 1963/64. Official authorities denied the figures as shocking and dropped them from his book. Only in 1966 he could get them printed in a scientific journal. The author in 1966 (4) discussed the possibilities of producing large numbers of tractors and said:

> "It does not seem at all utopian, to increase production capacity during the fifth plan from 40,000 to 100,000 tractors annually. Even with such a performance in 1976, which might seem unrealistic to many observers in Western Europe, it would take 10 more years to produce one million tractors--the number in Western Germany, where only less than a tenth of the area sown in India is cultivated."

The second approach-that of general economists and the Planning Commission in New Delhi--starts from the output capacity of Indian industry, its desirable long-term development and accidental imports under given scarcity of foreign currency. But for them, these are sectoral needs only, therefore of lower priority. The financial ability of cultivators to purchase tractors is secondary to them and a variable, dependent upon production, market facilities, prices of farm products, terms of trade of agriculture versus industry etc. Thus, the estimates have changed and increased during time, reflecting the improving outlook for the wealthier layers of the farming sector. In 1958, the demand was assessed as 8,000 units per year. Ten years later, the projection was a production of 40,000 tractors by 1970/71. For the end of the postponed fourth plan-1973/-/74-80,000 fourwheel tractors were estimated. Balis (1) refers to an estimate of 90,000 units per annum for the same year. Another 60,000 small tractors of Japanese type are projected for this crucial year. -These figures, by the way, are not very distant from those calculated by the author some years earlier and quoted above. The Planning Commission has taken a cautiously dynamic approach, accounting for probable developments in industry and some prosperity in the upper layers of landholders.

The third approach is used by B.K.S. Jain (9). As an engineer in tractor production, he has to see the purchasing power of potential custmers as determining factor. He calculated a demand of 52,000 units in 1973/74. Excess production above secure demand might deteriorate the sellers' market prevailing now. Industrialists are not too eager to destroy their favorable position. Thus, the demand estimates by Jain ought to be taken as the agreed minimum need, for which buyers with ready money are secured.

Which of these projections and calculations will prove right or come closest to reality, is everybodys guess. But one thing can be taken for sure. Both Government planners and private producers accept the demand of agriculture. Mechanization has come to stay and to be followed up. Its pace is set not more by fears of unemployment, but by socio-economic facts: availability of raw materials, accessories, capacity of tractor and ancillary industries, income of cultivators, success of crops and harvests, size of holdings etc.

If mechanical equipment increases in agriculture, a number of industries are influenced and animated, first of all steel, tyres, petrol and diesel, furthermore electrical equipment etc. The agricultural sector will spend annually in 1973-74 for tractor attachment and implements Rs 300 millions, for spare parts and replacements 150 millions and for fuel and lubricants 1.9 milliards Rs. Thus, the farming sector itself becomes a mover of economic development, a partner of industries in the market, not to be neglected any more. Mechanization will show its effect of pushing ahead exchange between the sectors of economy, hitherto kept apart and of tying farming to the market economy.(****)

Some conclusions emerge clearly from the different demant projections.

a. Such numbers of tractors cannot be imported, they have to be produced in India. Import can only be marginal, for prototypes, as an incentive or a competition

Puddling of soaked paddy-field. With a wooden stick it is worked different times criss-cross. The buffaloes, used here, are not holy and may thus be slaughtered.

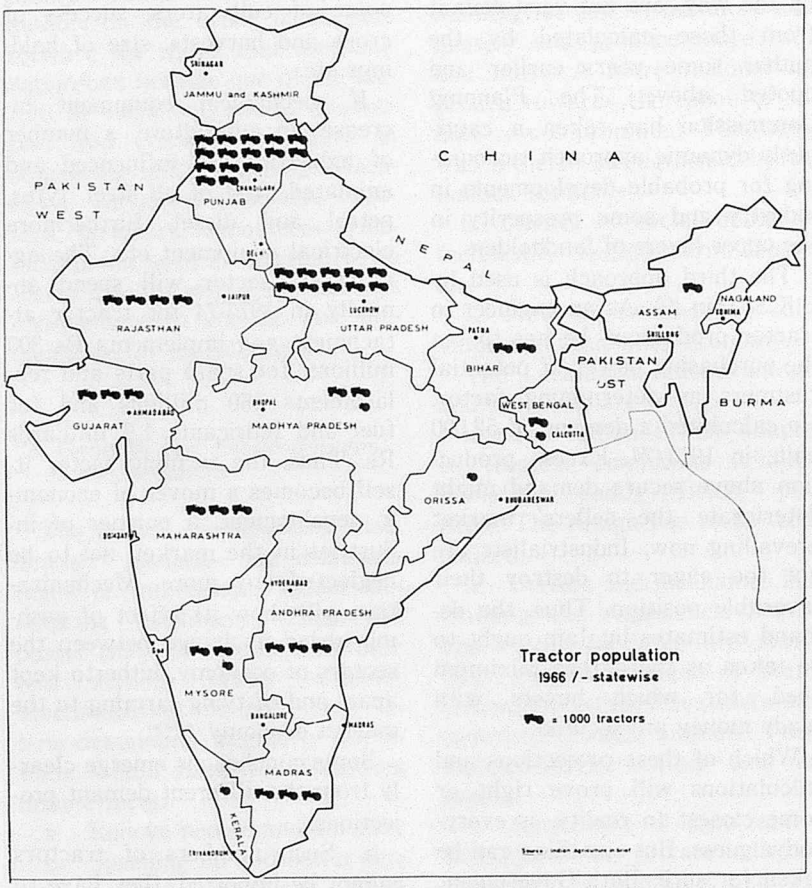
to industrialists too eager to exploit their oligopolist position.

b. Production programmes have to be coordinated and integrated to avoid bottlenecks and to assure steady growth.

c. While long-term mass importation would annihilate the positive effect on employment and engineering skill, such home production will have considerable linkage effects promoting a number of industries, creating new jobs and professions.

d. Equipment of the whole of Ihdian farming with tractors and tractor ploughs only will take a long time, not to talk about machinery and implements for the other operations. Even at a production pace of 100,000 units per year-as mentioned above, it would take ten years to reach the German number of tractors, which is cultivating the tenth of India's cultivated area. Thus, there is no prospect of full mechanization of all farming operations looming.

e. During a foreseeable future it would be economical nonsense to offer a tractor ownership, if the majority of the cultivators shall enjoy technical progress.



5. Size and Type of Tractors

Whether heavy four-wheel or small one-axle tractors are more suitable for India with its 50 million dwarf-holdings, is a question with technical, macro- and micro--economic, tenurial and other aspects.

Heavy tractors above 50 HP are only suitable for large-scale reclamation projects and heavy operations in large farms, be it State, private or cooperative ones. In medium-size farms and for daily light operations they have to be supplemented by tractors of smaller size-15-45 HP. Small tractors of up to 12 or 15 HP are most suitable for small holdings, for garden- type agriculture and soils in good physical conditions. The one-axle tractors, hitherto preferred in Japan, has certain advantages. But, weak persons have more difficulties to steer it than with the two-axle tractor, more easily driven by the steering wheel from the drivers seat. Its use in road transportation is less, costs and material per HP are higher.

But, most important are the economic considerations: the vast

Table I: Tractors and oil engines-Statewise

	Tractors						
	1956	1961	1966	1956–66 ±p.c.	net area sown 1965/66 (1000 hectares)	ha/ tractor	oil engines 1966
Andhra Pradesh	1.626	1.762	2.911	+ 79	10.995	3.469	46.741
Assam	159	489	834	+ 425	2.337	2.802	362
Bihar	1.227	1.520	2.132	+ 74	8.338	3.911	3.698
Gujarat	1.052	2.005	3.248	+ 209	9.528	2.933	112.428
Jammu and Kashmir	106	132	104	− 2	671	6.451	18
Kerala	187	276	418	+ 124	2.064	4.937	6.824
Madhya Pradesh	1.311	2.025	2.513	+ 92	16.529	6.577	16.511
Madras	822	1.387	3.278	+ 299	5.934	1.810	42.852
Maharashtra	2.066	1.427	3.260	+ 58	18.122	5.559	146.126
Mysore	807	981	2.595	+ 222	10.011	3.857	24.575
Nagaland	.	.	9	−	47	.	.
Orissa	95	194	667	+ 602	5.989	8.979	710
Punjad (incl: Haryana)	3.809	7.866	15.489	+ 307	7.411	478	8.158
Rajasthan	1.274	3.196	4.195	+ 229	14.131	3.369	7.252
Uttar Pradesh	5.839	7.139	10.139	+ 74	17.343	1.710	28.146
West Bengal	450	330	1.548	+ 244	5.443	3.516	4.162
Union territories	150	287	626	+ 317	936	.	523
India	20.980	31.016	53.966	+ 157	135.829	2.517	449.089

Sources: Statistical Abstract (20), Farm Mechanization News (22), own calculations.

majority of holdings in India, Pakistan, Ceylon and many other Asian countries for that matter are too small even for the smallest two-wheel type. The individual holding cannot exploit it in an economically profitable manner, if we forget the highly intensive, irrigated horticultural units. The economies of these countries are too poor to provide the masses of cultivators with individually owned tractors at least for a foreseeable future-the next 25 or 30 years. It should not be lgnored, that at least one new steel implement for soil operation had to be bought and delivered with each tractor. The wooden desi plough cannot be used with the tractor.

Some experts, particularly in Western Europe, might view the problem of tractor-size as a decision in farm policies for or against the individual smallholding, for or against individual ownership and use of the tractor. That can not hold true, in any case, in the land tenure conditions of South Asia. But experience in Western Europe has shown that even the small tractor cannot save the smallholding against overwhelming economic developments. Intensive technigues are to a large extent indivisible and have to be adopted by a large group of farmers, if they shall be effective. But, as Inukai (8) points out, the same applies to many divisible techniques, too. Tractor farming, along with mechanized irrigation, necessitates joint and "planned action on the part of farmers."

Preparation of rice-seedlings for transplantation in Tamil Nadu, Southern Judia.

6. Obstacles to Progress

In agreement with Behrendt (2) and many others the thesis of innate incapability and similar reasons for slow socio-economic development are rejected. Detailed scrutiny of progress reports in different fields shows very partial success only: cooperation, land reform, exploitation of irrigation facilities, area under high-yielding varieties. Nobody familiar with the heavy toil of Indian cultivators can accept the argument that they are lazy or unwilling to learn from innovations. What are the real reasons ?

Two lines of argument are suggested. Lewis (12) feels, that the existing institutional frame leaves ample room for an enormous increase of production by introduction of new technology. Behrendt (2) on the other hand sees economic progress and technological skill closely connected with social change. Blanckenburg (5) hesitates, whether foreign experts are entitled to propose socio-technical measures changing social order and balance. Sen (15) sees innovation not as a single measure, but as a process of interaction of technical success and positive psychological effects, encouraging further adoption of innovation and change:

> "It is a common experience that when a new technique is introduced which is more productive and less onerous, a farmer gets interested not only in working more intensively but also in an all-round improvement in his operations. Once the conservatism and apathy of a traditional farmer are overcome through the introduction of one impressive new technique, he becomes ready to accept other new techniques too, even if these may be less spectacular."

Inukai (8) after research in Thailand emphasises the same point: "There is indeed good reason to believe that tractor farming will open farmers' minds to further innovations, and that this indirect effect will play a significant role in the further development and diversification of agriculture in Thailand."

He wishes to "integrate changes in productive techniques with changes in institutions".

Thus, a stagnant society is to a certain extent broken up and moved by new techniques. Lethargy or apathy is superseded by mobility. The compulsion of technology affects production techniques and becomes a catalyst of social processes, hitherto held back in a self-sufficient economy with low inputs and small outputs. For the sociological observer it is thus understandable, why the tractorist and the mechanic have been made the new heroes in some communist countries, which were on the eve of economic take-off after the revolution.

The truth lies also the other

way round: the absence or the denial of new mechanical-technical equipment aggravates stagnation and hampers even biological--technical innovation.

The material obstacles against innovations and their diffusion have been mentioned above. Economic poverty of India and of most of its cultivators have to be added. The most important social obstacles are these.

a. The system of land tenure, particularly share-cropping and the payments for abolishment of the zamindari-system imply a continued drain of finance from farming to unproductive use and bar investments by the real cultivators.

b. The gradualistic implementation of agrarian reform, itself a consequence of the undisturbed old social system.

c. Slow industrialization does not promote rural exodus. Population growth thus leads to heavy pressure on land and further fragmentation of plots and holdings.

d. The social and socio-cultural order expressed in the caste system and the holiness of cows leads to social immobility, disregard and low payments for labour.(*****)

The huge economic and developmental difficulties, social and economic stagnation influence human attitudes and thinking, as Boserup (6) rightly pointed out. Lack of economic growth itself becomes a sociopsychological factor of depression, influencing the minds of economists and planners. Economists are afraid of mechanization, since it might lead to increased unemployment etc. Sometimes, this approach even catches the minds of foreign experts, who understand themselves as very modern, who live and work with most modern technical equipment and who claim to promote modernization of a developing country.(******) Behrendt (2) has explained the stereotypes of thinking of some development advisers, who believe in their donor nations superiority and the given and continuous inferiority of the receiving nations. This dialectical process finally turns experts and development agents into development obstacles. Perhaps, in some instances the resistance to innovation and the cultural lag are stronger with the official promoters of progress than with the cultivators who are blamed for slow adoptiond adaptation.

The same applies to Indian experts. It took them a number of years to grasp the potentialities inherent in tractor use and for the cooperative movement in hiring out tractors to members or in joint use on cooperatively farmed land. The report on cooperative farming (18), published in 1959, advised cooperative farming societies not to use tractors and similar equipment, lest unemployment might be aggravated. The report on cooperative marketing (19), published in 1966, on the other hand, suggested diversification of functions, inter alia "ownership and hiring out of small tractors, oil engines or other modern agricultural implements".

This is not to underestimate or ignore the economic and technical difficulties or the dangers of increased social and economic polarization, of eviction of tenants and share-croppers and of aggravated exploitation by tractor-lords. By foresight and early analysis, the means have to be prepared to counteract the adverse technological effects and to relieve the pains of social change. At this point, the experience of developed economies and societies can be utilized to bear fruit. A repetition of errors might thus be avoided. This active explotation of other nations' experience contributes to accelerate the process of development.

Everywhere, technical and scientific development involves the socio-cultural framework. Scientific discoveries and technological inventions are due to change cherished habits of life, traditional thinking and explanation of our world, the established social order. There is no economic growth without social mobility and social change. As it were, man needs time to understand discoveries, to acquire the skill to utilize inventions and to adapt his outlook to the change he feels subjected to. The cultural lag existing everywhere, in every country and each social group, is felt stronger, the more rigid the frame of society, the large the development lag, the more shaking the discoveries, the more unknown its final results. It is no wonder that as reaction to the rapidly growing wave of scientific discoveries people finally become afraid of the unknown future and stick to their traditional behaviour. Old established titles and thinking are expressed in different ways, in religions, taboos, philosophy, customs etc. This attitude is wide-spread in India, too, where the struggle between old and new is still going on.

Summary

Increased productivity of farming in highly industrialized countries results from various factors: bio-technical and mechanical--technical progress, changed farm organization, socio-economic and socio-psychological change. Starting from a different point of departure in India, the hypothesis is suggested that mechanization can be one of the factors for the progress of agriculture. After pointing out the advantages and problems of new farm technology, the prognoses of tractor demand are compared and analyzed. Even the most cautious demand projections exclude mass imports and call for internal production as main source. Given the dwarf size of most operational holdings, the

poverty of the cultivators and of the Indian economy, expensive machinery such as tractors and motor pums have to be utilized mostly by way of inter-farm co-operation and by some public agency. The economic and technical difficulties, the social obstacles and their feedback upon human thinking and behaviour are discussed. But modern technology itself in its widest sense gives new impulses to social change, which is vital for a rapid economic take-off.

* Though the soil literally remains unaugmentable, to a certain extent it can be replaced as production factor by technical intestments, i.e. capital

** Cf. Bergman (3,4)

*** Cf. e. g. Mathur and Kapp (13), Inukai (8) and Kaneda (11)

**** This effect of economic impetus is discussed in the Economic survey (17)

***** Myrdal(14) also emphasises, that the main resistance to change stems from attitudes and institutions and doubts the automatic spread effects of successful sectoral changes

****** Very rarely a foreign expert in a developing country rejects car, telephone, piped water, fan etc., because these instruments increase unemployment

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History of Farm Machinery Sales in Japan

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Japanese farm macinery and tools have an age-old history which dates back to the Middle Age. Japan imported farm tools from Mainland China in that age, according to the archives.

Jn the era of "Kanbun" (1661～1673) and "Genroku" (1688～1704) of Tokugawa Shogunate or one of Japan's feudal goverment, they developed "Fumiguruma" or a tread water lift wheel and "Senba" or a comb thresher. These were very popular harvesting tools. Not a few of their remnants still remain in barns today.

In the era of "Meiji" (1868～1911) and "Taisho" (1912～1925), Japanese blacksmithes forged small tools such as hoes, sickles or sericultural equipment. They themselves peddled for the sales to farmers or sold through an ironmonger's or grocer's.

With the advent of the diversified and enlaged farming in this country, European or American farm power machinery was imported by some traders in Tokyo or Osaka. The spread of those machines, coupled with the central Government's positive policy, created the necessity for a number of skillful dealers throughout the nation, who established a reputation among famers.

Pioneers in Farm Machinery Sales

Sadaji Terao, an 85 years old president of Taimei Co., in Tokyo who, in the early part of Taisho era (1912～1925) sold imported power farm machinery including kerosene engines on a nationwide scale, told about his bitter experiences as follows:

"In 1920 I enterd into an exclusive agreement with International Harvesters Inc. in the U.S.A. to import 50 unites of small kerosene engines on an annual basis. This contract was regarded at that time as crossing the "Rubicon".

"The best sales tactics was to visit in person from dealer to dealer for canvassing. I travelled from corner to corner throughout the country. The result, however, was not satisfactory as I had expected".

"It happened that the Ministry of Agriculture and Commerce of the Japanese Government was testing about 15 units of small engines imported from the Western countries. I immediately approached the Ministry in an attempt to have our IH engines authorized by the Ministry. My effort bore fruit, as I was successful in selling those 50 units to the Government-owned agricultural experiment stations"

"After sales should come servicing and supply of spare parts. I established franchised dealers in various parts of the country and attached a special importance to their technological training, which otherwise would have inconvenienced my usern".

"My franchised dealers strengthened their sales impetus, when they learned skilful servicing technology and increased returns there from".

"In this way, sales boom on our part lasted until 1930 when homemade engines such as "Kadota", "Kubota" or "Yammar" were developed one after another. These newcomers' sales competition became keener and keener year after year, which turned out the imported engines finally unprofitable. I however, still boast of the fact that I am a pioneer in the introduction of power farm machinery in Japan".

Japanese dealers of farm machinery owe what they are to a great extent to such a predecessor as Mr. Terao.

As aforementioned, the production of agricultural machines in Japan was greatly influenced by the introduction of foreign counterparts.

It gradually moved out of "Manufactur" in the latter part of "Taisho" era (1918～1925), however. We can safely say that

Japan's farm machinery industry started its first step in the early part of "Showa" era (1926~1935). Still predominant in the fields in those days were manual tools, which were main sales items for dealers. It was however, in those days that farmers began taking an interest in power machinery awaked and encouraged by the Governments positive policy.

Mr. Tsuruyoshi Motofuji, president of Kawakami Co, Kurashiki city, Okayama Prefecture, who was engaged in the sales of "Sato" Pedal threshers in Hirosima prefecture in the latter part of "Taisho" era (1918~1925), told about his sales experience in those days.

"In 1923 I sold no less than 1,200 units of "Sato" pedal threshers in these two prefectures. Our sales structure at that time was so poor that bicycles were only means of transportation and our warehouse was nothing but a temporary one borrowed from a local transporter. I was extremely busy day and night with assembling, sales and delivery of the machines which was delivered on an for term".

"I made a miniature model to show every and each potential customer including even passengers who happened to be on the train. Their names and addresses were kept in file for the ensuing visit".

"I initiated a unique sales structure under which I gratuitously offered one unit of thresher to a friendly farmer who helped me sell 10 units. Furthermore, I appointed eight friendly dealers to increase the sales of threshers. Owing to such positive sales tactics, I was successful in selling 1,200 units of thrshers in 1923. We retrieved about 80 per cent of the total sales proceeds and paid in full the amount bought from the manufacture".

"Mr. Sato, president of the company making "Sato" threshers, nominated me chairman of the National Association of Dealers of Sato Thershers".

"I was proud of myself who could contribute much to Japan's farm mechanization through the introduction and development of "Sato" threshers. I gave much frank advice as chairman of NADST".

Special Situation in the Wartime

In the early part of "Showa" era (1926~1938), Japan, unfortunately plunged into the Manchurian Incident which was followed by the China Affair.

Japan's economic system thus inevitably moved into a war-time economy. Consequently distribution blow in general went tight and the distribution of important materials were completely placed under the Government's control.

There was no exception farm machinery. Farm Machinery & Tools Control Corporation (FMTCC) was established in accordance with the control government's directive which objective was to coordinate the relationship between production and distribution.

FATCC's major roll is, therefore, to distribute farm machinery and tools allocated by the Ministry of Agriculture and Forestry (MAF) in each quarter of year to Zenkoren (National Purchasing Federation of Agricultural Co-operations Associations) to Municipal Industrial Association (MIA).

Such allocated machinery and tools were delivered to farmers in exchange for coupons at municipal offices. Dealers were in charge of technical assistance to farmers such as the adjustment of machines and shakedown thereof.

Dealers positively participated in a travelling servicing team

Window Display of a Retail Shop in Japan.

sponsored by the prefectural government.

The team performed a minor repairing on the spot, while a major one in a dealer's repair shop. Dealers also did their best to supply spare parts as smoothly as possible.

After World War II, the wartime was gradually replaced with rehabilitation counterpart to build a peaceful nation.

For this purpose, the supply of food was considered urgent. Demand for machinery and tools was most keenly felt. Under the circumstances, many factories which had been engaged in munitions production began to manufacture agricultural machines and tools.

Consequently, the production has rapidly increased quantitatively. The quality thereof, however, did not keep pace therewith and was extremely inferior. Many of the allocated machines and tools, therefore, were rejected and returned by famers to "Ken-kohanren" a government's sub-distributor.

It happened that economic depression hit our country in those days, which was due to too rigid economic policy of G.H.Q. (the Genera Head Quarters for the Allied Powers) towards Japan based on the recommendation proposed by the so-called Dodge Report.

In order to tide over such difficulties, the Japanese Government decontrolled the tight belt on distribution structure in March 1950. Needless to mention that FM-TCC was dissolved.

During World War II, farm machinery dealers played only a negligible role in the nation's distributive function. After the War "self-sustaining" farmers remarkably increased in number, whose average land holding was no more than 0.3 hectare. They were, however, very intent on increasing food production.

Under such circumstances farm machinery dealers mushroomed, since "amateur" dealers who had been demobilized joined the prewar traders. Thus the total number of dealers farm households numbered as many as 10,000 while no more than 6,000,000.

It happened that the Korean War broke out in 1951, which gave a favourable influence over Japanese economy which had been under chronical depression. Farm machinery traders could participated a lion's share, too.

On the other hand, "Ken-kohanren" in many prefectures were badly suffering from piled-up red figures under the pressure of a lot of dead stocks, which were mostly of inferior machines.

They managed, however, to escape from their financial crisis thank to a strong support extended by the Central Government. "Ken-kohanren's" purchasing system which was based on the verification of "Noshinren" (Prefectural Federation of Credit Co-operative Associations) and in collaboration with "Zenkoren" and Central Cooperative Bank for Agriculture and Forestry, embarked on the increased sales of farm machinery. Consequently, competition among farm organizations and dealers became aggravated again.

Two Distribution Routes

In Japan the big two groups traders and farm organization used to engage in the distribution of farm machinery. In the early part of "Showa" era (1926～1935), "Industrial Association", a kind of farm organization, was in charge of the distribution of agricultural machines centering on such hoes, sickles, pedal threshers, straw hand making machines or grain sorters as may required no servicing.

Under economic control during the War, however, the distribution of farm machinery was put on monolithic stractue. This experience gave farm organizations such self-assertive concept a concept that farm productive materials (such as machinery, fertilizer, agricultural chemicals, etc.) should be distributed by themselves. It was in 1952 that farm organization started the reinforced sales campaign on agricultural machines.

Farmers in Japan after the War were laced under less favorable conditions than they had expected to, because the agrarian reform caused the increase in the population in rural villages and the fragmentation of land area coupled with the unreasonably low price of delivery rice, heavy burdon of tax, etc.

To tide over such agrarian unstability that followed, the Central Government enacted a series of relief measures, for instans, Countermeasures for the construction of Comprehensive New Farm Villages, Law concerning the Aid in Farm Improvement Fund, etc.

As a result, farm machinery were encouragingly introduced, which in turn intensified the desire of farm organizations for handling agricultural macines. Thus, dealers were forcibly driven to a desperate position. It was in 1956.

Dealers, however, did not acquiesce in such miserable condition where they were unduly discriminated by the governmental policy one-sidedly in favour of farm organization.

They started a roll-back campaign. They not only strengthened their organizations hither to existed, but also established central as well as regional structures in cope with farm organizations which had intolerably penetrated in dealers' sanctuary. It was indeed in the first-half of 1950's.

Rapid Mechanization in 1960's

It was in June, 1961 that Agricultural Basic Law was proclaimed. The main purpose

thereof is to bring up self-supporting farmers and to create modernized farming. The mechanization of farm machinery is postulated to play an important roll in this Law. A rapid progress in farm mechanization could be witnessed, accordingly.

Following are the production of farm machinery in terms of monetary value;

Production Year	Japanese Yen (million yen)
1955	20,600
1956	26,400
1957	31,000
1958	34,800
1959	38,000
1960	56,000
1961	unavailable
1962	71,300
1963	73,400
1964	78,300
1965	88,600

During the decade starting 1955, the production increased by about 330 percent.

The following are the production of power tillers in termes of quantity.

Production Year	Number of Power Tillers
1955	38,000 units
1957	148,000
1959	168,000
1961	409,000
1963	440,000
1965	441,000

For a period of 10 years, the production increased as much as 1,100 percent, a wonderful record ever accompished in this field throughout the world.

In meeting with such a rapid spread of power thillers, distributors and retailers were forced to expand their maintenance facilities and to learn higher technogy. They did their best to.

On the other hand, Japanese economy has made a conspicuous progress year after year. Working population in agriculture has been on the decrease year by year. What is wores, international competition has aggravated in agricultural field. To survive this keen contest, it is essential to enlarge an enterprise and rationalize as well as modernize it.

For this, Japanese agriculture must depend on mechanical power all the more. In introducing machinery, we need one with high-performance. In prallel with this trend, the necessity for the improvement of traders' sales mechanism was more keenly felt than ever.

In July, 1962, Ministry of Agriculture and Forestry (MAF), therefore, designated farm machinery enterprises as one of "important industries" that has a direct relation with agriculture. This step was in pursuant to Law concerning Temporary Measures for Promotion of Small and Medium Enterprises by Kinds of Jobs. MAF conducted a survey on as many as 4,400 enterprises throughout the nation, in accordance with the Law.

The survey was made centering on their management types, facilities, competitions, trade practices, labour, finance, joint enterprises, facilities for common use, etc. Based on the findings of this survey, MAF made to farm traders in general many pieces of recommendation for improvement in the farm of the Ministry's Notification.

Farm machinery traders accepted the MAF's recommendation and tried their best.

There were, however, several matters that were beyond their power. MAF, therefore, specified kinds of jobs for sales and shakedown or the latter alone, in accordance with Law concerning the Promotion of Mechanization of Small and Medium Enterprises in September, 1967.

Furthermore, MAF proclaimed its Notification in March, 1968, whereby it mapped out basic plan on modernization of farm traders with the year of 1972 as its final goal. Thus, a full administrative support has been extended for the first time to traders in general who intend to modernize their business practice.

Such assistance from the Governmet is an unprecedented case to small and medium enterprises engaged in farm machinery distribution. Naturally traders have respened with ardent intention of doing what is expected of them.

Following are a chart and a table showing distribution structure and distribution percentage in terms of monetary value:

Table 1. Distribution percentage in terms of monetary value unit: ¥100 million

	1956	1960	1965	1966	1968	1970	remarks
(A)※	33	102	306	604	567	569	data supplied by ZENKOREN
(B)※※	367	581		1,275	1,912	2,579	data collected from commercial statistics
Total	400	683		1,879	2,479	3,148	
(A) / (B)%	9	18		47	30	22	

※Distributed by farmers' co-operative association.
※※Distributed by dealers.

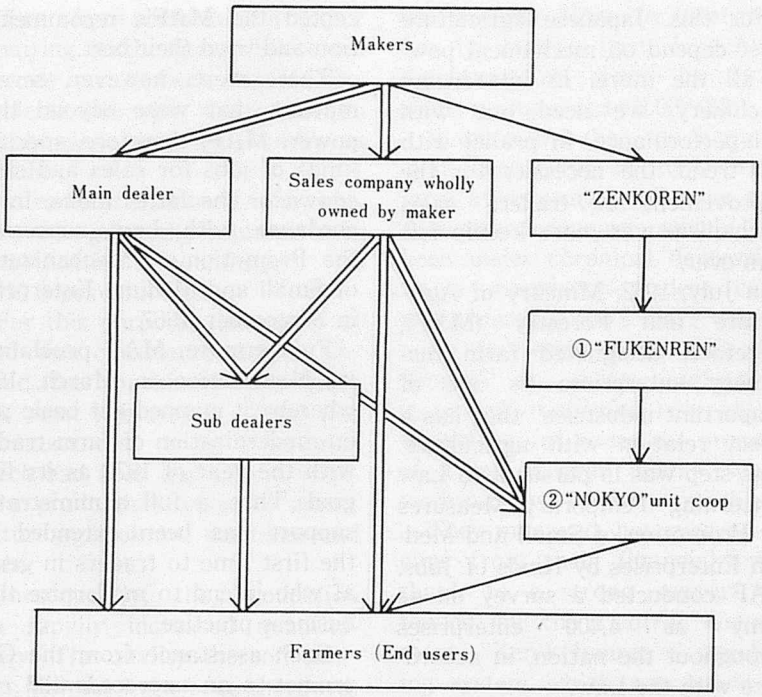
Note: Sales channelled through A gradually increased, however, we can say that they have shown a somewhat dull trend owing to a sudden change in demand in general and insufficient servicing by A, especially on high-performance Machinery.

Movement to Reorganize Sales System

Sales for sales have no longer the best policy for farm machinery dealers in these days. what is more important for them is their daily, untiring servicing activity such as maintenance, adjustment and repaire of machines sold to farmers. Also equally important for them is to make new models most enjoyable to their users.

It is certain that the growth of

Chart 1. Distribution Structure



①Prefectural Federation of Farmers' Co-operative Associations
②Farmers' Co-operative Association
→Sales channel through farmers' Co-operative association
⇒Sales channel through traders (destributors & dealers)

any enterprise does depend upon its ability of effective servicing in addition to its vivid sales activity. This has created the tendency that a large enterprises are in a more advantageous position than small and medium counterparts.

Consequently, large dealers are on the increase and some of small ones have left a sales front, while several of them have begun to orient themselves as a sub-dealer of a large company.

On the other hand, a trend toward oligopoly among manufacturers has aggravated competition for a production share among large manufacturers.

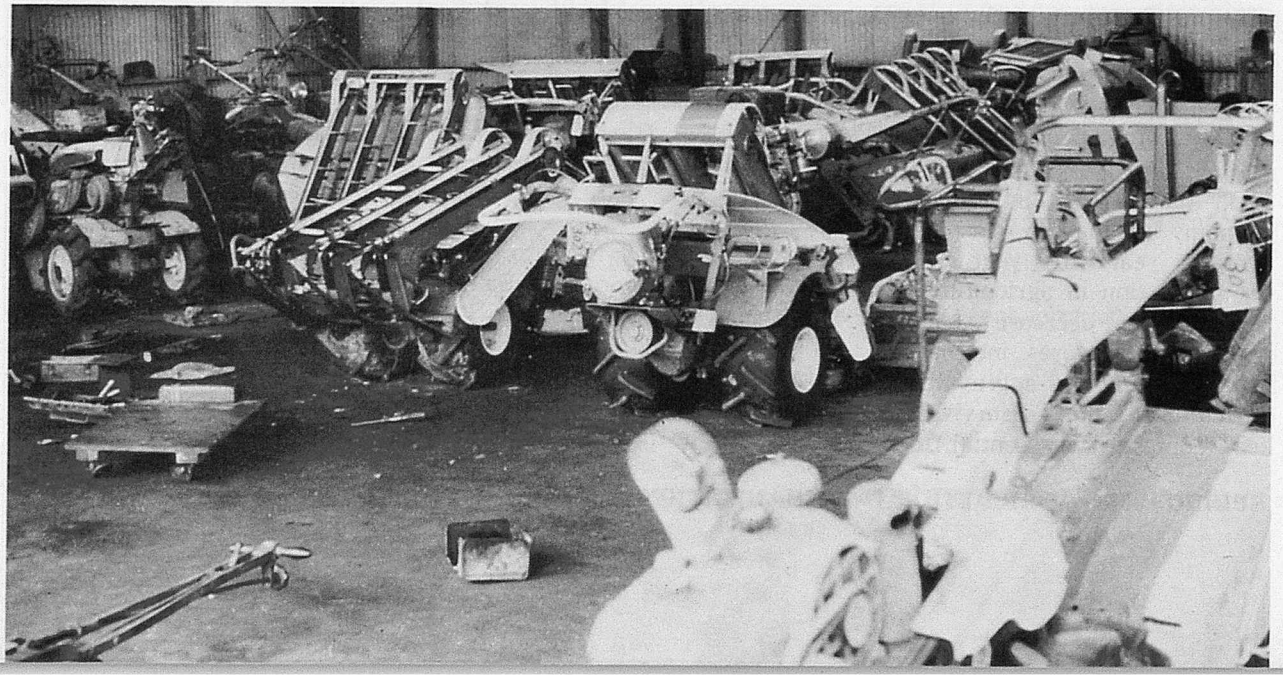
Many of such large enterprises are employing positive measures including the set-up of a new sales organization, the subordination of a influential retailer under their contral, financial aid to such retailer. These facts have considerably depreciated the raison d'être of distributors, although their number was already on the decrease. Large makers of farm machinery are, therefore, trying to reorient distributors as newly born retailers for the purpose of taking an initiative of the distributorship in farm machinery trade.

Today there are no less than 180 enterprises, large or small, oriented and controlled by large makers in the from of capital participation or staffmembers on loan therefrom. The annual market share by sucn subsidiaries in terms of monetary value, it is said, is ¥60,000,000/¥70,000,000. Thus the sales competition has become keener and keener among those large enterprises.

Under these circumstances, it is one of the most urgent tasks for dealers in Japanes to improve their sales structure so that it may cope with her rapidly changing background of Japanese agriculture, by making an appropriate readjustment between large dealers under orientation and their too so many and too small counterparts.

This task still remains unsolved. It should be seriously tackled by all the parties concerned, failing wich Japanese farm machinery industray would find it very difficult to enjoy a prosperity, outvying keen international competition. ■ ■

Repairing and Adjustment of Agricultural Machines. Binders and Tillers are many.



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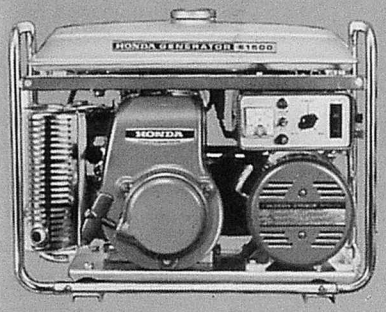
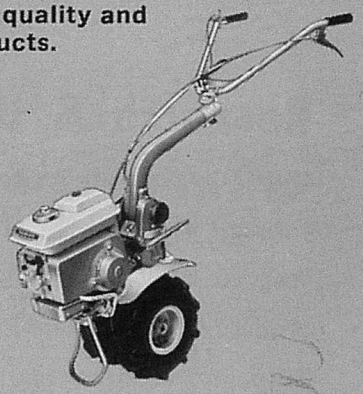


E1500 Portable Generator
4.5 hp gasoline engine.
120-240V 1500W AC
and 12/24V 100W DC.
Weight: 53 kg.

E300 Portable Generator
1.1 hp gasoline engine.
117-240V 250/300W AC
and 12V 70/100W DC.
Weight: 18.2 kg.



F28 Garden Tiller
2.8 hp gasoline engine.
Complete series of
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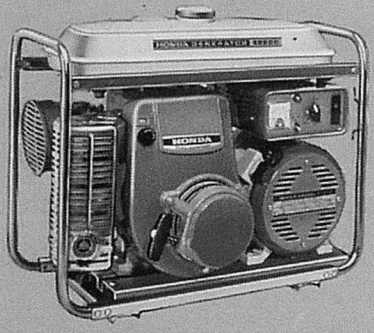
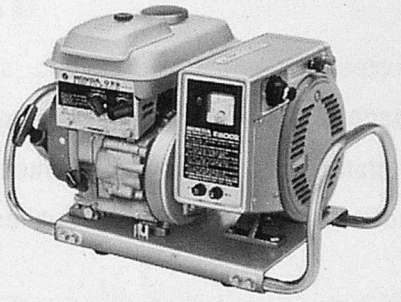
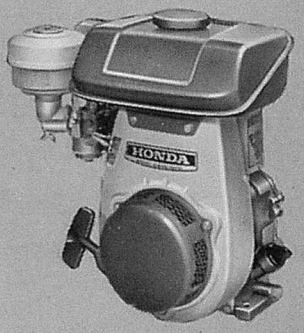
every agricultural need.
Weight: 37.9 kg.



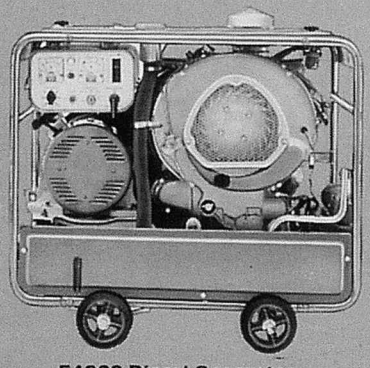
E2500 Portable Generator
6.8 hp gasoline engine.
120-240V 2500W AC
and 12/24V 100W DC.
Weight: 79 kg.



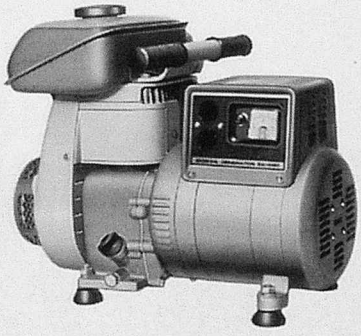
E800 Portable Generator
2.8 hp gasoline engine.
120-240V 800W AC
and 12V 100/120W DC.
Weight: 35 kg.



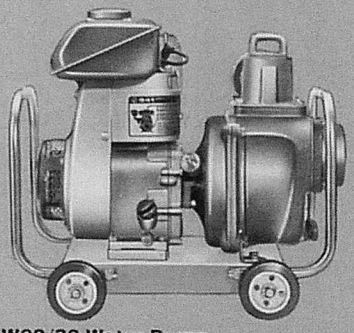
G41/G65 General Purpose Engines
171 cc (G41) or 240 cc (G65)
gasoline engine.
Output: 4.5 hp at 4,000 rpm (G41);
6.8 hp at 4,000 rpm (G65).
Weight: 17 kg (G41); 29.1 kg (G65).



E4000 Diesel Generator
10 hp diesel engine.
120-240V 4000W AC
and 12/14V 100/200W DC.
Weight: 183 kg.



EC1500/EG1500 Portable Generators
4.5 hp gasoline engine.
120-240V 1500W AC.
Weight: 37 kg (EC1500);
40 kg (EG1500).



W20/30 Water Pump
4.5 hp gasoline engine.
Self-priming aluminum pump.
Suction capacity: 0.65m³/min. (W20);
1.00m³/min. (W30).
Weight: 48kg (W20); 53kg (W30).

HONDA

HONDA MOTOR CO., LTD. TOKYO, JAPAN

ISEKI

Research & Development

ISEKI plays an important role in contributing to modern agricultural mechanization, through research and development of agricultural machinery.

We, at ISEKI, were the first to establish an integrated system for mechanizing rice production.

Through research and development, we hope to cooperate with other Asian countries in developing their own mechanized agricultural systems.

Our vast knowledge in this field will surely be of service in promoting such development throughout the region.

Production

ISEKI, with a history of over 40 years, presently employs some 3,000 workers in its four modern factories. These plants, equipped with the most up-to-date automated facilities and using the latest production techniques, turn out an excellent range of products.

ISEKI AGRICULTURAL MACHINERY MFG. CO., LTD.
Overseas Division:
2-2, Nihonbashi-dori, Chuo-ku, Tokyo; Japan.

creates profit

Marketing

ISEKI has succeeded in establishing a remarkable distribution system throughout Japan. This not only provides for the organized distribution of our products, but also includes a farm management and technical guidance service for our users and dealers as well. Apart from supplying other Asian countries with agricultural equipment, ISEKI also provides them with assistance in establishing their own distribution systems. Ones which fit their respective economic conditions.

Engineering Service

ISEKI provides, on request, a complete engineering service, which includes training, planning and consulting necessary for agricultural mechanization.
Our technical know-how, accumulated over the past 40 years, is sure to be of service to you, in particular.

ISEKI

ISEKI brings more efficiency to your farms.

Easy adaptability to climate and smart appearance for pleasant operation. This is ISEKI's machines.

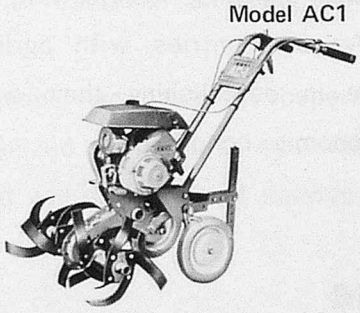
Each of ISEKI products undergoes thorough inspection, durability and performance tests, and exacting quality control. Further, ISEKI is proud of the establishment of its integrated system of paddy farming, i.e. planting through harvesting. Its operation follows briefly:

Tilling and puddling	:	By tiller and 4-wheel tractor
Planting	:	By rice planter
Harvesting	:	By combine harvester or reaper binder
Preservation	:	By automatic thresher, automatic rice huller, grain dryer and huller/polisher

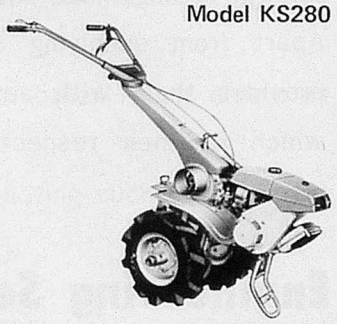
Surely, you can choose any of the machines with your request.

ISEKI Power Tillers

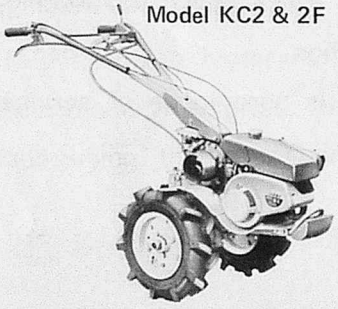
Model AC1



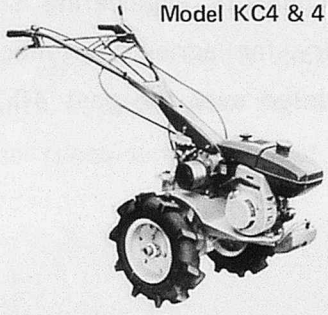
Model KS280



Model KC2 & 2F

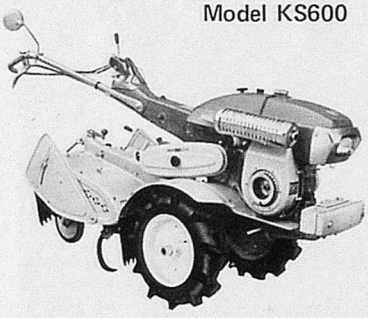


Model KC4 & 4F

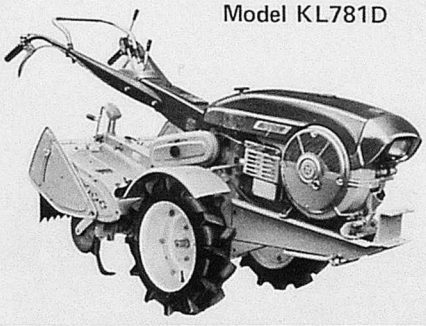


Model KS500

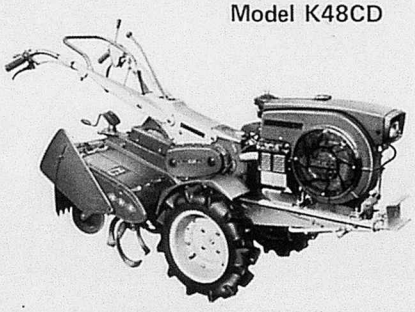
Model KS600



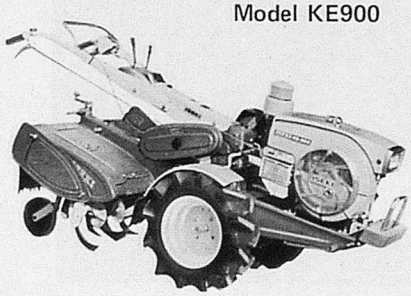
Model KL781D



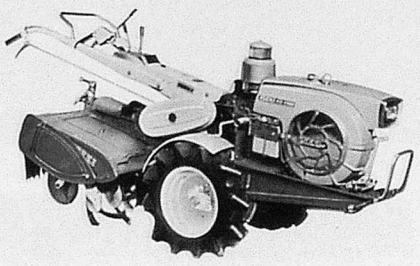
Model K48CD



Model KE900



Model KE1100

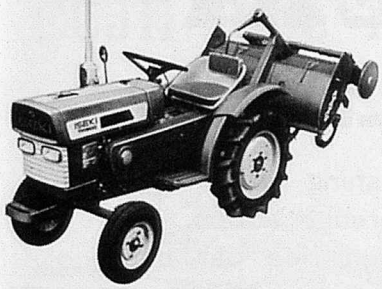


ISEKI 4-Wheel Tractors

ISEKI

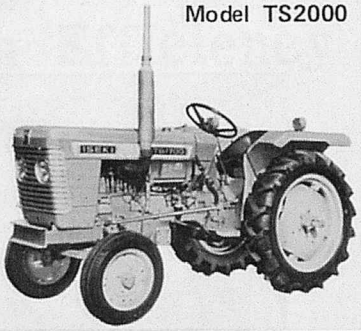
ISEKI machines work best on your farms.

Model TM1200



Model TB1700

Model TS2000

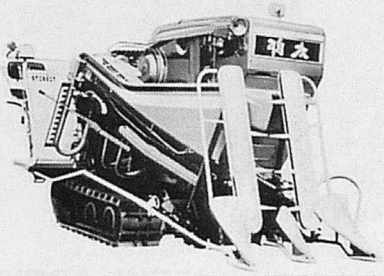


Model TS2400

ISEKI Combine Harvesters

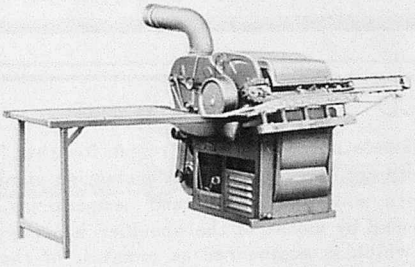
(Small type)

Riding type & walking type

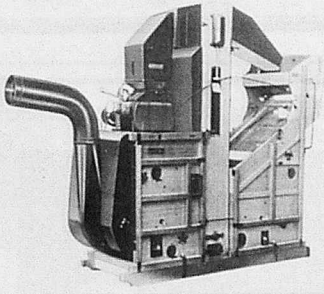


ISEKI Automatic Threshers & Hullers

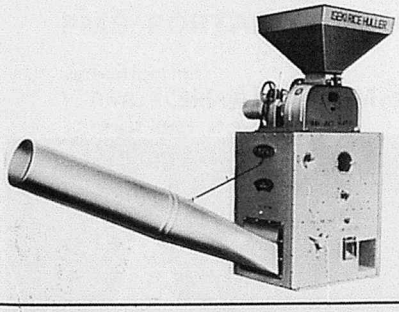
Model D2L



Model M50CA

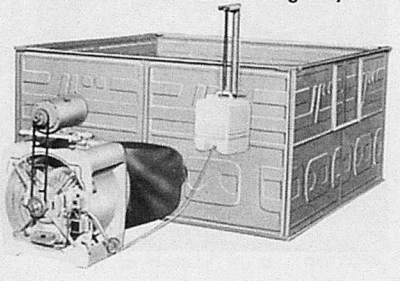


Model HC6B

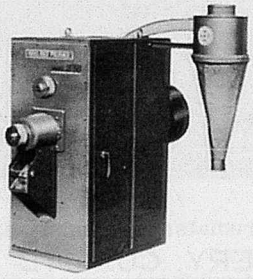


Others

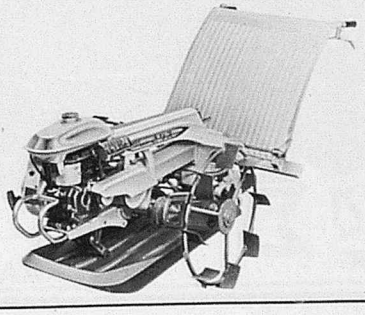
Ventilating Dryer



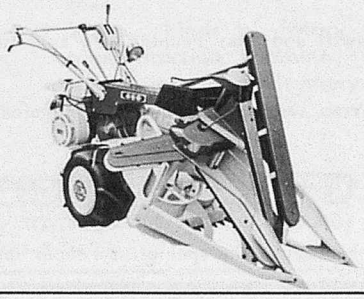
Rice Polisher



Rice Planter



RS250 & RS500



Contributing to the mechanization of in Southeast

Mitsui & Co. maintains a complete network of 119 offices in 72 countries.
Its creed of service aims at bringing happiness and a richer life to everyone
in every corner of the world through activities in all business fields.
Mitsui & Co. and its affiliated industries work for you — for the modernization
and mechanization of agriculture and the forestry industry in Southeast Asia.

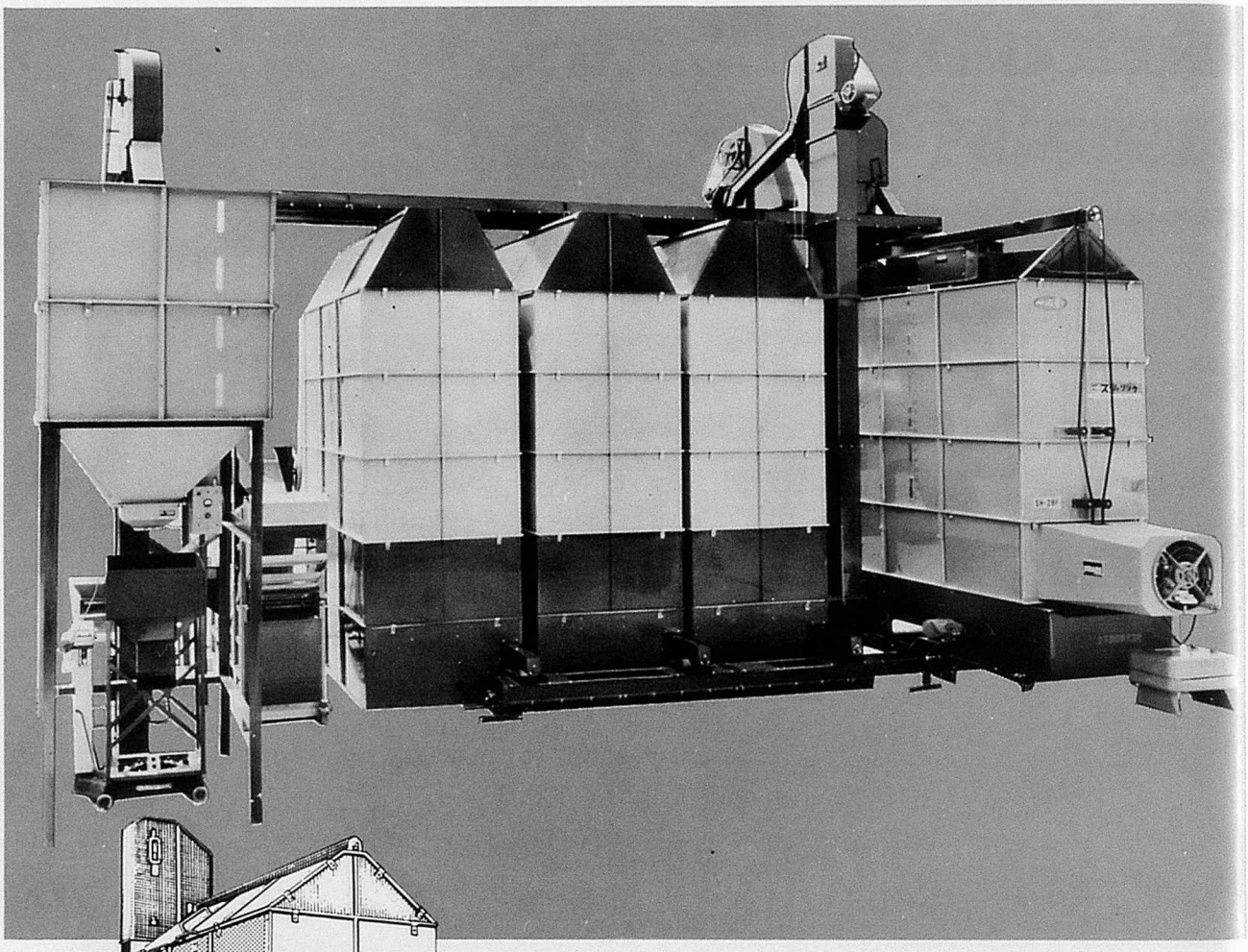
modernization and agriculture Asia–Mitsui & Co.

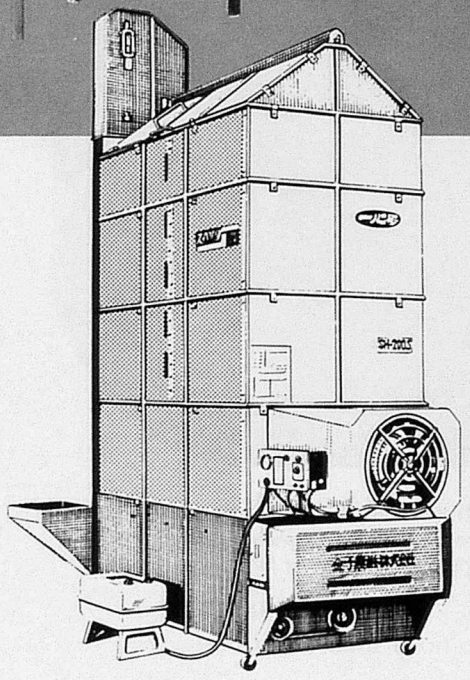
Representing Leading Manufacturers of Agricultural Machinery and Implements.
*Power Tillers and Implements *Tractors and Implements *Paddy and Rice Processing Machinery and Plants
*Water Pumps *Generating Sets *Chain Saws *Power Dust-Mist Blowers *Power Sprayers *Power Scythes
*Diesel Engines, Gasoline Engines, Kerosene Engines

MITSUI & CO., LTD.

General Machinery Dept.
Head Office: 2-9, Nishi Shimbashi Itchome, Minato-ku, Tokyo, Japan

KANEKO





"Workers' Health First"

ISSHINGO SUPERING SUCTION DRYER

"Must" of the dryer for rice and barley nowadays shoud be:

1. Good for workers' health.
2. Labour saving
3. Have good quality rice (barley)

This Dryer is a creative and complete closed type, no dust comes out of the machine (all the dust comes out at one place), labour saving, and can have excellently good quality rice based on newest effective drying reasoning.

KANEKO AGRICULTURAL MACHINE CO., LTD.

Hanyu, Saitama Pref. Japan
Cable Address : KANEKO GYODA (JAPAN)
Telephone 0485－61－2111
Telex 2942－462

drying Specialist

ISSIN-GO RICE CONDITIONING SYSTEM

Drying and Processing System to Make Good Rice

Two stage drying systems keep rice in good quality.

The two stage drying systems mean processing of pre-drying → tempering by natural air → drying for finishing. The features of the system are as follows.

* Using this system it takes so long tempering time that drying of rough rice is naturally performed without cracking.
* Rotation of rough rice prevents uneven drying and can get live and better quality rice.

This ideal two stage drying system is one of the features of the Ricecon System.

Full mechanization and automation of the equipments save your money and lavour.

Sanitary working environment with no dust and noise.

Many of us were used to belive that dust and noise are not avoidable in drying workshops. But this unpleasant dust and noise are removed by the Ricecon System to make clean and quiet working environment.

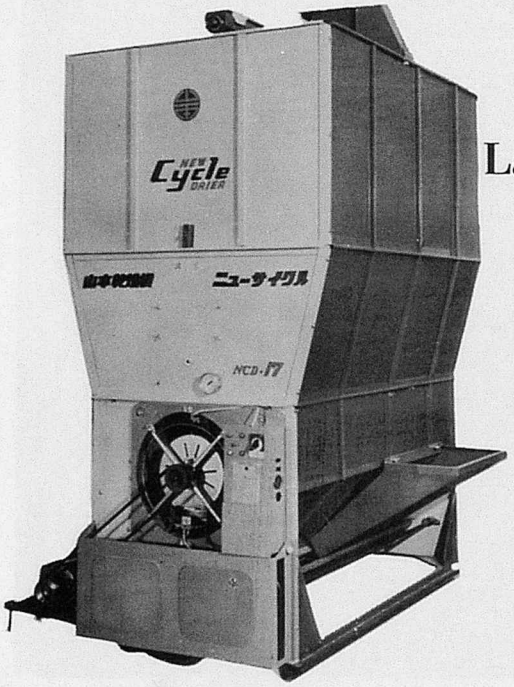
The Ricecon System consists of equipments produced by mass-production.

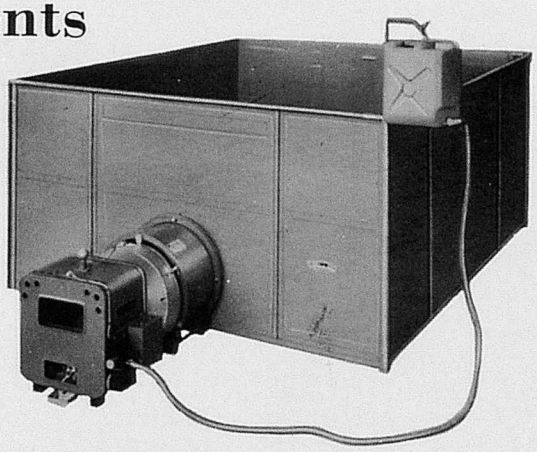
This makes the System reliable and inexpensive. Therefore cost of facilities can be repaid for short period.

KANEKO Drying machine for agricultural products

Yamamoto's
AGRICULTURAL MACHINES
Dryer Series & Implements

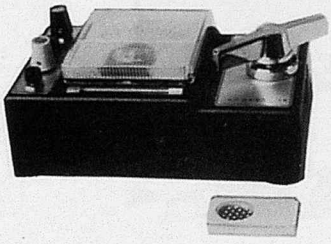
New Cycle Dryer Series
for drying the large quantity of rice.
capacity 1.7～3 tons





Layer type FD-58
for drying the small quantity of rice.

Rice Depot
for drying & storing the rice with low temperature.
capacity 10～100 tons



Moisture Meter
to measure moisture of rice.

YAMAMOTO PROVIDE YOU NEW MACHINES AND HOW TO DEVELOP YOUR INDUSTRY

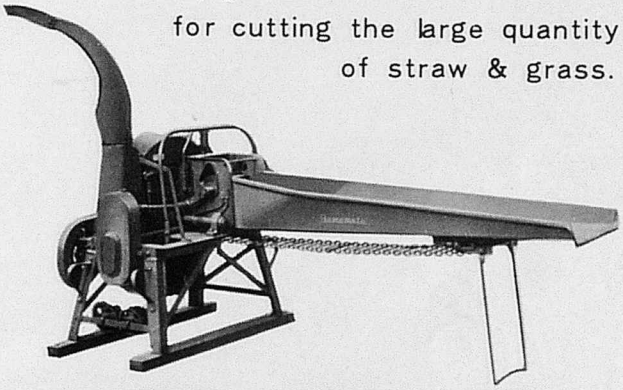
Cutter Series & Other Products

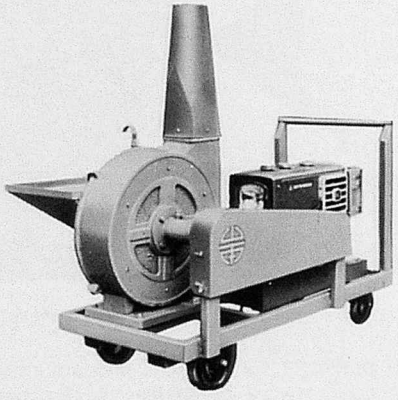
Cylinder type cutter

for cutting the straw & grass.

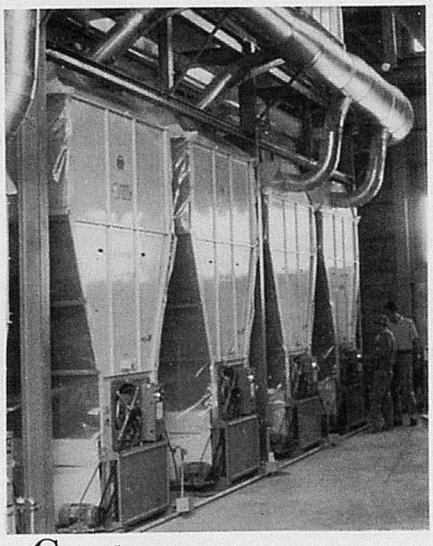
Wheel type cutter

for cutting the large quantity of straw & grass.





Grain Convayer



Rice Center

easy operation, excellent dryers, preparing equipment of high performance.

YAMAMOTO MFG. CO., LTD.

Head Office : Tendo-city, Yamagata, Japan

Branch : Oyama, Nagoya, Osaka, Fukuoka, Iwamizawa

Shall we Help Each Other To Develop Agriculture?

Kinsho's World Wide Net Work

KINSHO-MATAICHI Corporation one of the leading exporters, importers and general merchants in Japan originated under the name of KINSHO TRADING CO., LTD. in 1947.

We have increased our capital successively for coping with the remarkable growth of our business and are now capitalized at ¥ 1,070,000,000 with some 1,000 employees and our expanded network of offices covers the important trading centers.

We always try to realize peaceful and prosperous world through our business. Agriculture is also one of the most imoportant fields.

Especially we can at any time co-operate with you to promote agricultural mechanization. Whenever you will have problems related to agricultural mechanization, Please contact us !

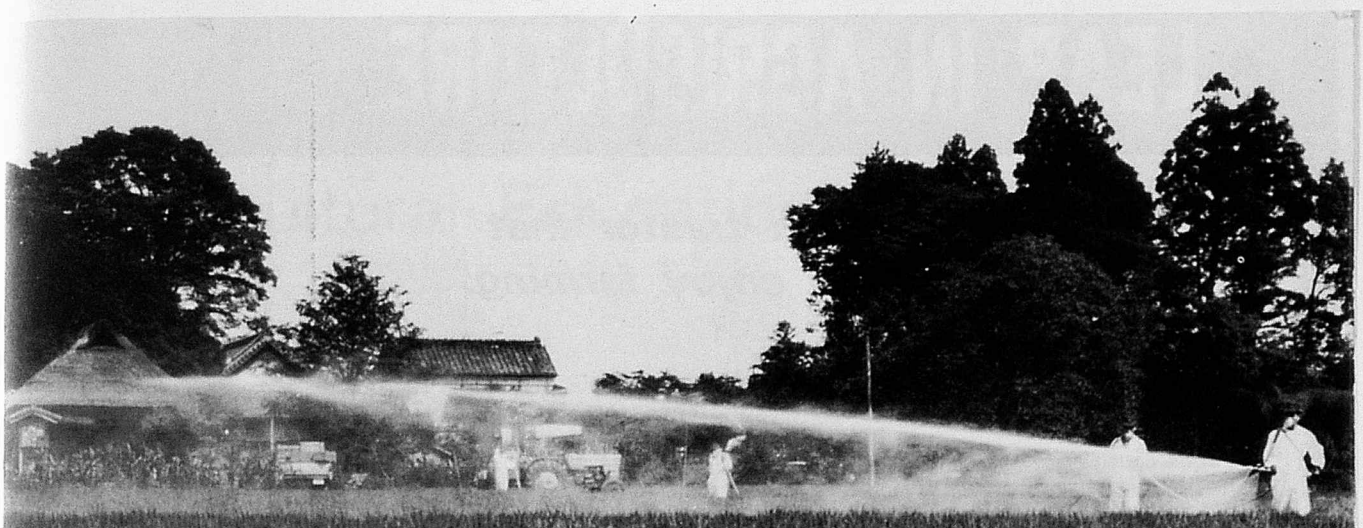
KINSHO-MATAICH CORPORATION

TOKYO Head Office: 8,2-chome, Kayaba-cho, Nihonbashi, chuo-ku, Tokyo. Central P.O. BOX 591. TOKYO
Tel. Tokyo (668) 5211・Cable Address: KINSHO TOKYO・Telex no: TK2356, TK2905

OSAKA Branch Office: 13,2-chome, Minami-Kyutaro-machi, Higashi-Ku, Osaka. Central P.O. BOX 24.OSAKA
Tel. OSAKA(271)2281・Cable Address:KINSHO-MATAICHI OSAKA Telex no:OS3269, OS0349

Sydney Branch: 38th Floor, Australia Tower Australia Square, Sydney N.S.W., Australia
Hongkong Branch: Room No. 207, Shell House, 24-28 Queen's Road, Central, HongKong
Bangkok Branch: 3rd Floor, Shinto Bldg. 115/1 Surawongse Road Bangkok, Thailand
Seoul Branch: Room No. 503, Unesco Bldg. No. 50, 2-Ka, Myungdong Chungku Seoul, Korea
Taipei Branch: No. 153, Section 2, Chung Shan North Road Taipei Taiwan
Manila Office: Room No.1003 Sikatuna Bldg. 6762 Ayala Ave, Makati, Rizal, Philippines
Rangoon Office: No. 359, Maha Bandoola Street, Rangoon, Burma
Djakarta Office: 14R Djl. Modjopahit, Djakarta 1/3, Indonesia
Saigon Office: c/o South Asia Trading Co. No. 7 Rue Pasteur Saigon Viet-Nam

THE SOONER, THE BETTER!



MARUYAMA being the oldest and largest sprayer manufacturing company in Japan with the latest developments in engineering has untill today made a great contribution in making progress for Japanese plant protection.

We in MARUYAMA has been firmly determined to work together with our neighboring South East Asian Countries for increasing their food production.

Therefore we would be happy and honored to receive any inquiries you may have to ask us, and we can assure you of our full cooperation.

The sooner, the better! You should take the advantage of this opportunity so that you may have more crops.

"MARUYAMA" produces everything about SPRAYERS & DUSTERS

Products

* TRACTOR MOUNT SPRAYER
* TRAILER SPRAYER
* POWER SPRAYER
* MIST DUSTER
* HAND SPRAYER
* BUSH CUTTER

MARUYAMA MFG. CO., LTD.
4-15 San-chome, Uchi-kanda, Chiyoda-ku, Tokyo, Japan
Cable Address: MARUYAMAPCA TOKYO

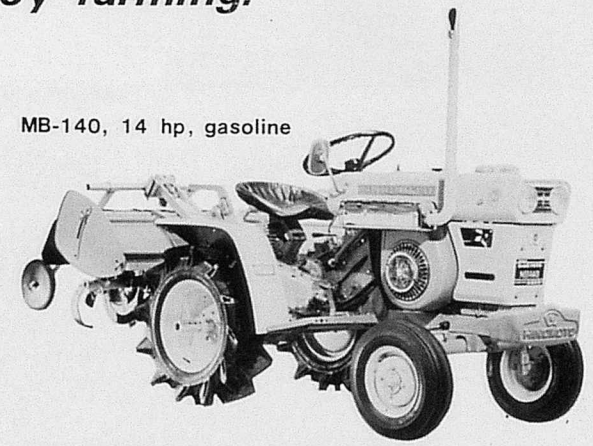
TRACTOR-A KEY TO GREAT LEAP IN AGRICULTURE

It's with a compact tractor that farmers can really enjoy farming.

Each HINOMOTO small size tractor with these merits :

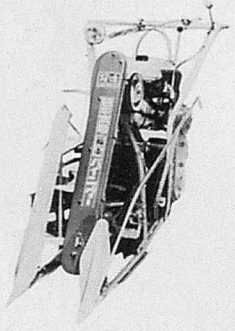
- *Its light weight lets the tractor travel in wet land; hence no fear of bigging down.*
- *It can run on a narrow farm road due to its small width.*
- *It has wide mobility. It can across border ridges without destroying them.*
- *30 minutes or so is enough for an operator to learn operating the machine.*
- *It's less expensive than big size units.*

MB-140, 14 hp, gasoline

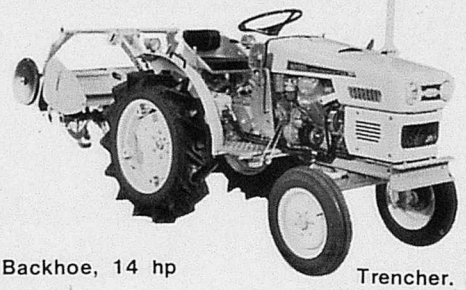


Hinomoto ranks top in the total of domestic production of tractor below 15 hp, and export volume of the same class from Japan. Engines, chassis and attachments are totally of our own make.

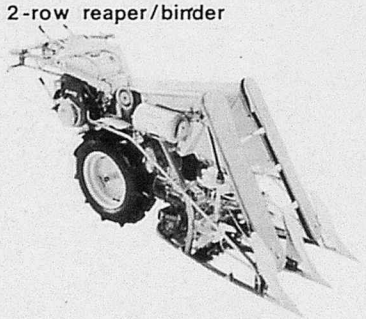
1-row reaper/binder



MD-200, 20 hp, diesel

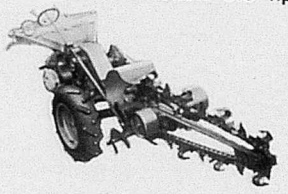


2-row reaper/binder



Backhoe, 14 hp

Trencher. 3.5 hp



Report No. 22, ON AGRICULTURE AND ITS MECHANIZATION IN EAST PAKISTAN (By Mr. K. Kinoshita) goes to the effect that big size tractors come into Pakistan were unable to operate in a submerged field because of their heavy weight. However, at the time of the standerdization test of a Hinomoto tractor, it displayed its splendid performance due to its light weight, and recieved good reputation there. (Mr.K.Kinoshita : agricultural engineer of Overseas Agricultural Development Foundation./ Report published by SHIN-NORINSHA CO., LTD., May 1971)

TOYOSHA CO., LTD. 55, JOSHOJI-16, KADOMA-CITY, OSAKA, 571 JAPAN

Appraising and Improving Vocational and Technical Agricultural Education Programs

by Cernyw K. Kline

Professional Engineer & Educator
formerly with Michigan State University
currently with Lansing Community College
Lansing, Michigan 48854, U. S. A.

I. The Established Need for Education in Agriculture

Most of the developing nations of the world are dependent upon agriculture for their livelihood and growth. A majority of the world's population will not know freedom from hunger until a *radical transformation* o-occurs in present methods of food production and distribution. Much of the effort needed to introduce and bring about change is educational in character. Agricultural and Techical education has a large role to play in developing human resources and is an essential investment item in economies requiring a supply of skilled and trained manpower for agriculture, supporting professions and industry. Educational plans must be analyzed, evaluated, adjusted and funded to meet these manpower needs.

Currently most developing countries face a *manpower crisis.* Middle and high-lvel technical, scientific, professional and managerial skills are in acute short supply, while surpluses of unskilled workers abound (Economic Commission for Africa Report, 1968, p. 10). Maddison (1964,pp. 4-5) further asserts, "Some African countries are so short of skills that a good deal of their capital aid receipts are not properly used and their capacity to use larger investment funds is limited." The same facts apply to Asia to alleviate the manpower shortages, developing nations are placing increasing reliance on the importation of foreign skills through bilateral and labor market arrangements. In 1963, for instance, Maddison (pp. 21-22) reported that African countries received over 66,600 technical assistance personnel, mainly primary and secondary school teachers. Multilateral and bilateral technical assistance sources provide several countries with top-level management and technical personnel. In spite of rapid advances in nationalization and localization in Africa, Asia and Latin America during the past decade, many countries continue to rely heavily upon external sources for the skilled manpower their educational systems have been unable to produce.

The Economic Commission for Africa (1968, p. 10) states, "Manpower requirement for the 1970's will have to be of a higher magnitude in terms of numbers and of more complex *"skill mix"* in terms of quality, if African countries really mean business with the task of industrialization and agricultural modernization. A better educational profile in the labour force is a necessity for technological progress and structural transformation in African economies." And it applies equally weld to Asia and Latin America.

To produce needed skiils locally, new courses and programs must be included in agricultural education programs. Furthermore, if the present socio-oultural and attitudinal reetraints on the acceptance of change and innovation are to be eliminated and development attitudes positively enhanced, a completely *new orientation* toward the objectives and value of agricultural vocational and technical educational programs will be needed.

The Economic Commission for Africa (1968, pp. 6-8) declares, "When all is said and done, however, the pace of economic progress is critically dependent on agriculture and industry (including mining); and due weight must be given to this fact in any con-

sideration of a strategy for economic development in developing Africa.... In the last analysis, an adequate supply of well-trained persons is the *basic* requirement for development..."

Requirements for semi-skilled labor, technicians and scientists call for people able to *use both* head and hands to apply laboratory results and knowledge in solving the practical problems of agriculture. ECA (1968) stresses that theoretical education divorced from practical experience breeds only misfits. Graduates of the former system are reluctant to enter occupations involving any manual work. Part of the attitude results from the failure of society to give adequate recognition and pay to technical vocations.

The increasing rate of introduction of new technology makes it imperative for nations to give much more attention to the development of agricultural training programs designed to impart new skills or to upgrade outdated skills in agriculture. Training becomes a continuous task since all factors are undergoing constant change. In agriculture a qualified source of manpow er is acute since the need for skilled persons is *directly related* to inefficient agricultural production, food shortages and rising food coats.

In many developing countries a growing body of middle-school leavers with general education are unable to qualify for skilled or semi-skilled work. They cannot go on with formal education because of insufficient general secondary, vocational or technical curriculums. They are, in effect, *overly educated* for work in traditional agriculture and *under educated* for any skilled tasks within society.

Tobias, in writing for UNESCO concerning the problems involved in international financing of education and the World Bank's approach to prerequisites for international loans (1966, pp. 407-410), says the concept of an attractive economic return from investment in education and training to satisfy labor market requirements is not new. What is new is the *systematic determination* of educational and training needs for economic development as a basis for international financing. Nations must anticipate their requirements and outputs by area, occupation and industry to make full use of ourrent labor forces and still provide a balanced educational plan to meet tomorrow's needs.

The International Bank for Reconstruction and Development (IBRD), a part of the World Bank, has recognized that education (including teachers, buildings, programs and financing) are all major concerns of the Bank, IBRD is interested in the *total commitment* of the country to education and its interest in sustaining and improving it. In evaluating a proposal for a loan for education, the Bank will test the capacity of the educational system to plan, innovate, manage and utilize what it already has. Intensive self-examination should help a particular educational system to strengthen its program by determining its weaknesses and deciding how they can best be improved.

The Bank's lending experience has demonstrated that economic development projects often cannot be devised or efficiently operated without the trained executives, engineers, technicians and administrators so lacking in developing countries. Without local supplies of high-level manpower, suitable economic projects are difficult to develop. In financing industrial projects, the Bank makes certain that *technical assistance* and expert support of all kinds are provided as required. The inclusion of education indicates the Bank's belief that agricultural education must be supported to achieve its mission.

The Bank believes that formal education has done its job if it makes the student or adult *trainable* and more apt to reach technical competence. In addition to formal education, the worker needs a well-rounded human resource development program to assure the necessary mobilization, utilization, motivation and training of high-level manpower.

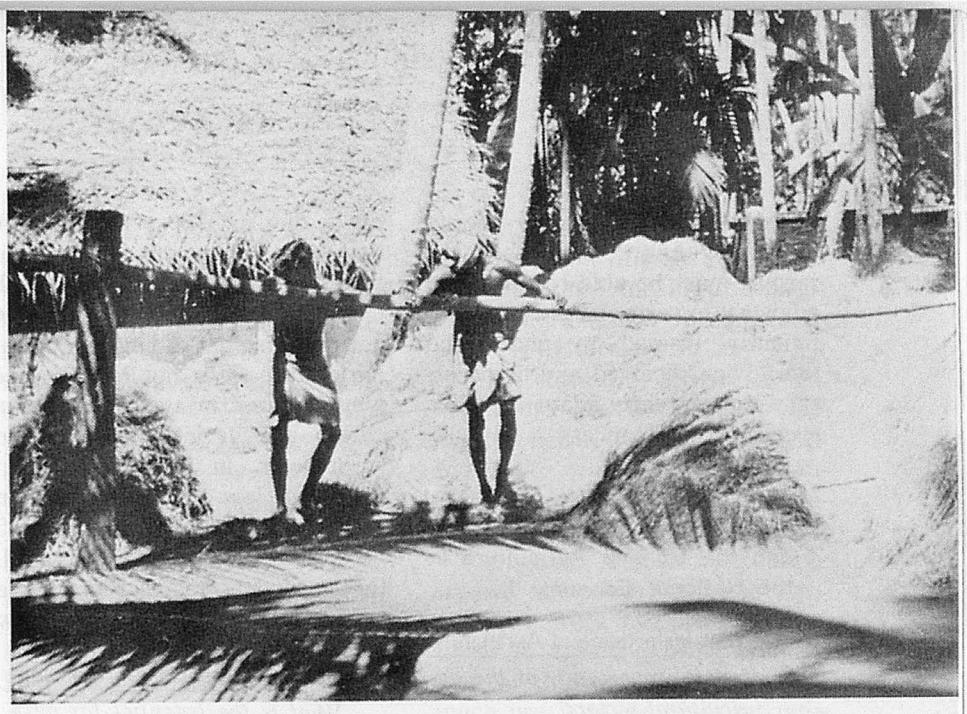
As an item of consumption, education is highly valued for its own sake. It cannot be regarded entirely as an instrument of production. There is need to decide the *balance* between traditional academic and vocational and technical agricultural education in developing countries. Agricultural education should be progressive enough to produce the technical leadership required without isolating these leaders from the mainstream of national culture.

The World Bank practice tends to set the standard of performance demanded by many other international lenders. International funds, however, are only a small part of the cost of education. The basic capital and most of the recurrent costs for agricultural education must come from local sources. The Bank will ensure that there is a dependable local revenue for operating expenses. It is fruitless to invest in education unless oparating costs can be met from local sources. The Bank also wants to know that funds diverted for education will not cripple other equally important efforts of the borrowing government. The long-term nature of education means that there is a *delayed payoff* untill the student matures and labor productivity rises, significantly.

2. Primary Considerations for Any Proposed Agricultural and Technical Education Program

A Purpose and Objectives of the Project

What is the main purpose of



Threshing rice in Kerala, South India. Between two palmtrees, a bamboo-pole is hanging. Two labourers are clinging to it with their arms, while treading the sheaves of paddy with their bare feet to separate grains and chaff. Labour input and output do not allow for more than subsistence economy.

the project?

What are its primary objectives?

The purpose of the project should be clearly determined: For example, to provide annual in-service training for all agricultural teachers and extension advisors in a given state or area of a country. Secondary purpose should be considered. The *primary objectives* of such training would be to provide refresher training for all agricultural teachers and agents who have been out of school for over two years, and to provide indoctrination training and orientation for all new staff members once a year.

If skills are the proper objectives of training, that is fine; but it must be recognized that skills have a remarkably and *increasingly short* lifespan. Professor Frank of M.I.T., Director of the Cooperative Teacher Education Project of Educational Services, and Director of the M.I.T. Study on Occupational, Vocational and Technical Education (1965, p. 18) states, "It has been said that half of the jobs that people will be doing in a decade or so don't even exist today; and preparation for two or three decades of useful contribution to society really should *do more* than prepare people to be retrained continually."

Frank(p. 19) suggests that the whole pattern of education for technical competence is wrong. It is based on a philosophy of common techniques which will not survive. He proposes that the main themes in education be recast in terms of those funcions which are foreseeably long-lived in terms of social need, rather than in terms of the methos by which you accomplish certain tasks. He says the real challenge to education is "to get out of skill-oriented into *mission-oriented* programs of instruction."

B. Background Leading to Proposal

What is the background leading to the project?

What studies, surveys or projects have already been completed?

Consider who is presenting the request for financing. What is the place of the project in the national development plan? What priority is attached to it by the government? Consideration should be given to all previous studies, surveys and projects which led to the proposed program, such as manpower surveys, studies of worker competence, follow-up studies on graduates of speific training programs, or a project to train high-school drop-outs.

C. Project Relationship to Total Agricultural Program

Is the project a prerequisite to an agricultural development program?

What kinds of activities will be supported in agriculture?

Consider whether or not a particular project is a requirement for the implementation of any regional or national agricultural development plan: For example, the proposed project may be a supplemental program to train all farmers in a new irrigation scheme to produce cotton as a new commercial crop, or it might be to train farmers in the use of agricultural tools as part of an improved farming system. In considering the activities that will receive support from a particular project, take into account other local, regional and national programs which may be involved such as fertilizer promotion, farm accident surveys, demostration of improved varieties or future farmer activities for community development.

D. Complementary Programs

Are other complementary activities needed?

If so, what other activities are related to project purposes?

Does a proposed project need other complementary activities or projects to make it go? For example, the introduction of cotton as a new cash crop may require the organization of producers into a marketing cooperative. Any great distance from the gin and the high cost of transportation may make it desirable to process the cotton locally. Both agricultural teachers and extension agents may have to be trained in these new functions. The farmers' knowledge must be based on an adequate general education that can be constantly adapted and renewed. Advisory and service work should also be an extension of vocational agricultural training and should be

based upon the capacity to acquire new knowledge. While the farmer must be able to rely upon advisory experts, he must be sufficiently trained to understand the advice received and, if necessary, to **correctly adapt** it to his special circumstances.

3. Considerations of Background and the Role of Agriculture in the National Economy

A. Current Importance of Agriculture

What is importance of the agricultural sector?

What is the relative economic importance of cash production?

Consider the importance of the agricultural sector in the national economy: What percentage of the current production is available for export and capital formation, if any? How many people depend upon agriculture for their livelihood? What is the attitude of young people toward agriculture? What percentage of the general national budget funds are supplied by taxation on agriculture? What percentage of the national budget is spent on agriculture and agricultural education? What is the relative economic importance of cash production subsistence production?

In Kalimantan (formerly Borneo of Indonesia), the writer spoke to a group of students enrolled at the agricultual University of Lambang Mungkurat and asked how many of them came from a farmer's family? Even though most of them were from rural areas, *not one* student raised his hand. The local newspaper carried a front-page article the next day which chided the students by asking, "Were students all ashamed to admit that they came from farms—even though they were studying agriculture and related subjects?"

In Ethiopia, from 80 to 90 percene foreign exchange is earned from the sale of agricultural products, and over 60 percent of the domestic revenue is derived directly from agriculture. With only about 2-3 percent of the national budget being spent on agriculture, it is not hard to see why progress in agricultural education and agriculture has been so meager. In contrast, Morocco—with less dependence upon agriculture—is spending about 25 percent of its budget on agriculture and has made remarkable progress during the last few years.

B. Future Potential of Agriculture

What is the potential for agricultural development?

What is agriculture's immediate and long-term role?

In most developing countries there is either unused land or land that has not been fully developed for crop or livestock production. What is the potential for agricultural development in a market-oriented economy? What role is seen for agriculture in the national development plan in the short and long-term outlook? In Sudan, for example, there are about 110 million acres of flat fertile soils that could be developed with dry-land farming techniques. Sudan has large irrigation projects which have resettled thousands of people, but the potential for the undeveloped land is even greater. The immediate role is to supply farmers already established with more of the improved farming inputs such as improved seed, tools fertilizer and credit. The long-range role is to develop more irrigation farming and to exploit the dryland potential with good soil erosion control practices. All of this requires a strong program of agricultural and technical education to develop an adequate extension staff supporting vocational agricultural and agribusiness programs in local villages.

C. Prevailing Patterns of Agriculture

What are the patterns of land-use, land-tenure and ownership?

What are the various types of agriculture and geographic locations?

What is the current use of modern inputs and techniques?

What is the present level of agricultural incomes and wages?

What is the economic efficiency of typical farms in major enterprises?

What is the total rural and urban labor force and population?

What is the active farm population and employment situation?

Consideration studies for investment potential should include making a brief outline of the prevailing patterns of land use for arable oultivation, for pasture and livestock production, for foreses and tree crops, for unused but farmable lands, for waste or non-agricultural lands, for farmsteads, villages and cities, and for other man-made structures such as roads and highways. Consideration should be given to the land-tenure system and ownership patterns, using census data if available. This should include tenancy arrangements, number of tenants and sharecroppers, percent of farmers who own their land, and size and fragmentation of land holdings.

Consider the various types of agriculture—shifting cultivation, permanent subsistence, market-oriented commercial—and give their geographic distribution. Determine the current level and use of agricultural techniques and modern inputs such as row-cropping, weed and insect control, irrigation, rotation, multiple cropping, fertilizer, improved seeds, and animal and mechanical power; again using census data if available.

Assess insofar as is possible the level of agricultural incomes and their distribution, indicating the amounts received from crops, livestock, work off the farm, sub-

sidies and value of products consumed in kind. What is the level of wages received in agriculture and how to these wages compare with non-farm work and urban wages? In the major areas and types of production, consider examples of the economic efficiency of typical farms. What does it cost to produce a kilo of beef or pork, or a kilo of rice or wheat, for example? How many man and or woman hours are required to produce the above?

Using census data or surveys, study facts concerning the total population and the labor force divided into rural and urban. Determine the active farming population by sex, age group, occupational level and special activity, if possible. What is the employment situation in rural and urban areas? What is the unemployment and under-employment by area, age, skill level and occupation? Is unemployment due to the lack of job opportunities or is there a shortage of skilled workers, or both?

D. Supportive Infrastructure

What markets are available to famers?

Is reasonable transportation available?

Does storage exist to hold harvest output?

Is local processing available for farm products?

It does the farmer little good to increase his production if he cannot market it or if the price falls due to over-supply. Without adequate storage to absorb and hold harvest gluts, the farmer cannot market his crops in an orderly way and is often forced to sell to traders or speculators and then buy back his own production later at a much higher price. Local processing can also increase the value of farm products and provide jobs and revenue for the rural community. Drainage and land reclamation can make land fit for production or make it more suitable.

A good transportation system is essential to move products to more distant markets and to bring back goods and manufactured materials at reasonable prices. Infrastructure investment in roads, railways, bridges, ports, communication and electrification benefit all sectors of the economy but have special application for the agricultural sector. Access roads can make new land available for production. The degree and quality of the transportation network has a major effect upon agricultural development in new areas and agricultural production in old areas.

Quoting Ethiopia again as an example, the weak supportive infrastructure in that ancient land is a major constraint upon agriculture today. There are limited storage facilities for even the most prevalent subsistence farming; markets are few and widely scattered; there is little food processing done in the country; and a half-way adequate transportation network will be long in evolving in Ethiopia's rugged and mountainous terrain.

E. Trained Manpower Shortage in Agriculture

What is the availability and distribution of trained manpower?

How well is manpower utilized —is there a shortage?

What is the recent trend in wages and differentials between occupations?

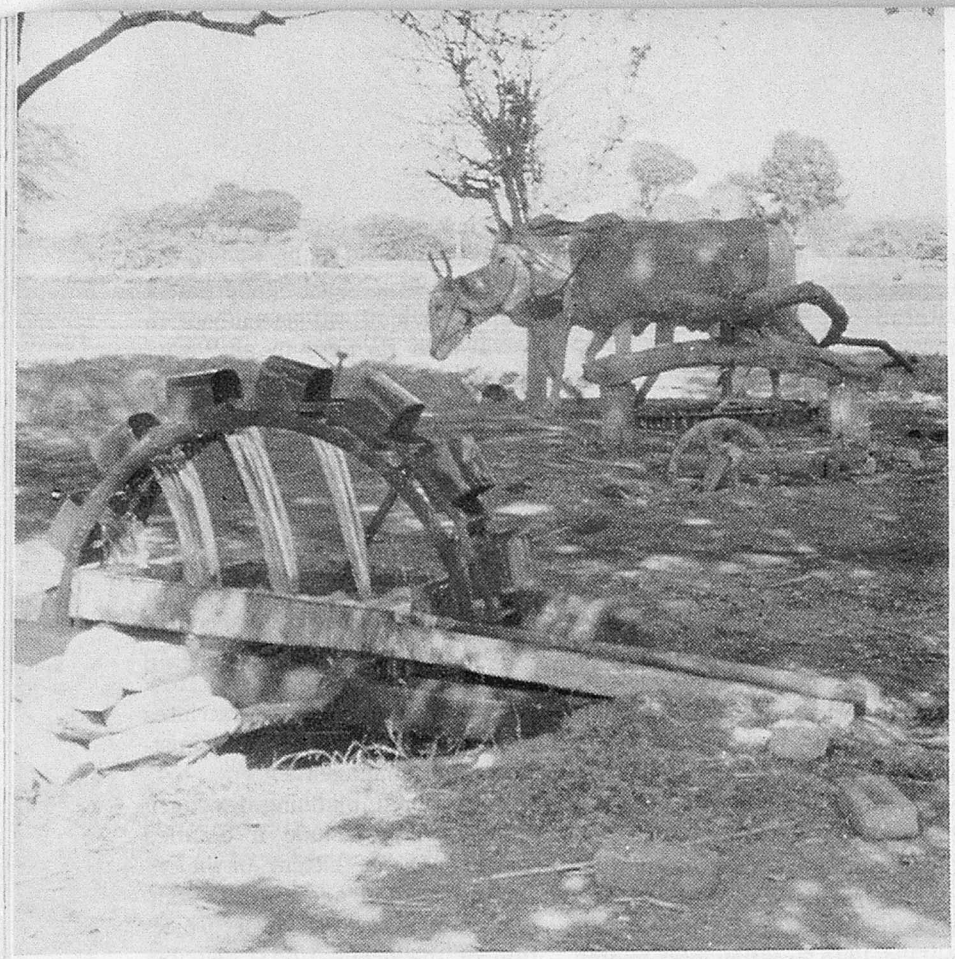
What is the extent of use of expatriate high-level manpower?

Consideration should be given to evidences of current shortages in trained manpower in the agricultural sector. How many farmers have received training in farmers' institutes, workshops, short courses or extension meetings? In more developed areas, do farmers receive information through the radio, newspapers or any other printed materials? Are certain areas or regions critically lacking in opportunities for farmer training? How many extension agents or agricultural teachers are available to counsel farmers? Does local government supply agricultural specialists to work with farmers in any way? In the state or provincial governments are the trained specialists tied down in administrative duties or do they get out into the field for on-the-spot appraisals of problems?

Do wage trends encourage trained manpower to leave agriculture and go into other occupations? Is anything being done to stop or alleviate this loss? How much use is made of expatriates in high-level position in administration and management?

Educational planning for agriculture must include a detailed analysis of the extent of *underemployment* in agriculture. Manpower inventories and a projection of the occupational distribution in terms of manpower requirements are converted into educational qualifications and targets for each sector and branch. There is an over-riding need to educate and train the population of rural areas both for a developing agriculture and for occupations other than agriculture. The main objective is to provide agricultural education as well as to facilitate the movement of people from agriculture into other sectors of the economy. The training should ensure the adaptation of those remaining in agriculture to changing orgnization and methods arising from economic development.

Perhaps the most important problem facing developing countries is the critical shortage of educated and trained personnel at all levels of proficiency in every enterprise of agriculture. At the highest levels a deficit of key people can temporarily be met by importing scientists and technicians, but this is only a stop-gap measure. The shortage of agricultural development specialists, including rural leaders, is an acute problem in the more remote



The Persian wheel is the most effective instrument for irrigation before the introduction of motorized energy. The Persian wheel is most common in Northwestern and Northern India. It can be utilized only, if the groundwater reaches a high level.

regions or less advanced regions of a nation. In Ethiopia, for example, the government is finding it impossible to adequately staff the primary Alemaya Agricultural College in the northeast quarter of the country. The location is good agriculturally but is far removed from a major city, and wage levels are low. A secretary in the capital of Addis Ababa can make more money than a professor with a master's degree at Alemaya. As a result, the U.S. AID program is still supporting 13 professorial positions in the College of Agriculture after almost 20 years of operation and external support.

F. Projected Manpower Requirements in Agriculture

What are prospective requirements for trained manpower?

What types of training are needed for the national development plan?

What is the estimated demand from active government agricultural programs?

What is the estimated demand from local or autonomous agencies for target years?

What are the numbers and types of personnel needed annually for program implementation?

Calculations should be made regarding the prospective requirements for trained manpower in agriculture, by type of training, as proposed by the national development plan. Estimates should be made of the demand originating in local or autonomous agencies which are charged with the agrarian reform programs and other development projects such as irrigation, resettlement, land reclamation, livestock, game reserves, forestry and livestock projects. These demands should be based on the target years of the development plan, projecting the number and type of trained personnel needed for their effective implementation and supervision.

No country can develop very far on borrowed brain-power. The national people themselves must furnish the will and the creative force to bring about change. What developing countries lack most is the knowledge of how to bring about the desired change. Thus education lies at the heart of agricultural development. Merely providing agricultural education does not solve problems, however, just as rapid industrialization does *not automatically* produce as a by-product the skilled manpower needed at every level. The training of people in agriculture must be planned from the start of any project and carried on continuously as development proceeds. Training must keep step with the expanding economy so that the required skilled manpower will be available for each new project and for the expansion of previous programs.

Economically the projection of skilled manpower needs serves as the basis for the efficient allocation of resources not only to the educational sector as a whole, but to its component parts as well. A UNESCO report (1964, Basic Study No. 15) states, "Without projections of the types of skill which are likely to be in demand a decade or more ahead, and the number of trained persons who can expect to find appropriate employment, there is a considerable risk of bottlenecks in the form of shortages of skilled labor, or else of creating an over-supply of certain qualifications. The usual dilemma is a shortage of certain skills only, sometimes accompanied by overt or disguised unemployment of those who have acquired proficiency in different fields. The optimum returns are obtained through a careful analysis of trends in the economy and the allocation of resources to key educational sectors in accordance with projected manpower needs."

Manpower needs in agriculture

must also take into account possible rural population transfers within agriculture from region to region, or from one type to another, as well as migrations to the industrial sector. Planning must be based on the characteristics of the economic system and its capacity to achieve the desired rate of output so that the quantitative and qualitative predictions of manpower requirements can be made for the various sectors of production. The kind of investment in human resources made in agriculture determines the quality of the largest segment of the labor force and consequently its contribution to the growth of both the agricultural and non-agricultural sectors.

G. Existing Institutions in Agriculture

What institutions are concerned with agricultural education?

What personnel are engaged in teaching, research and extension?

What personnel are working in non-government organizations?

Consider which public or semi-public institutions are responsible for education in agriculture. Determine the numbers, types and areas they serve. Where are they located and what courses do they offer for youth and adult education? How many persons are engaged in teaching programs, research and extension activities? Do they operate under the same ministry? How well do they coordinate their activities? Is there waste or duplication of effort? Do the research centers provide teachers and extension agents with information and answers to help solve the farmer's problems? How many other educators are working for private firms in agriculture or in other agencies concerned with agricultural production? Do they provide services not available through the government services? How do the private and semi-private associations finance their educational operation? Can new members join established associations and benefit from their expertise?

A large and rapid increase in the productivity of the rural economy is required to feed the growing populations and rising consumer expectations in developing tations. For this achievement, fundamental changes in the attitudes and insitutions of rural societies and in technological innovation are needed in all aspects of agriculture. Technical and vocational agricultural education must, therefore, have an understanding about the customs, productive patterns, traditions and social mores of communities. There is a complex interaction in the community because of the large number of people with a wide variety of interests for which it is difficult to determine the best course of action for greatest benefit to the community and the nation.

Occasionally a private foundation or school will step in to help solve a difficult problem where the government is either unable, unwilling or is unconvinced that a problem exists. The Narosurra Farm Mechanization Training Scheme in Kenya was formed by a private farmer to help African farmers learn how to use modern machinery and methods to farm more efficiently. Many of its graduates are now private contractors who perform machinery hire services for their neighbors in land preparation, cultivation and harvesting.

The training of agricultural technicians should be the responsibility of the national and/or regional governments. The government should, however, make all efforts to encourage large agricultural enterprises and industries not only to continue their existing training schemes but to expand them and to set up new ones. Encouragement should take the from of financial incentives and even direct subsidies for trainees by allowing industries to write off the cost of equipment, buildings and instructors used for this purpose.

All training syllabi should be revised and adapted to the actual labor market. New trades and skills required by changing local conditions should be given formal status and new training programs designed to meet basic requirements. The teaching of management should be included for all small agricultural, industrial and servicing enterprises.

Government supported technical schools and trade training centers should aim at complementing manual skills with principles of technology, improving the apprentices' language mastery, demonstrating the use of modern machinery, and teaching elements of management. Special demonstration mobile training vans can be used for conducting such courses for workers in villages and small industries far from the established technical schools.

4. Considerations of the Existing National Education System

A. General Education: Primary Level

What priority does primary level education have in the national budget?

What are its curricula and objectives?

What is the quality of its staff and facilities?

Consideration must be given to the current primary education system. Is the government committed to extending compulsory primary education to all citizens as a first priority? What percentage of eligible youth are enrolled in primary shools, and what percentage who start their education go on to graduate? What factors cause dropouts, and what percentage of the repeaters complete the requirements? Does the curriculum in rural areas have an agricultural bias? Does the curricu-

lum provide any pre-vocational training so that its graduates who do not go on to secondary schools will have some preparation for employment?

UNESCO (1964, Basic Study No. 15) says that even primary education which is mainly general and non-vocational should include some means of giving children a liking and respect for manual work. It should accstom them to observation and creative effort and encourage in them an intelligent approach. Learing through observation and action should supplement the acquisition of knowledge through books so that pupils will relate what they learn in primary scholl to the realities of everyday life.

In most developing nations, schooling is already absorbing a large portion of national budgets and of gross national products. Much of this expenditure is required by the rapidly expanding primary school systems which are politically popular. The problem of improving the quality of elementary teaching is largely one of funds to train and hold better elementary teachers. Professor Hanson, in his research study of the developmental aspects of education in Africa, carried out for the Institute for International Studies in Education at Michigan State University, writes (1965, p. 7), "The failure to challenge our basic assumptions about the identification of *education* with customary *formal schooling* may be the genuine educational treason. There is every reason to believe that schooling as we have known it, and the rapid expansion of this schooling, may be creating as many new problems for Africa as it is solving old ones." Another dilemma pointed out by Hanson is that once whetted, the drive for schooling does not slacken. The consequences of primary schooling for everyone tends to feed the smoldering fires of social discontent, disorder and destruction. The hallucination that a schooled population will solve the problems of developing nations is all too common. Hanson (p. 9) states that the sterility of educational thinking is shown in Nigeria where the number of primary school certificate holders must now number in the millions. The fate of these youngsters is explained by stating their poor qualifications are not in keeping with the demands of a modern economy. The easy solution is to assume they need more education and absorb them back into the educational system to be reshaped into more suitable products. But the doors of employment opportunity can be very fleeting and unpredictable. The danger of trying to give further training to millions of primary school leavers is that it requires the use of many of the already scarce resources of a developing nation. If used for primary education they cannot also be used to create an expanding economy without which there can be no additional jobs.

B. General Education : Secondary Level

What priority is given to secondary education in the national budget?

What are its objectives and curricula?

What is the quality of its facilities and staff?

In most developing countries the secondary school system is just beginning to unfold. Secondary schools are found primarily in the large cities and cater to the urban population. Students from rural areas have difficulty passing entrance examinations and also finding places to board while attending the better schools. The curriculum is primarily academic and aimed at further schooling. With the very limited opportunity to go on to college or to the university or to post-secondary technical shcools, most students are not prepared for skilled employment other than for clerical type jobs, selling and some service positions. In Nigeria, Hanson (p. 10) points out that the Secondary Modern School was developed in Western Nigeria to absorb the primary school leavers and to give them more practical training and knowledge. They now have to compete with secondary grammar school gradustes who are likewise unable to find jobs for which they are qualified. Hanson concludes by saying, "There has been to much easy thinking that schooled manpower would attract or ensure speedy economic development." The educational task seems to be one of making sure the right valves are opened and that the product which flows from them possesses the qualities which make it suitable for sound and economic development. The traditional secondary grammar or high school has *so far failed* to meet these requirements.

C. General Education : Vocational and Technical Level

What priority is given to vocational education?

How does its curricula measure up to general education?

What resources are available in staff and facilities?

shcSerious thought is being given in many developing countries to a form of secondary education which is vocational or technical in nature. This change in attitude is forced upon most educators when conventional secondary school system graduates are unable to find employment. However, the kind of vocational education needed is difficult to ascertain. In developing countries with low industrial capacity the number of job opportunities is extremely limited. Simply expanding vocational eaucation or converting secondary modern or grammar school into vocational education and technical secondary schools will *not create* more jobs for graduates.

The trend to include certain technical subjects in general sec-

ondary education programs should be encouraged. In the higher grades all pupils should be offered a choice between various special subjects as part of their vocational guidance. Where possible, methods of vocational guidance should be based on precise forecasts in the available fields of employment. Unfortunately, the rapid explosion of education has far outpaced society's ability to create jobs and opportunities and this situation can only worsen as the secondary school system spreads to all parts of each country.

Education places heavy demands on the fiscal resources of a nation, and since vocational and technical education programs are even more costly to implement, untimely and unwarranted expenditures for them may take away money needed for capital investment to create new jobs. The traditional vocation school, copied after European or American models, will probably be unable to make more than token contribution to economic development because it is often out of touch with reality and the aspirations of the people it is supposed to serve. Whether vocational and technical education succeed appear to be related to at least five factors (Hason, 1965, p. 34):

1. The perception of the students and potential students that vocational courses will actually "pay off"
2. The development of work habits and attitudes which subsequently enable students to make a success of manual vocations
3. The relevance of courses of study to African —or any other country's conditions
4. The existence of bridges over the chasms that separate school from successful earning power
5. The reinforcement which comes from continuing help, follow-up or cooperation.

Educators must demonstrate leadership and ingenuity of action which take these factors into account before vocational or technical education has much chance of succeeding more than the typical secondary school in a developing country.

D. General Education: College and University

Consider the curricula, staff and facilities of the universities.

Consider the national budget for education and its itemized distribution.

Consider the quality of the graduates and the contribution they make.

Consider the role which the university is filling in providing the needs for high-level manpower in the developing economy.

Universities are both prestigious expensive showplaces for a nation. They can serve a critical role in long-range planning and development. Initially they have an important job in educating the trainers and teachers for all of the lower-level educational institutions. They also serve as the source for most of the professional and semi-professional people needed to staff and operate the burgeoning government bureauracies and business establishments. Over-emphasis on post - secondary education can cause disillusionment to many secondary graduates who are not able to compete for the very select spaces in the university system. As such the university system should be played down for the average secondary school graduate until the national economy is on a sound economic footing.

One of the problems at the university level is that most students want to become lawyers, doctors or politicians; very few desire to become engineers, scientists and agriculturalists. This is in *inverse ratio* to the needs of developing countries. Students often only apply for agricultural training after they have failed to get into everything else. Part of this is due to the low professional image of agriculture and part is due to the fact that most students want to get away from the drudgery and limitations of the life they saw as identified with traditional agriculture. In Sumatra, for example, the student body at Medan University in 1962 numbered about 2,000 students in law and political science, about 1,500 in the fine arts, about 300 in the physical sciences, 50 each in medicine and engineering, and only 25 in agriculture.

5. Considerations of Existing Agricultural Education System

A. The General Structure of Agricultural Education

Harvest of sugarcane. They cut the cane with sickles.

What curricula and courses are available?

What are the qualities and work of the teaching staff?

What is the statistical record of the system?

What physical facilities are available?

What is the student input and output?

What is the investment in the system and recurrent expenses?

Consideration must be giveen to the whole structure of agricultural education and training. Take into account the number and kind of institutions at each major level: farmer training, vocational training, intermediate level of technical training, professional and/or university level. Assess all institutions by location and training level and obtain the following information for each:

1. **Curricula and Courses:** What are the entry requirements by education, background age and standards? What is the length and content of each course? What is the ratio of theoretical to practical training? Evaluate a break--down of the class or training schedule by the hour and week. What other activities are provided outside of class and laboratory experiences? Is there opportunity for in-service training or on-the-job experience? What are the qualifications gained by a graduate? How does the graduate's training compare with those of other agricultural, technical or general education institutions of the nation? Is there any evidence of the graduate's ability shown by follow-up studies or evaluation by employers or examiners?

2. **Statistical Information:** For a five-year period, or as long as the school has been operating, assess data on number of applicants, entrance qualification of students, enrollments by school year, number of dropouts, number of repeaters, subjects repeated, size of classes, hours of laboratory work, hours of field work and practical work, the number of graduates, and such other data as may be available and descriptive.

3. **Teaching Staff:** Assess each of the teaching faculty with regard to their qualifications of education, experience, technical abilities and trade or professional licenses. All staff and teaching assistants used for demonstration and practical training should be included. Consider the facilities used for staff and teacher training. What in-service courses and refresher courses are offered by the staff? What are the staff activities other than teaching,—research, extra-curricular functions, consulting, and government service? What is the range of staff pay by grades or levels? What are the career prospects as compared to other branches of the agricultural and government services? If possible, determine the morale and enthusiasm of the staff for their work and the future of agriculture. What are student opinions about the staff and their work?

4. **Physical Facilities:** Consider the location of the institution in relation to its function How close is it to government and private experiment stations and agricultural extension agencies? What other educational institutions are nearby? Ascertain the quality and capacity of the student residential and teaching staff accommodations. What facilities are available for theoretical and practical training, including equipment and machinery, tools, scientific and laboratory devices, visual aids, text books, reference materials and library? Consider the land area, laboratory workshop and farm equipment used for field work and research experiments. Are there at present other facilities nearby that are used for external training such as farms, markets, cooperatives, processing plants, settlements, factories and private businesses?

What is the quality of maintenance of school facilities? What is the general appearance and housekeeping standard? How up-to date are the teaching materials and equipment? Does the school cooperate with dealers and businesses in keeping current machines and equipment on hand for teaching?

5. **Students and Recruitment:** Form what cultural and social backgrounds do students come? How many have had agricultural experience and how many come from farm families? What is the financil status of students and their families? How were students recruited and why did they choose agriculture as a profession? If the shool is below capacity, why was it unable to attract sufficient numbers of qu - lified students? Consider the physical facilities provided students for study, rest and relaxation. What social activities and vacation privileges do they have? Most importantly, what are their employment prospects on completion of training? What does the school do to try to locate students in jobs? Is an employment referral service available? Does the school make follow-up visits with graduates to see how they are progressing and to determine how they might improve the school curriculum and training program?

6. **Finance and Investment:** In the past much capital has been invested in the institution? What is the projected investment; for what will it be used and when? How will the new investment improve the capacity of the school to offer superior training and qualifications in its graduates? How much is the annual recurrent budget and what is the breakdown by classes of expenditure? What are the sources of funds and what percentages are provided by local, national or foundation support? Is the institution receiving any support from technical assistance sources? Can the school increase its support

from local sources for recurrent expenses? Can the school farm or experiment plots supply food or provide off-farm sales for special needs?

B. Adult Farmer Training Programs

What adult farmer training programs are now being offered by schools,farmer training institutes, agricultural extension services, agricultural supply services, marketing cooperatives or commodity organization? Are programs given at the village level and taken out to the farmers, or held at schools or other government facilities? How many programs are offered per year in each geographic location? How many farmers attend each type of course? What is the best length course and when should it be given? Is it necessary to use inducements to get farmers to attend training courses? What types of course are most popular? What do farmers say their problems are, and are courses offered whichmeet their needs? What do the farmers think of the courses they have taen? Do the same farmers take each new course or are new armers continually being brought into the program? Have these farmers training programs helped to develop community leaders? Has the illiteracy of the farmers been a hinderance to learning by demonstration and group discussion?

Educational problems such as illiteracy are very significant for agriculture since this limits the receptivity of the rural society to the transmission of new knowledge and slows down the introduction of new practices necessary for agricultural development. It is increasingly evident that raising the living standards of the vast majority of the world's people cannot be done by crash programs. Agricultural education is a long and never-ending process. Planning and financing to speed up such a process must be long-term and continuous.

C. Projections of Output

What are the main features of the agricultural education development plan as proposed for the current and succeeding years? How many new programs have been planned and how many will actually be funded for the next two fiscal years? What is the five-year outlook for agricultural education in terms of number of new facilities needed, demand for teachers, number of students to be trained in schools or other programs, the number of adult farmers wanting special short courses or workshops, and the change in teacher preparation programs at college or university level? What is the 10 and 20 year outlook for agriculture in the area and the role of agricultural education in meeting the needs of these engaged in farming at that time?

What are the projections for the next five years of graduates from each of the agricultural education institutions at the different levels and specialties? Will there likely be a shift in demand from general production agriculture into more specialized areas such as dairy, seed stock, single crops, highly mechanized farming, or non-farm agricultural business? How will current programs in agriculture teacher education be modified or adapted to meet these new requirements?

What means is provided for evaluation and feedback? The evaluation of curriculum content for improvement and up-dating is very important in keeping up with rapid technological change. Feedback can answer questions about how the curriculum functions in practice, whether it turns out suitably qualified workers and what can be done to improve performance by changing training methods or selecting candidates. Two recommended methods of getting feedback are through advisory committees and follow-up studies of graduates. Advisory committees can help set entrance standards and develop curricula and add prestige to the training program. Training institutions should check on the success of graduates to determine whether or not the skills and knowledge learned during training are actually applied on the job and are of value. If such evaluation procedures are not currently being practiced, they should be introduced.

D. Additional Facilities Needed

The considerations concerning projected manpower requirements discussed in Section III F are also applicable here. Based upon the projected demand of trained manpower and on the output of the agricultural education institutions, what additional agricultural teacher training facilities are needed to meet the national development plan? Consider the demand and supply in each major region. Where is large-scale commercial agriculture likely to develop within the next 5 to 10 years? Where will the greatest demand occur for agricultural training and the need for new facilities? What are the government's plans for large-scale irrigation schemes or land reclamation projects? Where will be the greatest concentration of new agricultural secondary schools or vocational agricultural programs in existing schools?

6. Considerations of Factors Affecting Proposed Agricultural Education Project

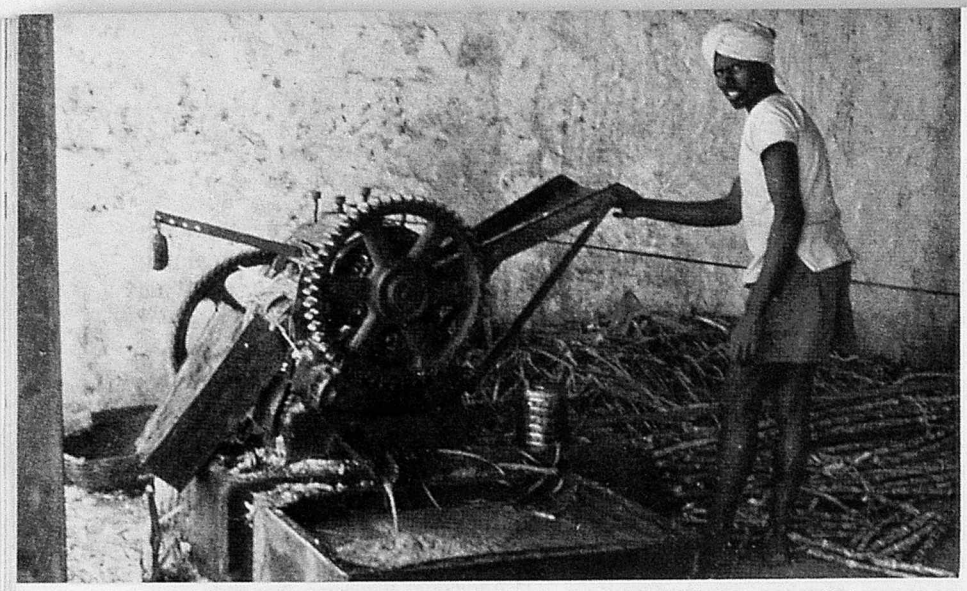
A. General Scope of Proposed Project

What does the project concern and what is its duration?

Who is responsible for its execution and operation?

What occupational sectors are directly affected?

Where is the project to be located and how long will it be supported? What is the area of influence of the project? What are the primary and secondary



Processing of sugarcane. The cane is crushed and pressed with a motorized cane-crusher. The juice is cocked and slowly condensed into gur, a semirefind, yellow-brown raw sugar, which is marketed and quoted in the markets.

concerns of the project? Is the project one of high-level planning, including the formation of policy, so that it sets new procedents and is therefore national in scope? Is the project concerned primarily with the construction and furnishing of facilities for an expansion of the present system and therefore regional in nature? Will outside agencies or other institutions be assigned responsibility for any of the detailed planning, execution, operation and control of the project? If so, how will coordination be established and liaison be maintained? How are the occupational sectors of agricultural education going to be affected by the project? Determine whether or not the project will result in higher standards in teacher training through better preparation and more realistic training, or through greater output of graduates due to additional facilities for teacher training, or new and more specialized curricula to meet the need for changing technology in commercial agriculture.

In this day of rising aspirations and mass communication, farm boys are not going to sentence themselves to traditional agriculture if they can possibly avoid it. What is needed is a *sweeping modernization* of rural life through land reform, agricultural research, extension services, widespread rural community development, and effective utilization of local labor in building roads, irrigation systems, schools, houses and other projects to make rural life more productive and attractive.

B. Proposed Policies

Consider new policies to improve the instructional system.

What sequence of action is to be followed?

What are the new policies to be adopted to improve the agricultural and technical education system? How will they change the character of new schools and programs? How will they effect programs in existing schools? Will preasent teachers need to be brought in for special workshop training? Will additional staff be needed to implement and carry out changes in policies? will the new policies change the standards of certifying teachers? Will new courses need to be added to the teacher training programs at the colleges or universities? Can present courses be modified to include the new techniques, materials or requirements? Will closer cooperation be required with industry and the business and social community? Will the new policies require an advisory committee or expansion of the scope and work of such committees?

What is the sequence of action to be taken in implementing new policies? What measures should be followed in modifying the internal organization of the school? Can regional committees of teachers be formed to revise and up-date courses and lesson plans? How will the modified courses be tested and evaluated? How will the field work and practical training be affected? How will the new measures affect the relationships between staff and students? How will it affect the image of vocational agricultural students with other students in academic and technical programs?

UNESCO (1964 Report) says it is imperative that agricultural education should not be planned as "education apart from" but should be fully intergrated into the national system of education. The provision of skilled manpower for agriculture at all levels involves technical and vocational agricultural education based upon a high degree of scientific and technological competence. It is urged that all education should have some practical bias. Separation may imply lower status for technical institutions and lead to over-specialization in skills which may become redundant. Technical education developed in conjunction with actual work in industry and agriculture economizes on manpower and is productive while learning.

Educational norms on the number of students per class, number of specialist teachers per class, funds available for education and annual cost per student are important in education planning. Close liaison must be established with agricultural research institutes and advisory services, and cooperation must be fostered with agriculture, industry and commerce in assessing educational facilities for practical training. Technical agricultural education must include emphasis upon flexibility and adaptability, diversity of specialization, and practical work to contribute to the demand for occupational flexibility. The need for "learning to learn" rather than memorizing sets of formulae is crucial.

C. Educational and Physical Data on Proposed Facilities

Consider the academic program for the proposed institution(s)

Evaluate the student body of the proposed institution(s)

Determine the source of students and teachers for proposed institution(s)

Consider the location and administration of proposed institution(s)

For each institution or group of smilar institutions proposed in the project, determine the following basic educational data: the school objectives and over-all program; the duration of programs and the academic year; the number of applicants and the minimum standards for admission and selection; the class hours per week and the size of classes; the curricula design; the practical content; the teaching methods; the requirements for advancement and graduation; the kinds of qualifications awarded; the library facilities; the availability and source of text books; and the types of instructional equipment.

For the student body supply information on: the input, output and enrollment in each academic and vacational program and class by full-time, part-time and evening classes (consider for the past 5 years if an expansion program); a year by year projection during the development state up to completion; separate by day students, boarding students, sex and regional sources where suitable. Consider the preparation of and readiness of the students to accept training.

Consider the source of teachers by numbers, qualifications and availability to meet the proposed development; the basis for the proposed distribution of schools; and the proposed administration of the school.

For each institution , evaluate the physical facilities; Location and siting with a site plan; architecture in sufficient detail for cost estimating; a list of instruction equipment to be purchased; and a list of needed furniture.

D. Proposed Timetable

Is there a realistic timetable for the design, construction and furnishing of the facilities? The scheduled timetable should show other essential and related stops in the project implementation such as: recruitment of educational consultants; hiring of expatriate teachers, administrators; legislative or administrative actions; site acquisition; arrangements with external agencies; selection of architect; submitting of bids; and all financial arrangements.

E. Cost Estimates and Financing

Capital costs

Annual recurrent costs

External costs for personnel and training

Total cost of project

For each institution or group of similar institutions proposed in the project analyze the capital cost to include: building construction with internal utilities; site construction with external utilities; architects; engineers and professional fees; land and acquisition costs; furniture, shop and laboratory equipment; instructional equipment; contingencies; and foreign exchange costs.

Plans should include a breakdown of salaries for staff and faculty; teaching supplies; building operation costs; maintenance costs for the plant, equipment and grounds; insurance and other contingencies. Consider the cost of hiring foreign personnel separately and also the costs of oversease training for local personnel. Consider aid or grants recevied from financial assistance programs.

Finally, assess the total cost of the project. What is the amount of the foreign exchange component that cannot be provided from local funds? Who will supply the local currency component? What means will be available to guarantee the annual recurrent local costs? What priority does the national budget put on the project?

F. Administrative Responsibility for Project Execution

Assess the government agency or department responsible for planning, implementing, executing and administering the project. Does it perform its current work efficiently? Is it adequately staffed and organized to execute the proposed project? What provisions can be made to reinforce it if necessary? How will educational data be secured? Who will be assigned responsibility for developing the new curricula and coordinating it with the facilities and instructional equipment?

Who will supervise the construction activities and work with the contractor (s) to see that they perform their work properly and on time? Will technical assistance be needed for either the construction phase or the educational program of the project? How long will this assistance be required?

7. Economic Justification

A. Compute the Estimated Cost per Student per Year

One way of determining the investment cost benefit structure of a proposed educational project is to compute the total investment cost and break it down into a cost per student per year. If the project is the construction of a new two million dollar facility for training teachers and has a 50-year potential for useful life and an average annual output of 200 agricultural education teachers per year, the investment cost benefit base would be for 10,000 student years. The original capital cost per student year would then be $2,000,000 divided by 10,000 or $200 per student per year. Any other use of the facilities by other classes or programs would further reduce this cost. The recurrent operating and training costs could be calculated

similarly. If the total annual cost to train the same number of student teachers (200 per year) is $200,000, the cost is $200,000 divided by 200 or $1,000 per student per year. A major question is how do these costs compare with other similar system in total costs and item by item. If the goals are realistic and attainable, how does the proposed project measure up to other efficient existing projects?

B. Evaluate the Benefits to Be Derived from the Project

There is, of course, no "pat answer" as to the benefits or their material value. Each project must be weighted according to its own individual merits in terms of the usefulness of new programs developed, the higher quality of the teaching staff produced, the larger number of teachers trained, and the competence of and need for the skilled workers, technicians, farmers, professional and scientific agricultural people directly or indirectly trained by the project. The many considerations which must be analyzed and wighed are discussed in the foregoing pages. While there are many factors which affect the economic justification of a project, it should be emphasized that one of the primary concerns of a lending agency is the ability of the borrower to continue the project once the external aid is discontinued. Tobias (1966, p. 413) says, "Foreign currency requirements are usually only a small part of the cost of education. The basic capital, and almost all the recurrent costs, will have to come from local resources. It is useless to lay out capital for education unless there is a dependable local source of revenue for operating expenses. Prospective lenders need to be reassured that operating costs can be met ..."

A good example of this problem exists in Kenya in East Africa. The Swedish government made loans and grants in large amounts to the Kenyan government to build a very modern and beautiful facility to train secondary and collage teachers in science and technology. After the facility was constructed on the outskirts of Nairobi, the Kenya government found it did not have enough funds to finish equipping the building to make it fully ready for occupancy nor the necessary funds to hire the staff and faculty required to operate it as a teacher training center. When we last saw the building in 1969, it was still receiving only token use — several years after its construction.

C. Consider the Loss If the Project Is not Carried out

The loss to the country if the project were not carried out must be evaluated again on the merits of each specific case. If projects and programs in agricultural and technical education could not be initiated because of a lack of qualified teachers, what would be the long-term economic impact on the nation's agriculture, or on a major agricultural area, and its contribution to the national economy in terms of such things as: products for export, raw materials for industry, commodities for internal use and consumption, and a mass market for all the other industries and enterprises of the national economy? If the project is a prerequisite for a larger project in agricultural development as part of the national development plan for agriculture or education, what would be its affect on the total development program? In what way would it hinder, delay or force cancellation of other important works or measures in the development plan? If the availability of skilled or professional presonnel were delayed, what would be the cost in annual increments? In lieu of local training and expanded agricultural education programs, how much would it cost to bring in qualified people from outside?

From the foregoing analysis it is obvious that there is not a simple answer to the question of economic justification. Many variables enter into the consideration including the basic role of education in cultural and economic development of human resources. In summary, how important is education to the nation's welfare? What is the attitude of the nation and its people as to the need for education? What priority is given to it in local and national budgets? What kind of education will equip men with the skills and knowledge they need for life's work and for the full development of the nation? Again, what is the economic role and the future of agriculture in the national economy? What part does it play in providing jobs, generating government revenues and creating the capital resources essential for economic development? What is the image of agriculture as a profession and what must be done to make it more attractive to the best students? How necessary is this in terms of providing an adequate and reasonably priced food supply? How important are the vast number of jobs that must be provided for the majority of the nation's labor force in agriculture?

Consequently, as a proposed project in agricultural and technical education, does the project under consideration have a high priority in the national development plan? If the project is urgently needed, how much of their scarce resources are they willing to commit to the project? What other high priority projects were considered and dropped in favor of this particular project? If outside funds are secured to launch the project will the necessary local money be available for each succeeding year for recurrent costs?

D. Summary of Investment Considerations by the Lending Agency

Before any financing institution can appraise an agricultural education project to decide whether or not a loan should be made, the

project must be thoroughly studied as discussed and a feasibility report prepared. Educational, technical, financial, organizational, managerial and economic aspects of each project must be evaluated in detail to provide the cost benefit analysis upon which final judgment is passed by the agency contemplating investment.

Finally, we would agree with UNESCO that one fact is clear when considering *any* type of technical assistance project, whether it is labeled for agriculture or for industry or whatever, — "If provision for education and training of nationals of a country is not built into *every project,* not include as an integral part of *every plan,* not taken for granted as a part of *every step* forward, the ultimate goals can never be reached. The road to development is already littered with abandoned projects and the debris of misapplied efforts which failed because the people for whom they were planned and initiated were not sufficiently trained to take them over, run them and make the fullest possible use of the benefits they might have conferred." The basic problem is one of selection, emphasis and priority rather than inability to do anything. Physical resources alone cannot provide an improved standard of living without the competence to develop them — and such competence in agricultural production and related enterprise can only be learned through agricultural and technical education and training.

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(**editorial note:** Photoes in this article were diverted from Dr.T. Bergman's)

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Some Suggestions for Rice Mill Modernization in Developing Countries

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1. Forward

In any of the developing countries, the importance of self-sufficiency of food-grains is much emphasized. Indeed, if some country is defficient in food-grain to feed the population, she has to spend enormous amount of foreign currency annually for the importation. This is one of main reasons that even the developped countries try to maintain the balance of comsumption and production of food grains in their own territories. This expenditure must be heavier burden for the developing countries who are always suffering from the shortage of foreign currencies required for the development of the nations.

Shortage of food in developing countries seems to be much relieved recently compared to several years ago owing to their strenuous efforts such as improvement of irrigation system, introduction of high-yielding varieties, encouragement of fertilizer application, extension of improved farming technique and so on which resulted in so-called "Green Revelution".

It seems, however, that for the rationalization of post-harvesting works sufficient attention is not yet paid. It is wortn noting that more than 10% of or sometimes almost one third of harvested grains are being lost in many of developing countries during these processes which include transportation, drying, storage, milling, packing etc..

Out of these post-harvesting processes, here we discuss about meaures for the improvement or modernization of rice milling.

2. Gains by Rice Mill Modernization

More than 85% of total rice production in the world is concentrated in South-east Asian countries from Japan to India including huge territory of Republic of China. It can be said that overwhelming majority of rice harvested in this area are now being processed by out-dated rice mills or milling equipments **(Fig. 1 and 2)** which constantly lose from two to as much as 10 ~ 15% of valuable rise rice with the very low milling recovery.

India improved milling recovery of rice by the nodernization of rice mills. Considering that degee of milling is much higher in other countries (in India it is limited to 6%) and more crude milling methods are prevailing throughout the area **(Fig. 3)**, the difference can be anticipated to be much more greater.

Assuming that average improvement of milling recovery of rice is 5% which is rather conservative figure, if some country is getting a million ton of paddy, additional yield of white rice is 50 thousand ton when all of rice processing is modernized. If they

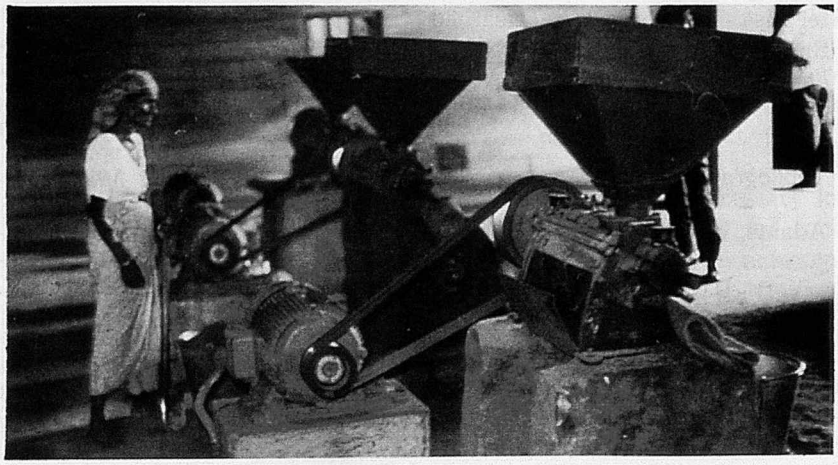


Fig.1. Huller mill (a battery of hullers)

are to import this amount of rice, they have to spend 6.5 million dollars assuming the price is $130 per ton. Such a great quantity of saving can be achieved simply by replacing those obsolate rice mills with modern ones without touching any other agricutural system.

3. Required Investment for the Rice Mill Modernization

The advantage and the necessity of rice mill mdernization in developing countries has often been emphasized but it does not seem to be well understood.

One of the main draw-backs for the practice is the required expenditure that will be involved. Really, if the interest of the investment and other expenditure surpass the profit, above calculation is sheer nonsense. However the investment is not so huge as supposed.

To get some idea, let us try to work out what can be the approximate figure for this.

Assumptions:

1) Quantity of paddy to be milled annually; One million ton
   Out of which 40% .... Commercially handled
   60% .... Home consumed by farmars
2) Commercially handled paddy is milled by rice mills, whose milling capacity is 1 ton paddy/hour **(Fig. 4)**
   Operating hours; 3,000 hours/-/year
3) Home-consumed paddy is milled by small rice mills on custom basis, whose milling capacity is 500kg paddy/hour **(Fig. 5)**
   Operating hours; 2,000 hours/-/year.

Then, 130 rice mills of one TPH and 600 mills of a half TPH are required respectively. Supposing the cost of the machines and the installation fee are $25,000 and $2,000 respectively, the total expenditure is about 4.2 million dollars. As for the buildings, prime-movers and other facilities, the existing ones may be utilized in most cases. This figure is much smaller than the above expectable surplus gain per year ($6.5 million). It means that all of the investment could be refunded in less than a year.

Of course this is quite a rough indication and it will be necessary to figure out more accurate value counting some other influecing factors for the actual feasibility study. However what we can affirm here is that the investment for the rice mill modernization is just "peanuts" compared to the expenditure for the import of rice which will be eliminated by the investment.

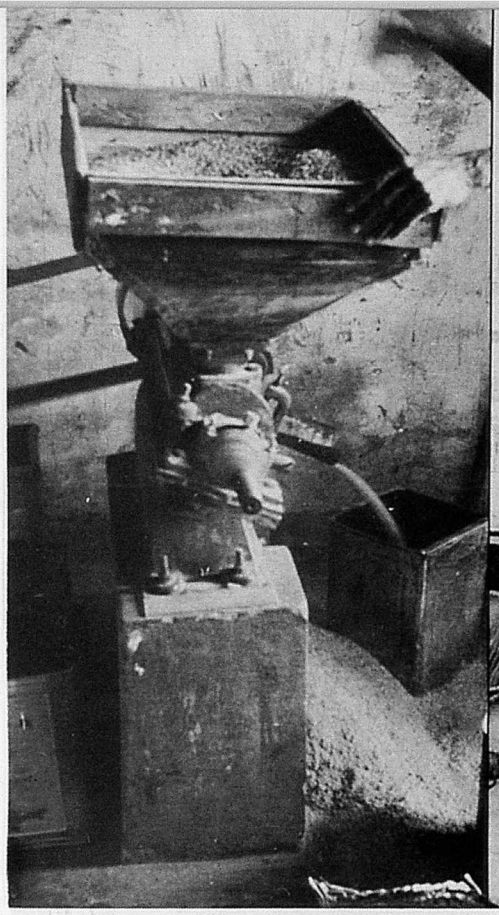


Fig.2. Huller mill (single huller)

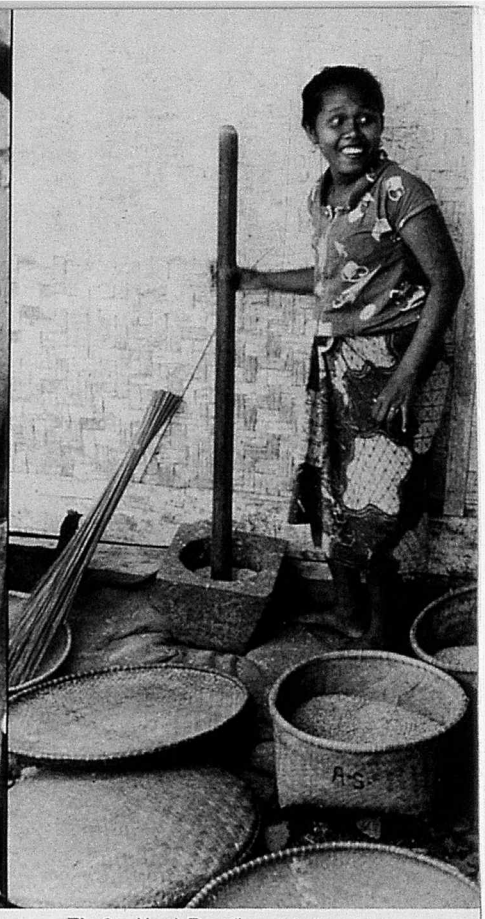


Fig.3. Hand Pounding a) Indonesia

Fig.3 b) Pakistan

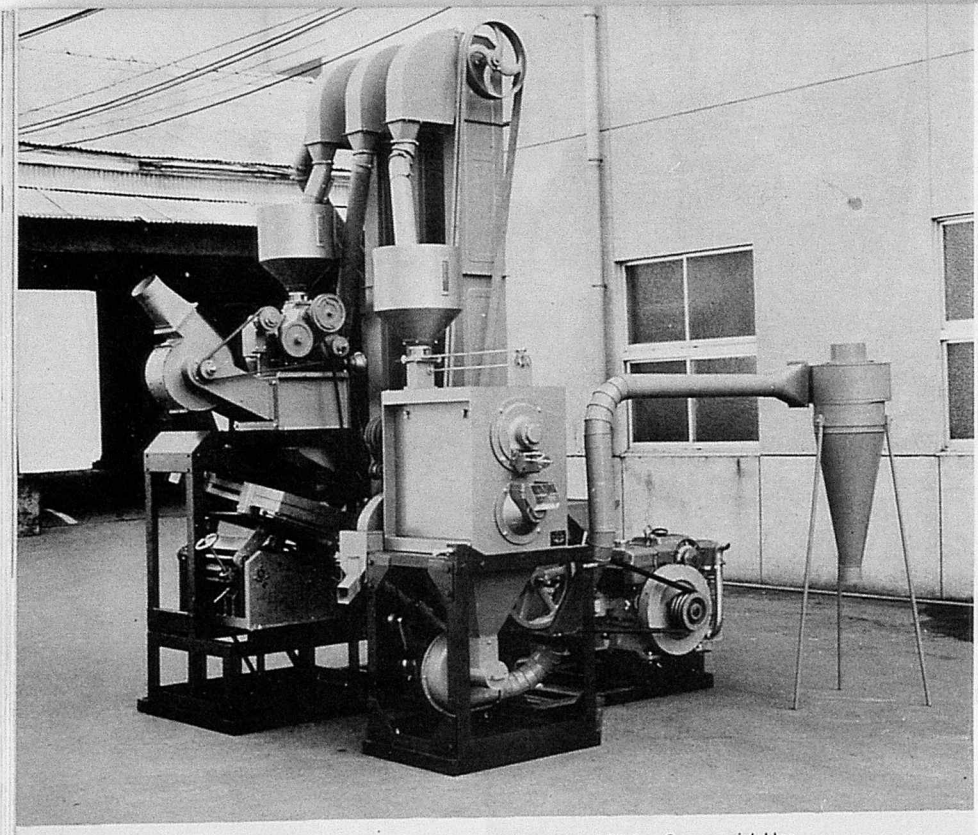


Fig.4. Mechanized Small-capacity Rice Mill for Commercial Use

4. Subsidy and not loan for Rice Millers

Keeping this fact in our mind, we believe that, for the encouragement of rice mill modernization, much more aggressive measures should be adopted than prevailing low-interest, long-term loan to the willing rice millers.

Really, what makes obstacles for the promotion of rice mill modernization is those troublesome procedures to get loan from the government. Rice millers are encouraged to innovate their facilities officially by being facilitated to use low-interest, long term loam from the government. But the utilization of the loan is very much hampered with the "official procedures" which include detailed declaration of managemental situation of rice millers, definite value of their asset, the proof of their capability for paying back, etc.. The reason why the procedure is so troublesome is that the government wants to make it sure to be paid back from rice millers.

From the economical point of view of the nation, it is quite clear that to push forward the rice mill modernization is much more important and profitable task than sticking to secure the loan.

For the real encouragement of rice mill modernization, it does not seem effective to prepare fund for loan except for the exceptionally large scale rice millers. It is much better to give away grant or subsidy to rice millers which will surely work for the innovation and does not involve much complicated and vexing procedure for rice millers. Any international or regional financing organization must be, we believe, helpful to arrange this kind of fund.

5. Example in Japan

In case of Japan, not directly aiming at saving of rice but to rationalize rice circuation, to sare the required labour and to improve the quality of white rice, the modernization and centralization of rice mills was started in 1963. And from 1967, the government started giving subsidy for those who want to set up modern rice mills of over 200 HP.

In Japan who are growing paddy of 17 to 18 million ton of paddy, there used to be about 37,000 small rice mills throughout the contry besides one million number of small homeuse rice milling machines owned by farmers.

Getting subsidy of total $3.4 million from the govern ment, 73 large scale modernized rice mills each of over 200 HP have been installed by 1971 **(Fig. 5).** Including these, now total 300 number 300 number of large scale rice mills of over 50 HP exist and they can mill about 70% of rationed of the nation. As the result, milling cost was lowered, the quality of white rice became much improved and uniform and the rice retailers became possible to do multiple business as rice is pre-packed and do e not take any much hands. This was necessary step especially to cope with the labour shortage and increase of population in urban areas.

Aside from the governments assistance and positive attlitude of rice millers organizations, the following two factors contributed to the success of the moderniza-

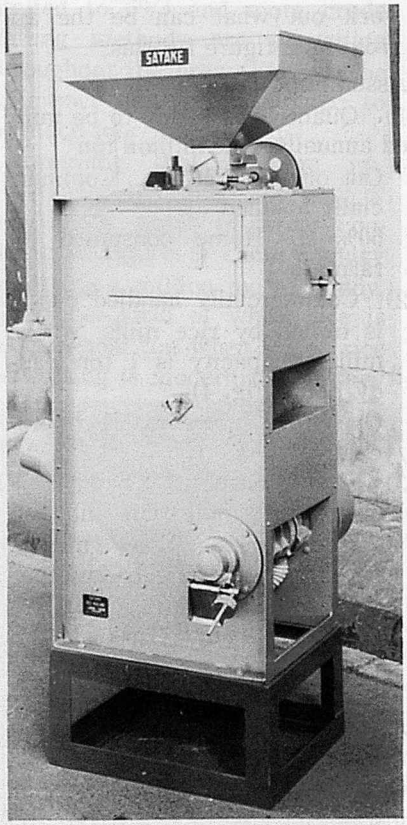


Fig.5. Modern Small Rice Milling Machine as a Substitute for Huller

tion; viz,

1) Prior to the government policy in 1963, "Compass" milling unit **(Fig. 6)** was completed in 1961 and many of the progressive rice millers were trying to use it enthusiastically.

2) Even though there existed some competition among suppliers of rice milling equipements, the overwhelming majority of the milling machines were some models of "Compass" units due to their far exceeding performance over other make. Hence various scale of large rice mills have been standardized and, as the result, the guidance by authority also became effective.

Japanese example may not be applicable directly to developing countries but there can be no doubt about that the government subsidy can promote and hasten rice mill modernization much easily and surely which ultimately bring forth the nation gaining. Here it must be emphasized that the required expenditure for the government is not so extravagant and the several folds' fruit was resulted very promptly.

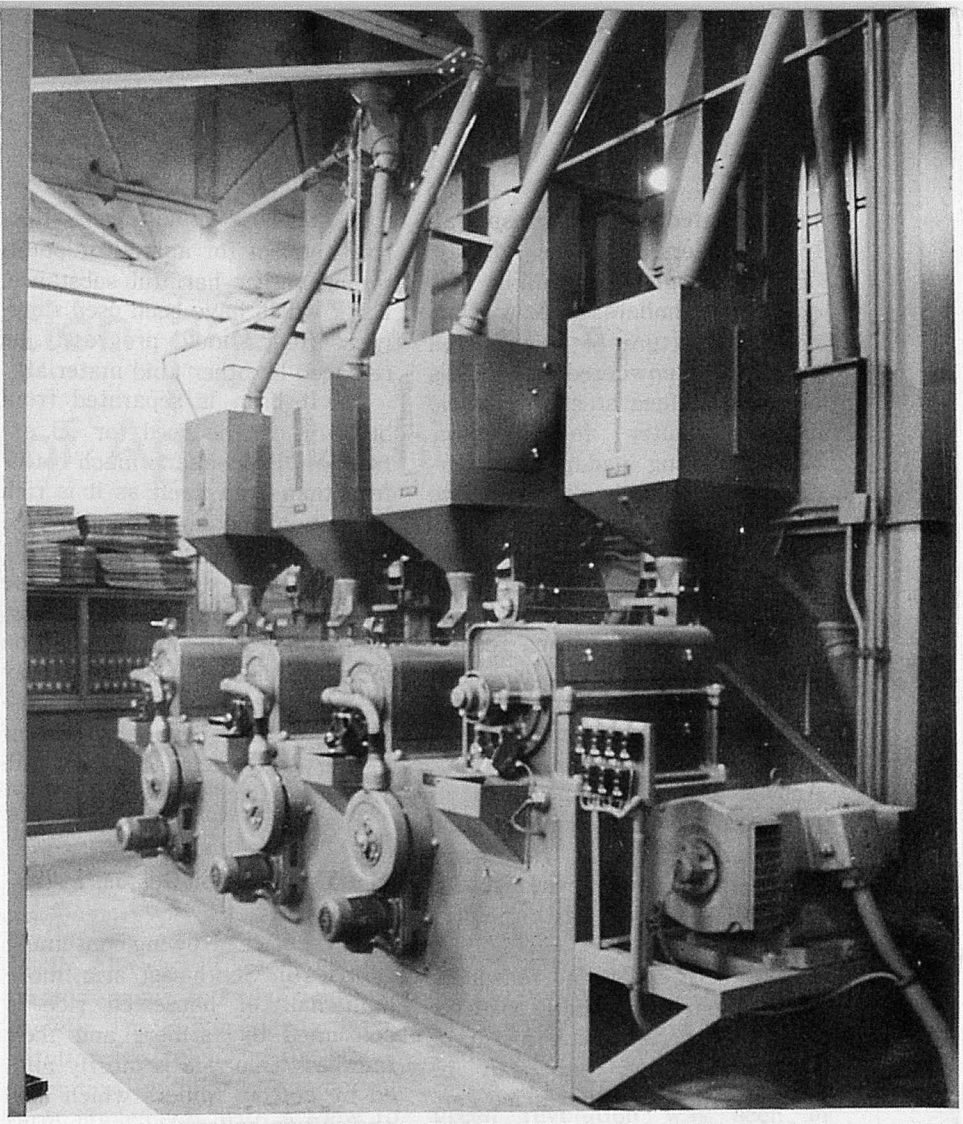


Fig.6. "Compass" Rice Milling Unit

6. Price Policy for Rice

Of course, subsidy is not the only measure to accelerate the rice mill modernization. What affect very much to it is the rice price of the government.

If the price of high quality rice is h enough or the difference of the price between the high quality rice and low one is large enough, then the most of rice millers will rush to the modernization of their facilites.

This we can see in the recent Indonesia. Their present atandard of white rice A.B. and C. are defined as below 25% brokens, below 30% and over 30% respectively. But these are going to be revised as below 20%, below 25% and over 25%.

In order to meet this new government standard of rice, rice millers are becoming quite positive to innovate. So long as they stick to their outdated machiney they are sure to lose. But, on the contrary, if they renew them they will not only maintain their income but can expect extra income. This is a plain fact. By use of their exisiting notorious hullers if they mill paddy into white rice which includes much brokens, they must sort out some brokens to improve the grade or must be satisfied with lower grade whose price is also low. By use of advance rice mills, if they get white rice of less than 15% brokens, they can add some brokens which is very cheap by more than 5% to increase the quantity still maintaining the top grade A. Therefore, their actual profit can be much more than it appears. It is quite sure that those modernized rice mills will give not only better head rice recovery, but also better overall recovery.

As far as the nation is still in short of rice, they are apt to disregard the quality and try to smiply increase the quantity. It may sound to encourage the quality-oriented price policy in this stage, but it really works for the increased supply of rice through the modernization of rice mills as can be understood from above example. Contrary to this, if there is no discrimination of grade in regard price, all of rice millers will try to satisfy with the lowest standard with minimum expenditure. This will surely lead to the preservation of obsolate rice milling equipments and the technique which do not care for the milling loss.

7. On "Usefulness of Hulles"

There is one strong arguement to resist the replacement of exist-

ing out-dated rice mills, especially of hullers. That is to say, "Even though the milling recovery of hullers is low, they produce mixture of bran, small broken and powdered husk. This is essential feed stock for cattle and/or poultry for farmers. Farmers bring paddy to huller-mills and take back white rice for their family and bran/husk/ /broken mixture for their poultry. If hullers are replaced with modern machines and husk, bran broken rice are separaed respectively, they will lose their cattle-/poultry feed, even though they may get some more quantity of rice for human consumption." Answer to this arguement;

1) Additional quantity and improved quality of rice gives more than enough money to farmers for buying cattle/poultry feed.

2) There can be no reason to spend a part of valuabli rice for feed. Feed crops such as maiz, sorgham, millet, etc. can be grown any place where rice cannot be grown be grown with much better efficiency than rice. These feed crops may be grown by indvidual farmer or collectively.

3) Husk is by no means effective nutrient for animal or poultry but rather harmful substance. Husk which have been used simply as filler should progressly be replaced by other kind material.

4) If bran is separated from husk, it can be used for oil extraction. Brancake is much better feed than bran itself as it is rich in protein and no poisonous free fatty acid.

In short, feed problem can be solved easily and in better way. In parallel with the intorduction of substitute for hullers, it may be recommended to arrange supply source and supply system of cattle/poultry feed and bran utilization system.

8. The Case of Custom Millers

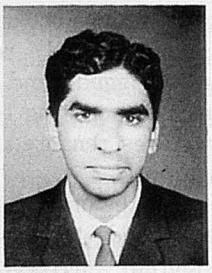
In the rice growing-consuming contries in South-east aria, more than half of harvested rice is consumed by farmers and their families. This rice is mostly milled by custom millers which hold one or two huller(s).

In some countries, these huller mill owners receive paddy brought by customers, mill it and return everything produced on some definite charge. In other countries, on receiving paddy they weigh it and return some definite percentage of white rice with or without bran on definite custom rate. Sometimes the charge is paid in rice.

In case of the latter, there can be no difficulties for the replacement of hullers with modern rice milling machinery because the additional outturn of rice will belong to rice millers. But in case of the former, some peole are suspicious on the possibility of replacement of hullers. Because it simply involves expenditure and the merit is never given to mill owners as additional yield of white rice goes straight to customers. However what is happening in the former countries is that the rice millers who introduced the modernized machinery are enjoying the merit also, either by getting more number of customers on account of their better milling recovery and the supreme quality of finished product or by elevating their custom rate because of their better outturn.

It means that even on custom basis milling, the better machinery pays more to the rice millers. ■ ■

Present Situation and Problems on Marketing of Agr. Machinery in India



by A. M. Michael

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The modern agricultural machinery industry in India has been only about a decade old, though indigenous manufacture of traditional farm implements has been an age old practise. The industry now is at the threshold of expansion at an accelarated pace.

The need for a large scale farm mechanization programme was recognised during the Third Plan period. Production of tractors and different types of power driven equipement was organised. Facilities for research, development and testing of animal operated and power operated equipment were established. Special programmes for demonstration and popularisation of agricultural machinery were started. To meet the need of trained personnel for the operation and maintenance of farm equipment, training centres were established at the Central and State level.

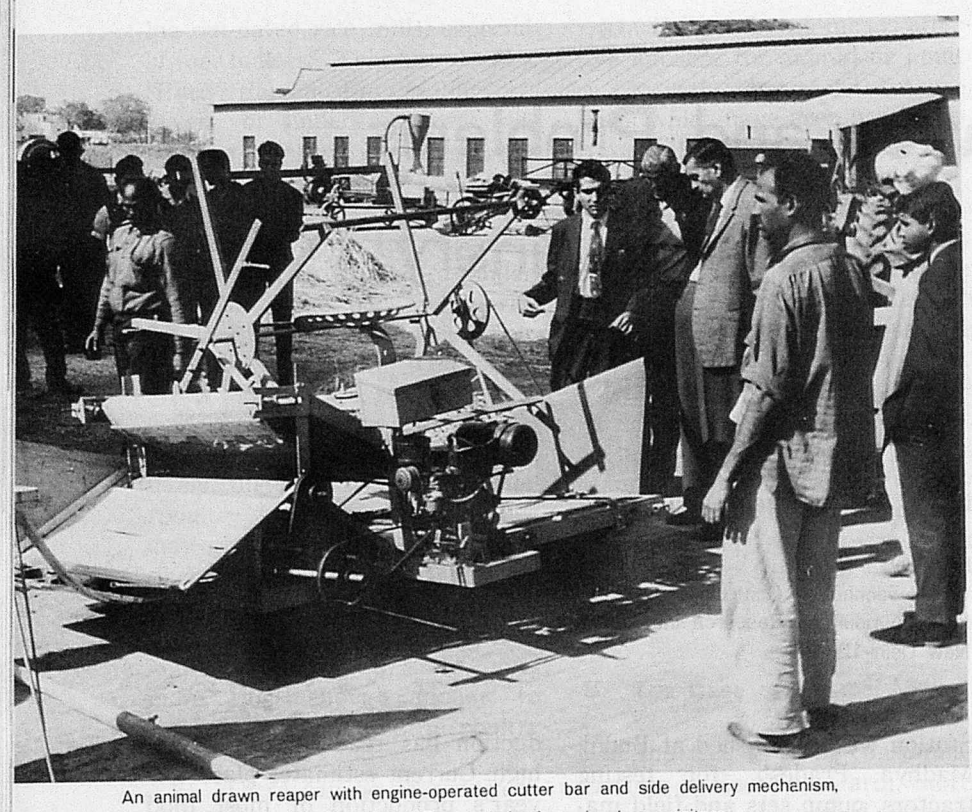
Today there are nine instituations in India offering degree courses in Agricultural Engineering. Five institutions are offering post-graduate courses with specialisation in Farm Machinery and Power and Soil and Water Conservation Engineering. A National Farm Machinery Testing Station was established at Budni, Madhya Pradesh, for testing tractors, pump sets and field machinery. The Indian Standards Institution has taken up the standardisation of a large number of farm implements with a view to ensure quality of production and interchangeability of parts. With a view to increase agricultural production though efficient supply of inputs, especially agricultural machinery and to offer machinery hire and repair facilities Agro-Industries Corporations have been set up in most of the states as a joint venture of the Central and the concerned State Governments.

The Central Govt. has recently decided to establish 500 Agro-Service Centres in the rural sector to provide services in the field of agricultural equipment, agricultural supplies like fertilizers, pestcides, seeds, animal husbandry and dairy products and projects like land development services, irrigation systems and processing of farm produce.

Impact of Green Revolution

India's total agricultural production has reached on all-time high. Current estimates place this year's production of most food grain crops, peanuts, sugarcane and tea at record or near record levels. The first impact of the green revolution was seen in 1966-67, when scientific inputs of the previous decade lead to successful wheat hybrid cultivation. The food grain production rose from a trough of 76 million tonnes to a peak of 95 millon tonnes. In the subsequent years 1968-69, 1969-70 and 1970-71 the grain production was 94, 100 and 105 million tonnes respectively.

The marked increase in land productivity has transformed the traditionally conservative outlook of the farmer in a nmber of states, esptcially, Punjab and Haryana. A forecast of the future growth of agriculture in India could be based on the post 1967 experience of Punjab and Haryana. The earlier period of virtual stagnation indicates the importance of science and technilogy in agriculture and the consequences of its neglect. **Table 1** shows the increase in output as a result of the introdrction of hybrid wheats in Punjab and Haryana.



An animal drawn reaper with engine-operated cutter bar and side delivery mechanism, developed at the Indian Agricultural Research Institute, is shown visitors.

The present population of India is over 550 million. The marked increase in food production during the past few years are sufficient to feed the present population above starvation levels. This does not however, ensure the minimum per capita calorie needs, which if provided, the food grain requirement will rise to 115 million tonnes against the 105 million tonnes produced at present. To this must be added in the coming years the needs of the increasing population. The situation calls for concerted efforts to increase crop production. The solution is in increased use of high yielding crop varieties, multiple cropping and reclamation of waterlogged and salt affected areas amounting to over 6 millon hectares rendered unfit for cultivation.

For the introdroduction of hybrid seeds the prime requisite is assured irrigation, increased power availability to the farmer, adequate supply of fertilizers and plant protection. A major source of assured irrigation is by increased use of groundwater through wells and pumps operated by elctric motors or engines. An important factor in the success in of multiple cropping is the use of specialsed machines in

Table 1. Wheat Yields In Punjab and Haryana during The Period 1965–71.

Period	Punjab	Haryana	Total
	yield in million tonnes		
1965–66	1.90	0.87	2.77
1966–67	2.45	1.06	3.51
1967–68	3.33	1.44	4.77
1968–69	4.49	1.53	6.82
1969–70	4.90	1.80	6.70
1970–71	Estimated		8.00

Table. 2. Tractor Availability in India

Year	Wheel Tractors (Qty.) Indigenous Production	Imports	Total
1	2	3	4(2+3)
1961–62	880	2,997	3,877
1962–63	1,414	2,616	4,030
1963–64	1,983	2,349	4,332
1964–65	4,323	2,323	6,646
1965–66	5,714	1,989	7,703
1966–67	8,816	2,591	11,407
1967–68	11,394	4,038	15,432
1968–69	15,466	2,508	17,974
1969–70	17,099	11,000 *	27,099
1970–71	20,099	12,000 *	32,099
Total for the decade:			
(a) Quantity	87,188	44,411	13,599
(b) Percentage	66	34	100

* Estimates.

Table 3. Estimates of Annual Demand for Farm Tractor (for the IVth Plan Period)

Year	ISAE Committee Estimates: Annual demand	%-age rise over previous year	Annual demand as estimated officially
1969–70	31,000	—	70,000
1970–71	38,000	20	70,000
1971–72	43,000	15	75,000
1972–73	47,000	10	80,000
1973–74	52,000	10	90,000
Total for the IVth Plan period	211,000		385,000

Table 4. Tractor Demand Sizewise

Tractor size (Engine HP)	% of total requirements in 1971	1973–74 Official Estimates	1973–74 Likely range
1. 25 and under	11	28	15 to 20
2. 26 to 40	74	50	60 to 70
3. 41 and above	15	22	15 to 20
	Total=100	100	

Table 5. Tractor Prices

Make	Model	Engine HP	Unit list price FOR destination Rs.
1. Eicher	115/8	26.5	17,480
2. Escorts	47 W	49.0	24,900
	37	34.5	17,910
	27 W	28.0	13,849
3. Hindustan	35	35.0	15,710
	HWD50	50.0	22,350
4. International ..	B-275	35.0	19,570
5. Massey Ferguson ..	1035	35.0	21,140

Table 6. Estimates of Annual Power-Tiller Demand

Year	(during the IVth Five Year Plan) ISAE Committee Estimates Annual demand	%-age rise over previous year	Annual demand as estimated officially
1969-70	2,000		20,000
1970-71	4,000	100	30,000
1971-72	8,000	100	30,000
1972-73	16,000	100	60,000
1973-74	32,000	100	80,000
	62,000	Total for the IVth plan period	230,000

seed bed preparation, sowing, intercultivation, harvesting and threshing. Effective mechanization in multiple cropping will lead to increased labour efficiency, timeliness of operation, good qualitty of work and reduced cost of farming. The present agricultural situation points to the need for an all-out increase in farm mechanization.

Demand Trends and Supply of Agricultural Machinery

During the past few years there have been an ever increasing demand for the supply of tractors and agricultural machinery. Indigenous production of tractors began in 1961-62. **Table 2** shows the annual availability of tractors in India during the past decade. There are currently five firms engaged in the production of tractors with a sanctioned capacity to produce 45,000 tractors a year. Two more firms will go into production shortiy. By the end of the Fourth Five Year Plan (1973-74) the annual indigenous production of tractors may be about 50,000 units against an estimated demand of 90,000. **Table 3** shows the estimated annual demand of farm tractors during the Fourth Plan period. Tractors of reputed makes are in short supply at present, mainly because of the carry forward of unsatisfied demand in previous years. The gap is being narrowed down through increased production and imports.

Most of the tractors produced indigenously and imported are in the size range of 26 to 40 H.P. **Table 4** shows the estimated tractor demand sizewise.

Table 5 shows the price of the tractors produced indigenously. Tractor pricing is controlled by the Tractors (Price Control) Order 1967 of the Govt. of India. The price of imported tractors are also fixed by the Government.

POWER TILLERS. The power-till er demand at present is mainly for puddling operations in small paddy fields. Farmers in India have been slow in accepting power tillers for farm mechanization. Main reasons are the high cost of the power tillers, the use of traditional animal-drawn implements suitable for wet land cultivation, the lack suitable ground tools to suit the conditions in the country insufficient haulage capacity of imported power tillers and the insufficient traction of power tillers while operating under upland conditions in heavy soils.

The present power tiller population in India is about 10,000, out of which about 7000 are imported from Japan. Indigenous industry licensed to make power tillers have been slow in making progress. Only two firms have gone into production of power tillers. Five more are to start production soon. **Table 6** shows the estimated annual demand of power-tillers.

IMPLEMENTS. Farm implements may be classified into two groups: bullock-drawn implements for land grading, seed bed prepartion, sowing and intercultivation, and tractor-drawn implements for the above operations and harvesting. Stationary machines operated by tractors or other mechanical power sources like engines or electric motors form the third group of farm machines. Simple implements for seed-bed preparation such as mould board ploughs, cultivators harrows and levellers are available in sufficient number to meet the current demand. These implements, by and large, are manufacturactured by small-scale industries. There are about 1300 registered manufacturers in this line. There is, however, great scope considerably widening the range of equipment for all farm operations from land preparation to harvesting and handling of produce. Machines for sowing and threshing are in short supply. Most of the indigenously developed machines for sowing and havesting need further sophistication to successfully meet the wide range of farm situations. Though a few machines for harvesting grain crops, groudnut etc have been developed at the research centres they are still at the stage of pilot trials and evaluation. Equipment for rice transplanting has not yet been introduced.

ENGINES. The diesel engine industry is fairly well developed in India. There are over 700 manufac-

Table 7. Estimates of Annual Investment in Some Important Agricultural Machinery Inputs

Item	Annual requirements (quantity)	Unit Cost (Rs.)	Estimated annual investment (Rs. million)
1. Wheel tractors ..	70,000	30,000	2100
2. Crawler tractors ..	1,500	200,000	300
3. Power-tillers ..	30,000	10,000	300
4. Engines ..	80,000	3,000	240
5. Electric pumpsets ..	250,000	1,200	300
6. Power-sprayers/dusters ..	30,000	1,500	45
7. Power-threshers ..	50,000	2,000	100
8. Water-well drills ..	100	600,000	60
9. Bullock-carts, pneumatic tyred ..	250,000	1,000	250
10. Improved bullock-drawn implements- ..	300,000	100	300
11. Fuels and lubricants for farm prime-movers ..	2million tonnes		2005
Total ..			6000

turers with a total output of 250,000 engines a year. About 66% of the engines produced in the country are in the range of 4 to 5 H.P. About 21% are in the range of 6 to 10 H.P. The industry has reached such an advance stage of production that the export earnings from diesel engines and spares have reached a turnover of about Rs.25 million.

PUMPS. There are over 2 million irrigation pumps in use now. About 55% of the pumps are driven by electric motors. The present density of power operated pumps is 12 per 1000 hectares of net cropped area. This figure is expected to double within the next two years. Most of the irrigation pumps manufactured in India are of the volute centrifugal type. Deep-well turbine pumps and submersible pumps are also being manufactured in increasing numbers since the past few years. A nearly unexplored area in the pump industry is the manufacture of low-lift high discharge pumps, especially propeller pumps.

Table 7 presents the estimates of annual investment in some important agricultural machinery inputs.

Imbalances in Inputs for Mechanization

Acceptance of mechanisation by the Indian farmer has brought to focus imbalance created by the current patterns of menchanisation based on Western experiences. These imbalances are creating social and economic pressures in the rural areas.

The existing conditions in India pose many difficult problems for the direct adoption of the Western experience in agricultural mechanization. The small and scattered land holdings, and the poor economic economic conditions of the average farmer restrict the of units designed for large scale mechanization. The land holding pattern in India is shown in **Table 8.**

A study of tractors likely to be produced indigenously by 1975 indicates that there is hardily any likelihood of a tractor selling below Rs.22,000. These tractors and the allied equipment are within the reach of only the few who hold irrigated areas over 10 hectares. For a real large scale impact of mechanisation the market to be nursed is that of the millions of small farmers. Similarly, for equipment like combined harvester, threshers and power threshers solutions are to be found specific to the size of the farm holdings, per capita income constraints as well as available manpower resources.

Mechanization and Labour Displacement

Mechanization of agriculture in India is often opposed on the ground that not only the scope for employing the employed and underemployed is reduced, but aiso there is the risk of reducing employment at a

An animal-drawn buck craper used to grade land for efficient irrigation

time when the labour force is swelling because of increase in birth-rate as well as longivity. Unless job opportunities are increaed by accelerating the growth rate thorugh quicker and wider adoption of improved agricultural technology, mechanization may prove detrimental. Recent studies have shown that as a result of tractorisation, the use of bullock power goes down, but because of the marked increase in cropping intensity and yeild per hectare, the employment in the field increases by about 7 per cent. Besides there will be increase in employment in processing and marketing of agricultural produce. In Punjab where there has been acceleration in the pace of farm mechanization, wages have increased and labour availability has become more difficult.

Bottlenecks in Farm Machinery Industry

Important problems facing the farm machinery industry underline the need for proper assessment of demand, development of markets, availability of finance, research and development to suit local conditions, availabilty of raw materials and components, improved production techniques and better training and service facilities. A proper assessment of demand for major inputs is important. Increased emphasis for demonstration of implements and their cost benefit ratio is necessary to develop markets. Development of rural markets will open up a vast potential for business not only for agricultural machinery or other inputs, but also for a wide range of consumer items.

The agricultural machinery industry is facing some problems of finance. Procedure for grant of loan by nationalised bamks needs to be simplified. Some items of raw materials, ancillaries and machine tools are in short supply.

Table 8. Size of Land Holdings in India

Holdings (hectares)	No. of holdings (millions)	Area operated (million hectares)	Percentage of total area
1. 0-0.4	8.67	1.7	1.3
2. 0.44-2.22	22.62	23.0	17.9
3. 2.42-5.05	12.00	38.6	29.0
4. 5.45-10.10	4.54	30.6	22.2
5. 10.5-20.20	1.77	29.1	17.3
6. Beyond 20.5	0.52	15.5	12.3
Total	150.8	133.4	100.00

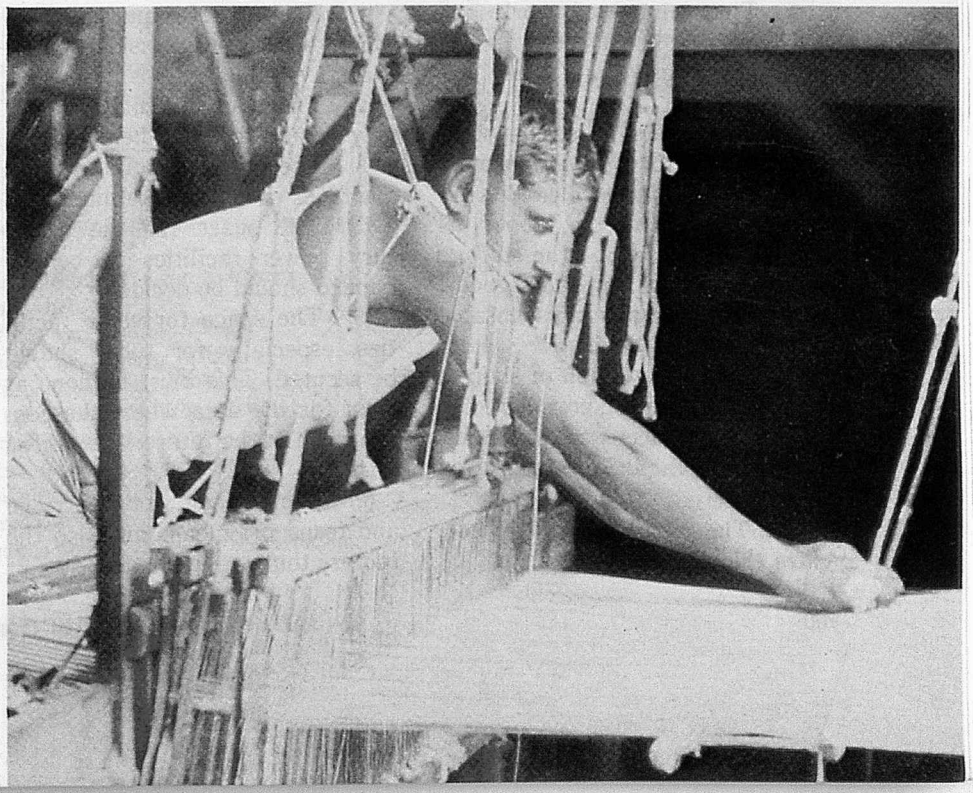
Difficulty is faced in the availability of high carbon steel. Ancillary items in short supply include pistons, rings and liners, fuel injection components and thin walled bearings. Small scale manufacturers require training on production technology for efficient and economic production of farm machinery.

Little attention is being paid at present on research and development by the industry. Even when the production is in collaboration with foreign firms having long experience in the line, the items require to be adapted to level operatiing conditions, available raw materials and skills.

There is scarcity of skilled workers. workers. Training of workers for the industry is important. Equally important is the need for training operators. Training facilities available at present are too small to meet the need.

The farm equipment industry in India is at the threshold of rapid progress. The young industry requires to be carefully developed. The industry should meet the needs of the small and large farmeralike.

Acknowledgement: Table 1 and 8 are adapted from the paper "Horizons before the Agricultural Engineer" by M.M.Suri presented at the tenth annual conference of the Indian Society of Agricultural Engineers held at Jabalpur from Februauy 3-5, 1972. Tables 2-7 are from the paper "Production of Agricultural Machinery in India" by B.K.S.Jain presented at the International Rice Research Conference held at Manila from April 19-23, 1971. ■■



Handloom weaver stretches the warp at his loom

Model Layout for Repair Shop of Agricultural Machines

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1. Location for the Construction of a Repair Shop

1.1 The conditions that decide the location

Close investigation on the location is required, first of all, befor starting actual construction.The basic factors that must be examined, will be as follows;

(1) If it is near to the main shop.

(2) If there is good volume of traffic.

(3) If power source is available easily.

(4) If sufficient water supply and drainge is available.

(5) If it is near to the sales market.

(6) If the site of shop is available easily.

1.2 The factors which should be considered over the decision of plant scale

(1) The volume of work and the capital to be invested are regarded as decisive and basic factors.

(2) The means to secure various elements for production must be examined. These elements include power sources, labour as well as the means for the storage and delivery of finished goods. This examination is indispensable for blue-printing a shop.

(3) Easier expansion of shop in the future should be considered.

(4) Finally, accessory facilities (ex. welfare facilities) shold also be considered.

1.3 The conditions that decides the site of shop.

Among many conditions to be examined, the following can be mentioned as basic ones.

(1) The scale of shop that is decided taking into consideration the space which is necessary for the prospective expansion of shop in the future.

(2) The lay and the soil of site.

(3) The degree of land readjustment.

(4) Environmemtal conditions such as geographic position, traffic means, etc.

1.4 Considerations over the possible expansion of shop in the future

Not only the site but the buildings, power facilities, accessary facilities, etc. should be planed taking into consideration the possible expansion of shop in the future. The followings, however, should be considered before construction begins.

(1) The utmost expansion plan should be drafted comsidering the space available for this purposes.

(2) The plan of buildings that may be added should be drafted.

(3) The base for buildings and machines should be examined.

(4) The space for the necessary power facilities to be expanded should be decided.

(5) The space for same facilities, especially for tubes should be secured. This must be done at least for the area where the construction in the future is expected difficult.

(6) Equipments for carriage and transport means are also the factors that are important.

(7) The expansion plan on the accessary facilities, especially for warehouses, should be examined considering the site, the method of construction, etc.

2. The Scale of Repair Shop

2.1 Factors to decide the scale

(1) The area for a repair shop is decided by the space that is needed for the machines to repair, working, facilities required, passages and the accessary facilities.

(2) The working facilities and the kinds of equipments required can be decided by the kind of machines to repair and their volume.

(3) The space there by decided must be examined if it satisfies the standard defined by regulations.

2.2 Space for repair work

(1) The working space is composed of the space for the machines that need repair and the space for repair works.

(2) When the machine to repair is of small size, it will not need large space. When it is of large size, however, like a full-sized tractor, it will need large space.

(3) The width around the machine to repair is usually one meter in every direction. But when it is of large size, about 1.5 meter will be needed because comperatively bigger parts and tools are required for its repair works.

Table1. Standard for the recognition of agricultural machines repair shop (Required facilities and tools) by N.F.A.M.R.A.Japan.

	The second class repair shop	The first class repair shop (in addition to the left items)
space of shop	19.8㎡ and up	39.6㎡ and up
engineer	first grade license holder, one and up	first grade license holder, one and up second grade license holder two and up
machines	drill press, grinder, electric, drill, vise, compressor, washing-equipment	lathe, chaine block, welding equipment, painting equipment, jack, car washing equipment, (smith equipment)
tools	surface plate (large and small size), V block, square, calipers, screw driver (allsize), spanner (mm, inch), hand monkey wrench, pliers (large and small size), wrench for magnet, file (rough, middle, finish), scraper, punch (for belt), hamnmer (iron, non ferrows metal), Saw for iron, oil feeder, grease feeder, hand pump for washing petroleum, cleaning-put (30—60-cm), hand grinder, hand tools for wood working, saldering tool, drill, set-socket, punch for flying wheel	scribing block, chiwhc, sel, vise, bearing punch, wire brush, satchet drill, valve meet cutter, valve grinder, pipe wrench,
guage	platform weighing scale, tape measure (steel), stick measure (steel No.31), Slide calipers, counter, stop mater	chickness gauge, wire gauge, screw pitch, gear pitch pressure gauge (500 lbs), combination set, micro meter (25—30—50mm)

(4) The shop that has a great volume of work must have a respective workshos according to the size of machine to repair.

2.3 Equipments that are indispensable

(1) The minimum facilities required for a agricultural machine repair shop mentioned here are based on the standard by "National Federation of Agricultural Machinery, Retailers, Association. N.F.A.M.R.A.Japan". **See Table 1.**

(2) The list that follows shows the set of equipments and tools to be prepared for a repair shop of agricultural machines based on the afore-mentioned standard. **See Table 2.**

(3) There should be some special rooms, for example, for painting as the case may be.

(4) The number of equipments and tools to prepare should be decided through the analysis of the details of repair and its volume.

(5) The equipments required will determine the necessary space for both the equipments themselves and the works related to the equipments. In case of ma-

Table2. The table of required facilities and tools for the 1st and 2nd class repair of agricultural machines (by N.F.A.M.R.A.Japan)

	Name	Size Efficiency	Remark	class 1st	class 2nd
Machines and tools	electric drill	maximum drill liamater of 6.5mm	JIS	○	○
	grinder	single phase 0.4kw (0.5ps), 100V	for a shop to which it is impossible to lay a power line	○	○
		three phase 〃	〃 possible 〃	○	○
	compressor	0.4kw (0.5ps), 100V	〃 impossible 〃	○	○
		3.2kw (3ps), 200V	〃 possible 〃	○	○
	jack	1ton class garage jack. maximum contracted height of 120mm.		○	
		maximum stretched height of 400mm			
	lift	1ton class air lift		○	
	vise	parallel vise type, calibre 100mm		○	○
	drill press	maximum drill diameter of 13mm	single, three phase	○	○
	chain block	mobile type 1ton, fixed type 1ton		○	
		mobile type 500kg, fixed type 500kg			○
	gass welding	trailer and others. one set	bombe not included	○	○
	painting	spray gun, hose and others one set		○	○
	parts washing	200W single phase, 1159×955×560mm		○	○
	car washing	hose, brush, others		○	○
	steam cleaner	200W single phase, 100V, 1210×900×520mm		○	
	anvil	50kg		○	○

	battery	tunger 12A		○	
	oiling facility	lubricator, grease pump and others		○	
	mobile tool table	three-storied 790×530×395mm		○	○
	mobile working table	four-storied 800×620×480mm		○	○
	surface plate	605×605×100mm		○	○
Gauges	platform weighing scale			○	
	balance scale	with damping device 1.5～7kg		○	
	pressure gauge	200kg/cm²	for measuring oil pressure	○	
	hydrostatic balance	syringe formula	for battery	○	
	cylinda gauge	kalmer type. measuring range 50～100mm		○	
	toe-in gauge	measuring range 900～1,600mm		○	
	tire-gauge	Stick type. JIS (3.5kg/cm²)		○	○
	micro meter	0～25, 25～50, 50～75, 75～100 (four kinds)	JIS second grade	○	
	slide calipers	with 150mm depth gauge	〃	○	○
	thickness gauge	0.04～0.3mm (9pes set)		○	○
	straight edge	500mm (steel)		○	○
	torque wrench	plate spring type 1,300cm-kg class		○	
	tape measure	10mater and up		○	
	steel measure	1,000mm		○	○
	stop watch			○	
	forlding scale	wooden,1,000mm		○	○
	revolving scale	electric, portable type		○	○
	nozzle tester	400kg/cm²		○	○
	pump tester			○	
	battery tester	－3～0～＋5		○	
	scribing block	300mm		○	○
	V block right angle	4×25×1.5inch (set)		○	○
	triangler-scale	200mm (set)		○	○
	indunction tester	portable		○	
Tools	valvesheet cutter	stem diameter 10mm		○	
		Stem diameter 7～10mm			○
	wheel puller			○	
	gear puller	3,4,6,inch (set)		○	○
	bearing race puller	0～100mm		○	○
	grease gun	lever type 180cc (push-out pressure 140 kg/cm² up)	JIS	○	
	adjustable reamer	15～27 (6 pcs, set)		○	○
	General tools				
	box spanner	9～32mm (set)		○	○
	double ended wrench	8～26mm(6Tset)		○	○
	screw driver	(－) 2,4,6,8 inch (4set)		○	○
	〃	(＋)		○	○
	monkey wrench	8inch		○	○
	one hand hammar	1pound		○	○
	wooden hammar	head diameter 45mm		○	○
	punch	5pcs. set		○	○
	chisel	4pcs. set		○	○
	file	8pcs. set (middle) 200mm		○	○
	metal scissor	240mm,		○	○
	pincer	8inch		○	○
	plyer	8inch		○	○
	soldering tools	paste, solder for 100w		○	○
	pipe wrench			○	○
	scraper	250mm		○	○
	folding bolt puller	4pcs. set		○	○
	saw for netal	200～300mm (wooden grasp)		○	○
	oiler	pistol oiler (240cc)		○	○
	wire brush	4 lines with 19 holes		○	○
	spectacles wrench	8～26mm (6pcs. set)		○	○
	snap ring pincer	for shaft, for hole (set) 8 inch		○	○
	oil stone	4.5×1.5×6.25inch		○	○
	tup, dice set	6～18mm (8pcs. set) 0.25～0.75m (〃)		○	○
	socket			○	

chines that has rotating mechanics, examination must be done further.

2.4 Passage

(1) A passage that is means to connect work shop and facilities are considered next.

(2) A passage is important for the prevention of danger, or getting in the way of other works thus enabling the flow of work smoother, especially when an object to repair is large in size or when the volume of repair works is big.

(3) A passage for men usually need 1～1.2 meter in the width.

(4) When the flow of things exsists, item to item examination should be practised.

(5) White or yellow colored line are often drawn to show definitely the boundaries of passages and workshops.

2.5 Accessary facilities

As accessary facilities, the following should be considered together.

(1) Facilities like an office building, toilets, dressingrooms, etc.

(2) Power facilities, airconditioning facilities, etc.

2.6 Quantitative details of repair

(1) It is the portion among the classified objects to repair and the portion between small size tractors and large size tractors that are meant here by the quantitative details of repair. Further more, it means the portion between the repair of engine parts and driving parts.

(2) Consequently, the facilities and the space of workshop should be decided after examining the quantitative details of repair.

(3) Baseed on the result of investigation on the details of repair and the careful estimation of the volume of work taking into consideration the market situation of agricultural machines, effective investment plan should be worked out in order to set the facilities in full operation.

2.7 Volume of repair

(1) Volume of repair will have close relation with the details of repair, facilities and space.

(2) It should be carefully considered that the volume of repair of agricultural machines fluctuate from season to season.

(3) As there are seasonal ups and dowms in the volume of repair, the planning of a repair shop to the peak of the year should be avoided. Rather, efforts should be made to sequre a regular amount of work throughout the year reducing the work at the peak.

(4) For this purposes, actual conditions of customers must be grasped through the past record of turnover, which will be helpful to avoid seasonal concentration of repair work, by visiting the customers before they must come to the shop. It will keep the machines of customers in the good condition.

3. Building

3.1 Form of building

(1) As the example of the structure of a building one storied as well as multistoried building may naturally be mentioned. It is not usual, however, to set up a workshos on the second floor and higher because of the difficulty of carriage.

(2) When it is multi-storied building, the second floor and higher will be used as a part of a sales shop or the depository of parts.

(3) When it is considerably large shop while the site is restricted, a multi-storied building has advantages.

3.2 The shape of building

(1) The shape of a building should be determined in relation to its arrangement.

(2) The decision should be made not only by the present requirement but also from the view of possible expansion in the future.

3.3 The structure of building

(1) First of all, it should be constructed with endulent materials such as earth quake-proof or fire-proof ones and should be reasonable in the constructing costs as well.

(2) The buildings are often iron-framed, slate-roofed and have a steel shutter at the entrance.

(3) The height of ceiling must be decided in consideration of the shop facilities requested and the objects to repair (including trucks and cranes used for carriage)

3.4 Accessary facilities

(1) Lights, ventilation, air-conditioning, etc. should be well considered (Consultation with a specialist will be recommended)

(2) Facilities of water supply and drainage, piping and wiring should be arranged in anticipation of actual repair works because mobile facilities of repair may be required in some cases.

3.5 Arrangement of buildings

(1) The best way is the seek the area that may satisfy an ideal arrangement that was worked out in advance.

(2) When the outline of an area is already given, an ideal arrangement should be worked out first and then sales store, shop and car park should be arranged properly.

(3) Such an arrangement as sales store, shop and car park face the road in a group may be worthy of consideration.

(4) When there is need to store dangerous articles like oil in large quantity, a separate storage of it must be built to prevent the danger.

4. Inside Layout of Shop

4.1 Analysis and examination of informational materials

(1) a) The volume of repair and b) concentration tendency of repair due to the seasonal fluctuation should be examined. These are the factors to induce repair

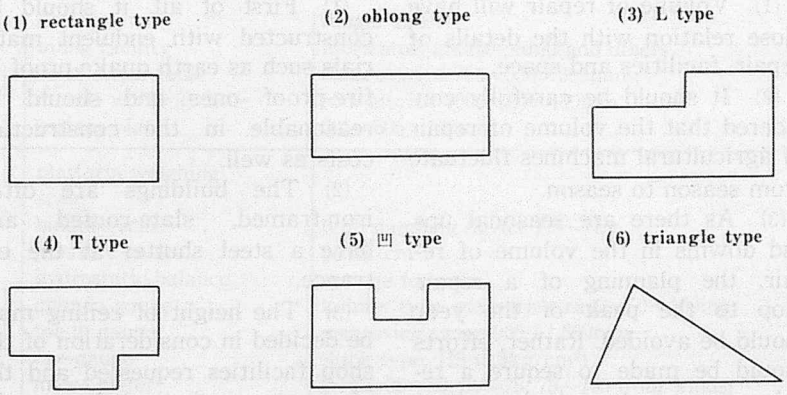
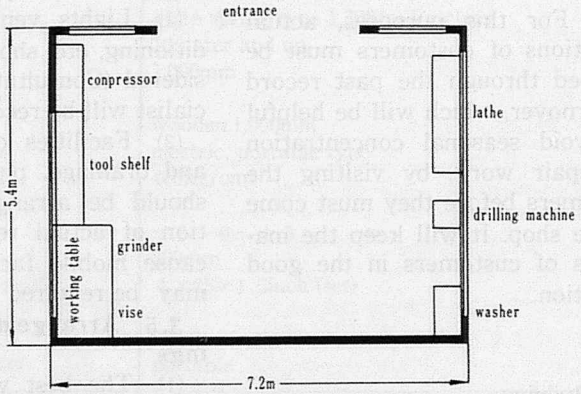
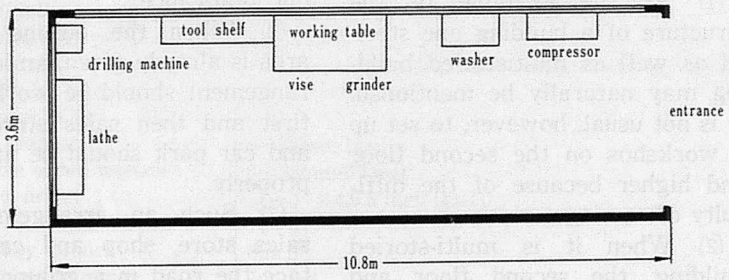


Fig.1 Shape of repair shop

(Rectangle type)



(Oblong type)



(L type)

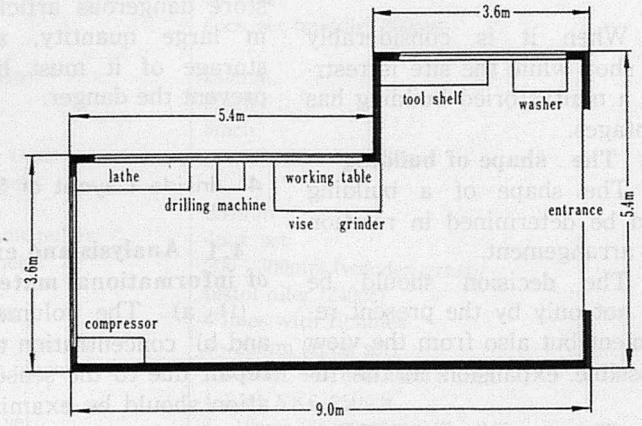


Fig.2 Layout

Table on the combination of basic factors of repair work

①	②	③	④
1	×	×	×
2	×	×	○
3	○	×	×
4	×	○	×
5	○	×	○
6	×	○	○
7	○	○	×
8	○	○	○

①=Combination ②=Worker
③=Machine ④=Material
○=Moving ×=Fixed

orders.

(2) The order of works should be decided by a list of working process, so that the kinds of repair and repair work could be analyzed.

〔Ex.〕 Process of Repair Work of Engine

- Removing engine from chassis
- Carrying to working table
- Disassemblying
- Carrying to washing-room
- Washing
- Carrying to working table
- Overhauling parts
- Correcting
- Carrying to assemblying table
- Waiting
- Carrying to chassis
- Setting

(3) Repair work can be realized by combining the movement of basic factors such as workers, machines and materials. So it will matters much to know the movement of them and reduce the loss to the minimum amount. **See Table.**

4.2 Examples of layout (By the minimum standard by N.F.-A.M.R.A. for the first class repair shop)

4.2.1 Premissing condition of layout

(1) Condition 1. prescribed area of more than 39.8 square meter

(2) Condition 2. possession of the following repairing machines 1. Drilling machine 2. Electric

drill 3. Grinder 4. Chain block 5. Compressor 6. Welding machine 7. Painting machine 8. Jack 9. Vise 10. Washing facilities 11. Car-washing facilities 12. Forge, Lathe

4.2.2. Basic plan of arranging tools and machines.

(1) Tools : To be arranged on the shelf or on the wall.

(2) Vise, Grinders : To be installed on the working table.

(3) Painting tools, spray guns : To be on the shelf (there is no consideration here for a painting room but it should be provided as the case may be.)

(4) Lathe · Drilling machines : The space for the machine it self plus working space.

(5) Compressor : There is no need of considering the speciall place. To be mobile.

(6) Forging on a small scale : To be considered in case of need.

(7) Washing : Prevention of fire should be especially considered.

(8) Welding : Oxygen and electric welding should be considered separately.

(9) Chain block : To be arranged with the space of repairing work located in the center. Electric hoist.

(10) Parts for repairing purposes : To be prepared at the sales shop (the area of repair shop)

(11) Car-parking and washihg place : To be considered separately.

4.2.3. Shape of repair shop **See fig. 1.**

4.2.4. Lay out **(See fig. 2.)**

4.3. Model layout of repair shop in the U.S.A.

4.3.1. In the case of an shop with 180 square meters.

〔The first case :**fig. 3.**〕

(1) With the floor space of 12m × 15m and with two doors of 4.8 meter each.

(2) An entrance and an exit are arranged separately.

(3) Working rooms are usually two but incase of need, an part of the area for test-driving could be used temporarily.

fig.3. The first plan

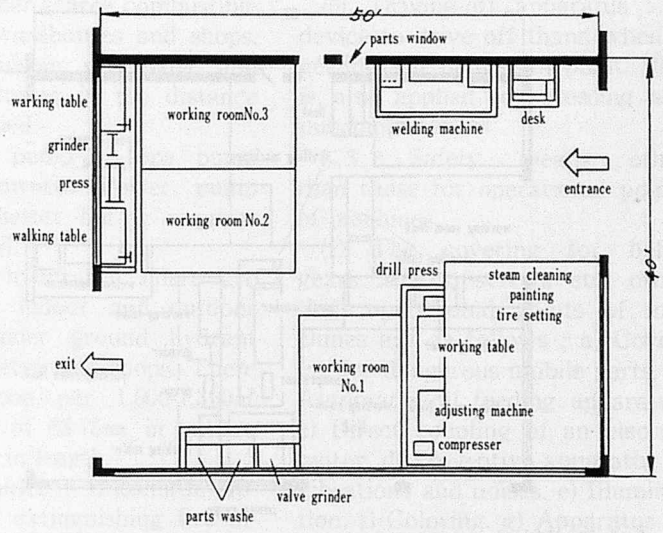


fig.4. The second plan

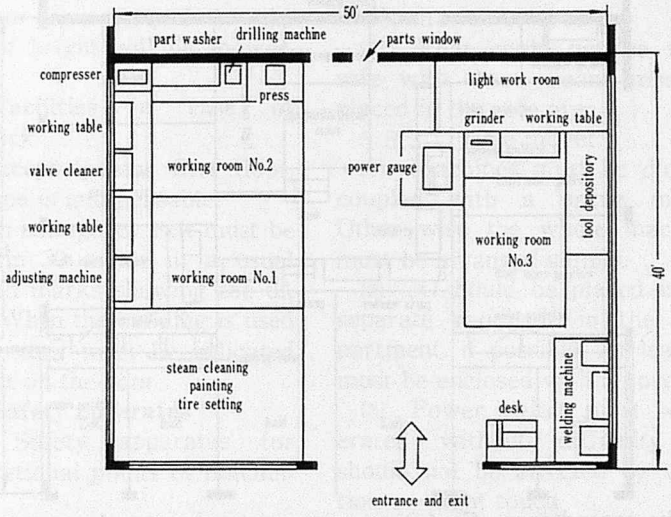


fig.5. The third plan

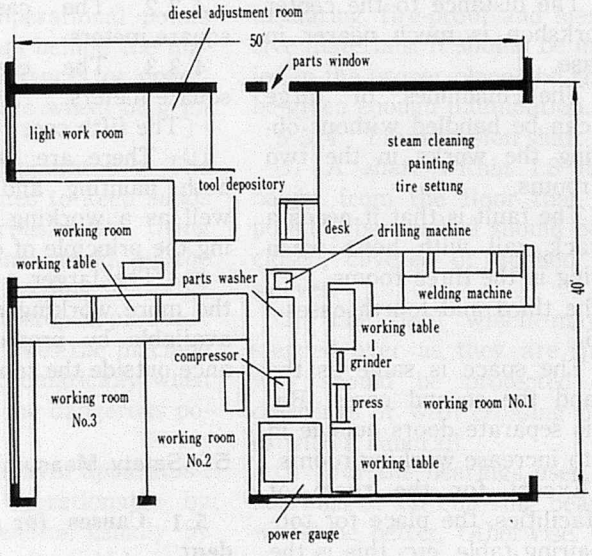
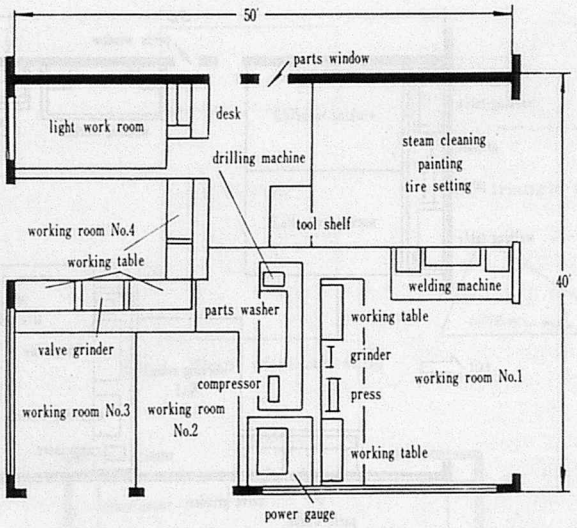
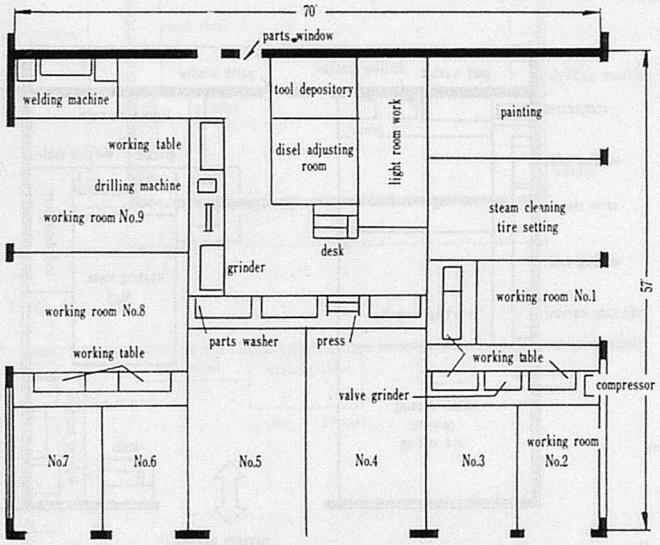


fig.6. The fourth plan



flg.7. The fifth plan



〔The second case : **fig.4.**〕

(1) The distance to the center of workshop is much nearer in this case.

(2) The machines of large scale can be handled without obstructing the works in the two other rooms.

(3) The fault is that it needs a two-track rail with hoist when repairing in the three rooms.

〔The third and fourth cases : **fig.5.6.**〕

(1) The space is same as the first and the second cases. But there is separate doors outside in order to increase working rooms.

(2) Except for the room of Disel facilities, the place for tools, repairing table, etc. this is the same type as usual.

4.3.2. The case of 233.8 square meters

4.3.3. The case of 395.1 square meters.

〔The fifth case : **fig.7.**〕

(1) There are two rooms for both painting and washing as well as a working rooms adopting the principle of outside door.

(2) The larger a shop will be, the more working rooms will be available by providing on entrance outside the room.

5. Safety Measure

5.1 Causes for labour accident

The labour accident could be attributed to two main causes, workers themselves and material causes such as machines and facilities. The followings could be mentioned as the causes examined only through the material conditions of layout of a shop.

(1) Breakage of buildings and facilities by naturaldisasters such as fires, earth quakes, winds, floods, etc.

(2) Lack of proper safety equipment.

(3) Imperfection in blue-printing and the defective structure of facilities.

(4) Breakage and wear of facilities.

(5) Lack of proper handling and controling.

(6) Noise, dusts, vapour, etc.

(7) Atomosferic conditions such as weather, temparature, etc.

(8) Bad ventilaration.

(9) Improper structural conditions such as space and height, etc.

(10) Out of order. Lack of cleaning tools and facilities.

(11) Improper working clothes, shoes and personal outfittings.

(12) Lack of and improper safeguards.

5.2 Fire prevention equipment

5.2.1. Fire-proof materials

(1) Wooden frame : Wooden zinc walls and corrugated iron sheet walls framed with wood as often seen in workshop, are lack of endurance and may easily catch fire.

(2) Iron frame : Wooden walls framed with iron are easy to build but lack of endurance. Zinc walls corrugated iron sheet walls or asbestors walls framed with iron are used widely.

They have much resistance against earth quakes but are not complete against fires. A good structure has disposed iron frames inside amd has fire-proof materials used for walls, windows and door ways.

(3) Ferro-concrete : Best in

fire proof and cheaper in the constructing costs. In case of a factory building, however, registance to earth quake will be reduced becuase windows and spans need large space and are open wide.

(4) Ferro and iron framed concrect : Sufficient in either fire-prevention and earth-registance but require the highest cost of construction.

5.2.2 Fire-prevention structure

(1) There should be necessary space for fire-prevention and refuge between the main buildings and the border next or between two main building and more.

(2) In case of buildings with a floor space of 660㎡, imcombustible materials must be used for outer walls and roofs. (Regulations of Labor Safety and Sanieary).

(3) In case of wooden buildings, the construction of a building that exceeds 3,000㎡, 13 meter in height and a meter in height of eaves is prohibited. And in case of a building that exceegs 1,000㎡ must be separated with fire screens inside if it is not of fire-proof structure. (Construction Standard Act)

5.2.3 Essential points of a fire-prevention plan

(1) The inside of shop must be separated by fire screens or fire doors.

(2) Combustible things must be isolated.

(3) Fire-proof materials should be used for stairs or lifts to prevent fire from spreading.

(4) The installation of wires and tubes through which fire could be spread must be cheeked.

5.3 Fire-extinguishing facilities

(1) Water tank and sand box : Simple but effective when fire starts. Buckets of round bottom should be prepared. Usual type may possibly be used for other purposes.

(2) Fire-extinguisher : One extinguisher per floor space of 450㎡ and within 30 meter in the distance will be enough where there is rather scarce combustible things. In warehouses and shops, one extinguisher per 200㎡ and within 15 meter in the distance will be needed.

(3) Fire pump : Fire pump must be owned. Power pump would be better but it requires good control.

(4) Fire hydrant : There are two kinds, indoor and outdoor use. An under ground hydrant would be better for shops. There must be one per 1,000-1,300㎡ with hoses of 63-75㎜ in calibre and 15-20m in length.

(5) Sprinkler : Automatic apparatus for extinguishing fire inside the building. It is set to a water tube drawn to the ceiling. The floor space equal to the square of height will be showered.

5.4 Facilities in case of emergency

(1) Except for the first floor, fire escape is indispensable.

(2) An emergency exit must be set within 30 meter in a usual shop with marks showing the direction. When the building is used at night, they must be indicated by a light on the door.

5.5 Safety apparatus

5.5.1 Safety apparatus for the operational points of machines

(1) Covering : To apply coverings over the operational points of machines from behind the machine. To apply fences or coverings over aprasive wheel of grinder.

(2) Feeding apparatus : The apparatus designed to keep hands off from dangerous points. Using an inclined plane would be the simplest way of feeding.

(3) Automatic stop apparatus : A device that makes the machine stop working outomatically when a hand get into the dangerous point.

(4) Remote control apparatus : An apparatus operationable by buttons and handles usually by using both hands. It could be used for pressing and punching.

(5) Driving-off apparatus : A device to drive off thand when it get into the dangerous point. This is also applied for pressing and punching.

5.5.2 Safety means other than those for operational points of machines

(1) The covering for belts, gears, shafts, screws etc. other than operational points of machines are as follows ; a) Covering for dangerous mobile parts. b) Automatic oil feeding apparatus. c) Direct coupling of an electric motor. d) Preventive apparatus of vibrations and noises. e) Illumination. f) Coloring. g) Apparatus to cover over the parts which engage in the intensive motion for the sanitation of eyes.

(2) What could not be made safe with these means must be placed in the safe area.

5.5.3 Prime mover

(1) Machines must be directly coupled with a prime mover. Other wise the whole machines must be arranged simply.

(2) It should be placed in the separate room or in the compartment, if possible. At least, it must be enclosed with a covering.

(3) Power switch must be operated without difficulty but should not be affected by vibration or slight touch.

(4) Electric switch must be of insulating, fire-proof and inexplosive materials. It should be installed in the proper place and should be given enough illumination.

5.5.4 Transmission shaft

(1) A shaft within 1.8 meter height from the floor that may possibly be touched should be enclosed, covered or applied with sleeves.

(2) The shaft which may be stepped over as they are in the way should be protected with coverings or with crossing bridges with a handrail.

(3) For the bearings used, ball bearings or oil cup ring bearings would be better. Otherwise, safeguard should be attached to pre-

vent the danger of touching in oiling.

(4) For linch pins, deep-set ones are desirable. Otherwise a cover should be applied.

5.5.5 Belts and others

(1) The belts within 1.8 meter height from the floor and belts pullys which may possibly be stopped over or passed under must be enclosed or covered. The belts which are over 1.8 meter in height from the floor or installed in the basement and still in danger of touching when cleaning or oiling while in operation must be enclosed or covered.

(2) The belts which are in the way of other works or in the working room and exceed 3 meter between the belt pulleys, 1.5 meter in the width and also exceeds the speed of 10m/sec. must be strictly safeguarded.

(3) In case when the interval between belt pulleys or bearing stands is less than the belt width × 3 centimeter or belt width × 1.25 or in case when the belts are removed while in operation, a belt receiver must be provided.

(4) In jointing belts, projecting points of checknuts must be shavenflat.

(5) A belt shiften should be installed at the position where the worker can operate an idle wheel easily.

(6) The gears desposed must be covered.

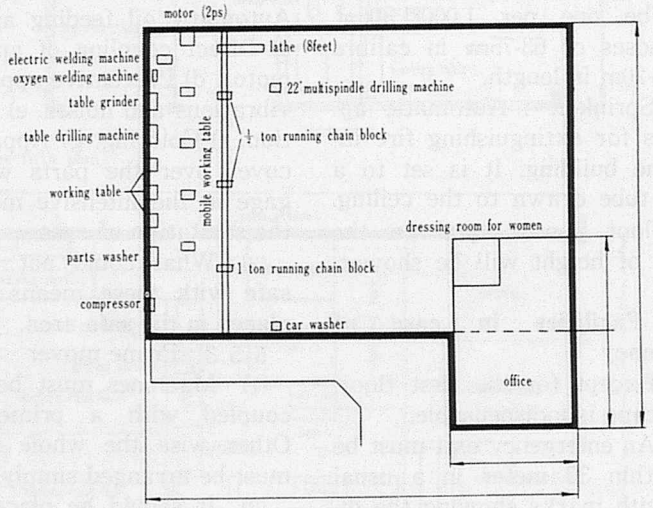


fig.8. A shop (first class) Space : 608m² (the first floor 370, the second floor 238)

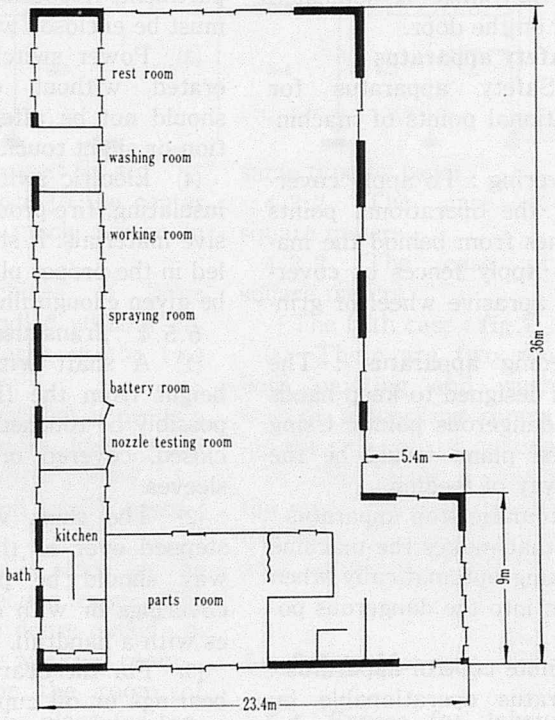


fig.9. B shop Space : 1,260m²

6. Layout of Space for Parts department

6.1 Ten conditions on the effective management of parts department

(1) Service counter must be clearly seen from the entrance of shop.

(2) The parts should be displayed other than storing in the back yard but should not let customers get in the depository.

(3) A installing equipment should be colored in light and displayed in order in the compartment. The place for parts should be indicated clearly for the convenience of cleaning.

(4) A shelf must be prepared for blades of plough, shafts, canvas, etc.

(5) It iv desired that the displayed is easily accessed by clerks.

(6) Windows must be made for the supply of parts to the service shop.

(7) Card-recording files or record books should be prepared.

(8) Catalogues should be displayed in order in the shelf.

(9) Sales registor to record orders and sales tickets should be prepared.

(10) The explanations on the machines should be prepared for the immediate reference.

6.2 The arrangement of parts department

(1) The arrangement of parts department should be made to enable both customers and service shop workers to have access

to the goods.

(2) Visible parts such as sales counters, show windows or shelves so that it can appeal to the customers.

(3) The parts should be placed in order and if necessary, a window could be made to see a part of them. Otherwise, seasonal goods should be displayed or the floor or in the show window.

(4) The use of a displaying-panel designed for customers to be able to find what they want easily may give them the impression that the shop has good amount of stock. The panel can also be used for the display of seasonal goods.

6.3 Indispensable conditions for the construction of parts department facilities

6.3.1 The room of manager of parts departments

(1) It should be placed between the depository of parts and the service shop and also should be placed near to the room of manager of service department so that the department can be managed in close relation to service activities.

(2) The facilities for card indexes, correspondences and filing should be provided.

(3) It should be placed where manager can talk with the person in change of parts.

(4) It should be placed where the whole activities of the department are visible.

6.3.2 The depository of parts

(1) It should be constructed with room left for expansion in the future.

(2) It should be placed next to the displaying shop where the parts of new fashion are displayed for introduction.

(3) Bins, which are solid, easy to cleam and economical, should be used.

(4) Accounting and delivery section should be placed near to the room of manager of parts department with ample space and should be isolated from the counter of retail shop.

6.4 Fixtures necessary for parts

6.4.1 Quality and quantity of fixtures

(1) As for the fixtures of parts, ready-made or ordered, or the ones provided by local contractors are all available without difficulty.

(2) The size and capacity should be decided in consideration of potential amount of sales dealers are expected to attain as well as the service plan to the customers.

(3) Attractive and modern fixtures are desired while they should always be well matched to the actual requirements.

(4) Variety of good plans offered by the suppliers of parts fixtures should be made reference.

6.4.2 Counter

(1) It matters much that counters are orderly arranged, attractive and comfort to see.

(2) If space permitis, counters should face two direction so that customers can see as many bins or shelves as possible.

(3) A showcase to display parts and accessaries can be installed in a part of the counter.

(4) The vacant space under the counter can be used for storage. For example, drawings or display shelves for small parts or gaskets.

6.4.3 File shelf for catalogues on parts

(1) Counter racks or hangers to contain parts catalogues or price books should be provided in order to save time and counter space.

(2) Index marker can indicate what each shelf contains and be used as a pull-out grip as well.

(3) Each shelf contains such things as are 2.75 inches thick, 8.5×11 inches in size.

(4) Gum cushion can pr tect the surface of counter. The metal board that is hanging can prevent the books from being worn out or from the dust.

6.4.4 Flexible bin

(1) A bin is one of the most economical facilities for both depository and display of parts.

(2) Bins should be arranged so that the various sizes of section can be made available by separating it without considering their structure.

(3) This arrangement requires more cost than usual but the space thus made available can contribute the reduction of cost and offer the advantage of effective use.

(4) The horizontal one prevent the parts from dropping off bins. It should be raise high enough with a supporter in the front for placing number cards.

(5) The size and the shape of bin are left for personal choice.

(6) A usual bin should be arranged so that customers can look down on the passage between the bins. This will be helpful for the personnel in change of the sales of parts.

(7) A shalf and spare bin, which should face the counter, are placed on the end of bin.

(8) Casting of large size finished or unfinished, however, should be stored at the bottom of a bin.

6.4.5 Compact cabinet

(1) Valuable parts of small size or parts that are faced to be lost easily are often stored in the cabinet. Various cabinets are used for this purpose.

(2) The cabinet with shallow sliding boxes may not need to purchase. Other kinds are available as ready-made which ever it may be of wood or copper.

(3) Glass containers are also used for either storage or display of small parts.

(4) The partition of thin boxes inside the cabinet should be made like that of bin so that it can be arranged in accordance with the spece necessary for the parts to be stored.

(5) These partitions can be made by itself or installed in the counter.

(6) The parts that need cabinet or container storage may be such as cabrators, magnet parts, small cotor pins, nuts and bolts, and other small parts.

(7) These parts would be stored better in the thin boxes of cabinet after being wrapped than placed on the shelf or in the bin.

(8) Gasket would also be stored better in the cabinet. Drawings are often needed.

(9) Gaskets of larger size should be placed in the drawings that are fastened with wooden nails at the several points, when the thin boxes are used.

6.4.6 Shelf for heavy parts

(1) The size, shape and function of shelf will be affected by the goods that are stored.

(2) Some of these parts are stored most economically in the bin on the shelf horizontally placed on the supporters.

6.4.7 Depository of parts at the invisible place

(1) Many of the parts that are delivered to parts department are difficult to arrange orderly of their nature.

(2) Most of them can be stored in the visible place. There is a dealer who stores them on the shelf provided in the nearby warehouse.

6.4.8 Display table

(1) Oil, grease, plug, oil filter, electriclight, etc. are the goods that sell fast and are wrapped attractively so that they can appeal to the eyes.

(2) The parts that turn over quickly or the ones that are slow in turn over but the choice of which is left to the customers should be displayed on the self-service table or on the eyeland table that are near to the parts counter.

(3) This table can be an effective sales man though he does not speak and therefore it should always be kept clean and attractive.

6.4.9 Passage

(1) The passage between the counter bin and the shelf should be two and half feet in width.

(2) A passage that is connected with the counter should be provided as much convenient as possible in communicating with the office of general affairs or booking.

(3) It should also be made as much convenient to the person who is in charge of service activities and parts business.

(4) The entrance to the parts department is also used in the delivery of goods and as the entrance to the service shop as well.

7. Some Examples of Repair Shop in Japan (Fig. 8~11)

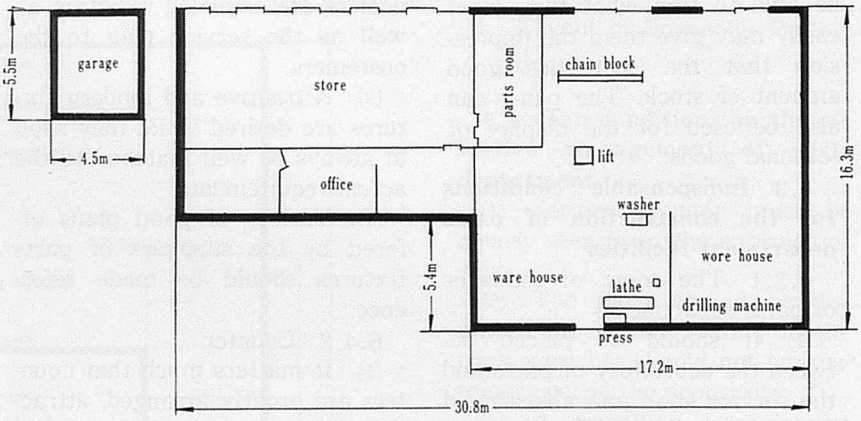


fig.10. C shop (first class) Space : 267m²

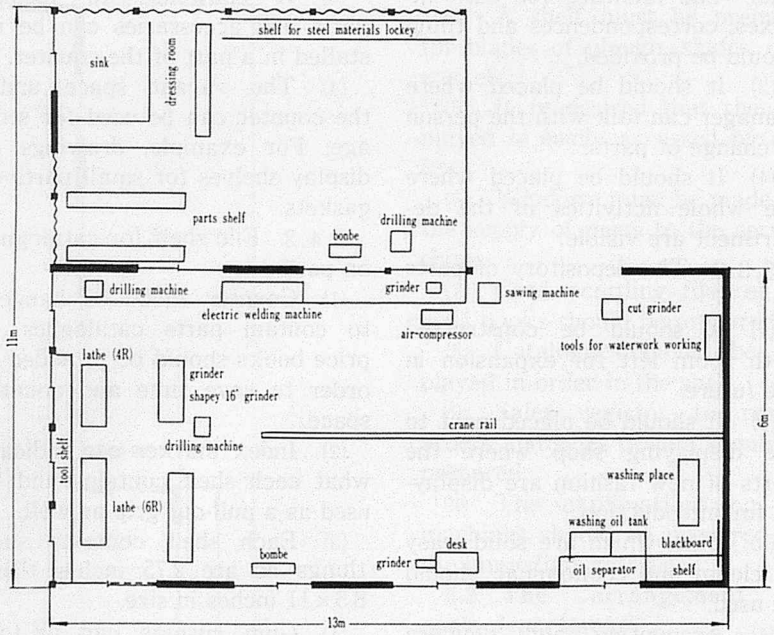


fig.11. D shop (first class) Space : 112m²

MANUFACTURERS' OPINION

Monitoring the Performance of Distributors

David Brown Tractors (Sales) Ltd.

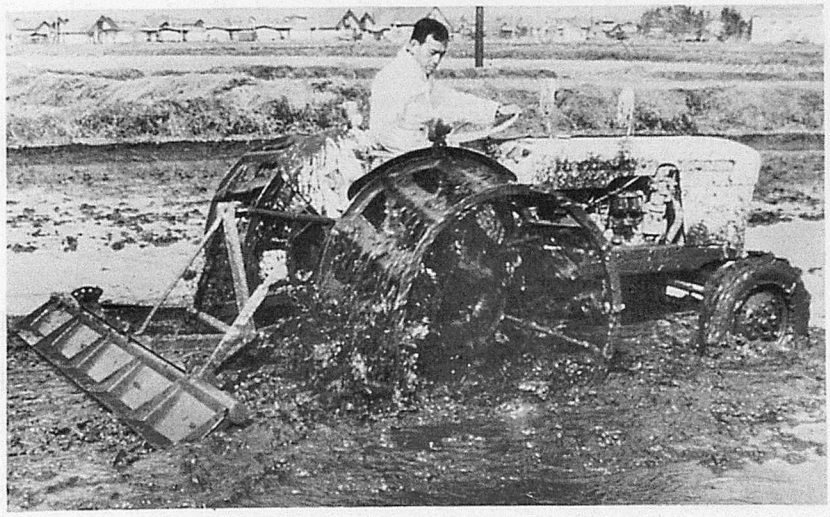
(Meltham, Yorkshire, England)

The most basic definition of marketing is "find the need and fill it". Over simplified as this statement may be, it is, in fact, the guiding principle behind the approach to selling any product in any part of the world. In Asia one does not have to search for the market—it exists. What one does have to do is to appreciate the scale and characteristics of the market.

To do this David Brown Tractors use all the modern weapons of marketing. All markets are under constant research surveillance, information being collected and collated from official sources (i.e. Government statistics and publications), local publications (magazines, etc.) and reports from David Brown personnel who constantly visit and tour many parts of the world, including Asia. From these reports a comprehensive picture is built up indicating the geographical characteristics and patterns of farming in each country, and the Government and industrial policies insofar as they affect importation and sale of David Brown tractors and implements. With this information, ideally, specific tractors should be designed for each market, but this is not commercially viable. What in actual fact happens is that the most satisfactory products from the current range are offered, having due regard to local conditions. This means that it is possible to manufacture a **basic** tractor which is suitable for most parts of the world (and, therefore, can be produced at a lower cost than a smaller number of specialised machines) and then build-in special modifications to meet particular conditions of climate, altitude, etc.

Alongside the development of the product for each specific territory a marketing strategy is developed, directed to fulfilling the general commercial requirements for the territory, together with particular policies for individual markets. There is the all important question of local distribution which must be approached logically and methodically. It must be geared to the achievement of pre-determined objectives based upon criteria associated with a parts and after-sales service of the highest quality, with the appropriate form of local sales promotion and with a sound financial structure.

David Brown Tractors consider that their responsibility includes monitoring the performances of their distributors and agents to ensure that the facilities are maximised. Equally important is bringing an experties to distributors and their staff where this is lacking. A fuller knowledge of the product, a greater experties in after-sales service and, perhaps, more profitable parts handling, are all requirements for the mutual exploitation of a franchise. In the last resort, where the franchise cannot produce results that



A DB 780 fitted with special cage wheels levelling a paddy field

are beneficial to the manufacturer, to the distributor and, most important, to the farmer, then an alternative solution is sought.

Successful export marketing is born of a profitable and harmonious relationship between maker and seller wherever the latter may be. But behind this entire set-up must be the presence of the manufacturer because it is his policies and his understanding of his distributors and his markets that will determine his basic orientation. David Brown like most international manufacturers in the tractor and farm equipment business wholeheartedly subscribe to these views. The fulfilment of a need and the giving of a service to those who cultivate the soil is, after all, the farm equipment business, whether in Asia or anywhere else in the world. **(by David Harrocks-Taylor** · Export Sales Manager)

Paddy field tilling by a Mitsubishi tractor

Support to Bring up Local Manufacturers

Mitsubishi Heavy Industries Ltd.

(5-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan)

In almost all of the Asian countries, it is now very common that the agricultural production efficiency thereof will be low and food selfsupport by themselves will also be hard to maintain, although their main industry is agriculture.

In order to improve the above problems, we think it will be essential that, in addition to the agricultural administration by their governments, their governments should promote the mechanization of agricultural machinery and the improvement of cultivating methods, together with the basic study for farm-land systems.

For the purpose of promoting the mechanization of agricultural machinery, the followings will be necessary, which will also be common to the benefit between their country and ourselves.

(1) Their government should bring up good local manufacturers of agricultural machinery and try to introduce foreign investments and technical assistance from developed country of Japan, together with the supply of SKD or CKD parts thereof.

(2) As one to assist in propagating agricultural machinery, their government should enforce on farmers long term finance system or subsidy.

(3) In order to let farmers fully utilize agricultural machinery, collective use among farmers' group, leasing or renting should also be considered.

(4) After-services therefore should also be carried out through the control of above local manufacturers.

These above items, we believe, will be the outstanding problems to be improved and systemized under the deep understanding of their governments, and we, one of the agricultural machinery manufacturers in Japan are ready to support such local manufacturers in the way of giving technical assistance, investing capital or despatching supervisors and engineers, sometimes fully using the economic cooperation between the governments of Japan and their country.**(by Shozo Iwamoto** · Manager of Export Section, Agr. Machinery and Engine Div.)

Permanent Romanian Representative in Asia

Auto-Tractor

(2,N.Iorga Street, Brasov, Romania)

Romania has produced tractors for 25 years, just at the end of 1971 celebrated the big plant in Brasov this important event.

Short time after his foundation, the Romanian tractor industry has produced even for export.

The export to Asia began in

1952. It increased each year, and in 1970 represented more than 50% of the Romanian total export.

Iran, India, Iraq, Pakistan, Thailand are important partners of Romania, who grow their inquiries year by year.

We have to mention that Iran was one of our most important partners who has imported Romanian tractors since 1965, and this represented the greatest part of his total tractor import.

With a view to maintain and enlarge the existent markets, and to obtain new ones, the enterprise Auto-Tractor Brasov, which sales Romanian tractors abroad, has got permanent Romanian representatives in the most countries of Asia, which are studying the local conditions, are transmitting periodically reports, and are informing from time to time the company respectively the plant about the inquiries and the market situation, with a viwe to direct the production according to the local exigencies.

So can you explain the great variety of Romanian tractors. There are produced 11 types in the two families of the wheel and crawler tractors. We are exporting tractors in the range of 40-150 HP, for vineyards, vegetables works, for all purposes (universal), for works on slopes and hills, tractors with two and four drive wheels, with equal wheels etc.

We present hereby some of them, which are appreciated in the whole world for their robustness and quality.

The rich variety of types, as well as their continuous modernization was just the result of a marketing activity, which has led the production to satisfy the demands. Thus, the tractors are equipped with automatic hydraulic depth control unit permitting the adjustment of working depth and drawbar pull, they semiindependently or synchromously operated power take-off, which permits unlimited uses of agricultural implements, the most of speeds are synchromeshed, the optional equipments are permanently diversified, there are created continuously new models.

In some countries were the inquiries so big, that for to satisfy them we have built assembling lines. At the same time, if an extraordinary interest appeared, of national proportions, we setted up joint companies.

Romania pays great attention to the service, technical assistance of his tractors. It has a well organized technical assistance network, with tens and hundreds of specialists.

Our country participates actively and consistently in the great exhibitions of Asia. Djakarta, New Delhi, Tehran, Bagdad, Damask, Osaka are all towns which marks great Romanian successes.

With a view to make popular the most recent produces and for knowing better the work conditions of our products, Auto-Tractor plans a mobile caravan through Asia, by the end of 1972. On this occasion there will be carried out demonstrations and meetings with the local users.

The efficiency of our marketing policy is proved : the tractors are appreciated with one voice for their quality (they gained more international prizes), we have penetrated in the market of England (the greatest tractor exporter of the world), we are receiving inquiries from the whole world, even from Asia.

Asia, in full economic expansion started on the way of developmen just by the intensive

PICTURES

Characteristics	Type of tractor			
	U—445	SM.445	U.650-651	S. 1500
Motor power	40H P	40H P	65H P	150H P
Gearbox forward speeds	6	6	10	
Gearbox reverse speeds	2	2	2	2 and reversing gear
Wheel or crawler type	wheel	crawler	wheel	crawler
Motor	Diesel with direct fuel injection			supercharged precombustion chamber
Power take-off	either semi-independently(and independently) or sincronously operated with tractor travel speed.			
Drive axles	1	1	1 2	1

U.650(left), U.651(right) manufactured by Auto-Tractor

mechanization of the agriculture. "Mechanization in Asia" is not only a title of revue, but a phenomenon at which development Romania has participated and shall participate as actively as possible by a suitable marketing policy (**by Mircea Florescu** · General Manager)

Asia as Big Market for Engines

Ishikawajima-Harima Heavy Industries Co., Ltd.

(Shin-Ohtemachi Bldg., 2-1,2-chome, Ohtemachi, Chiyoda-ku, Tokyo, Japan)

We regularly began to export agricultural machinery only three years ago. About 10% of total products are exported. Main exports are engines and tractors.

In Asian developing countries, general importing companies of light machines are serving both as importers of agricultural machines and domestic selling agents. They are not specialized importing companies of agricultural machinery. The same is true of Japanese exporters. They are general trading companies, dealing with not only agricultural machinery but also other goods. Consequently they have commercial relations with various foreign trading companies.

Some 90% of our total exports are engines and the rest are tractors. A market for engines is expanding. They are exported almost on genuine commercial base. In the case of tractors, they are exported by tenders conforming to the governmental program for agricultural mechanization in each country. Then, it can't be regarded as trading on commercial base.

Though Asian developing countries are great market for engines and tractors in the long perspective, there still lie many problems such as foreign money shortage. We should cooperate with each government to promote domestic production.

Distributing system is quite unfinished in developing countries. Its consolidation will take long time. Single manufacturer can't so profitably establish a distributing and repairing network for aftersale-service as in developed countries, since its sales volume are very small in developing countries. It may be necessary that government institutes joing service center or puts gasoline stands which are considerably popularized in charge of that function.

As regards technical training of importers of developing countries, we invite them to Japan and educate them at our own charges. To promote sales, we send engineers to those countries and make them assume the technical leadership.

Since imported agricultural machines are produced in accordance with agriculture of exporting countries, they cannot suit to agricultural situation in developing countries. In this context, there occurred recently a demand for establishment of an international institute for development of agricultural machinery under the cooperation of the government of each country, where they should develop such machines as to fit to the local conditions of producing and selling ability.

Some of governmental agricultural mechanization programs are too impetuous to be suitable to the actual conditions. For further agricultural mechanization, basic consolidation such as river works is most important. Other various conditions must be improved at the same time. Besides, we may need to research sociologically and psycologically into farmers' will-to-work.

Common process of rice crop mechanization is as follows: huller and rice pearing machine→thresher and harvesting machine→power tiller and tractor.

Small scale irrigation will extend because it leads to multiple cropping and yiled increase. Considering that electricity is not popularized, demand for small engines will rapidly increase for pumping use and as other power sources.

It is beyond the power of a single manufacturer to promote further agricultural mechanization and to settle present difficult problems. The siutation makes governmental, civil and international cooperation necessary. (**by Kinji Goto** · Manager, No.4, Machinery Export Dept.)

Self-Sufficiency of Foods by a Tractor

Toyosha Co., Ltd.

(55, Joshoji-16, Kadoma-City, Osaka, 571 Japan)

It is self-evident that sufficiency of food stabilized human living and it is the base for the formation of a nation and its existence as well-being.

If a country, even with abundant territory and manpower, should buy and import foods from foreign countries at huge cost, it does not only cause the money goflow from the nation's finance but also discourage and

spoil people and make them dependant not on their capacity but on the others' assistance and cooperation, and the future of the country will be badly affected.

With the limited resources of foreign currency, you could do more farmers pleasure in farming with HINOMOTO small tractor which is not expensive than big-sized tractor. This small tractor is comparatively powerless than big one in dry field, but more mobile in wet paddy.

a) HINOMOTO's cultivating width is 120 cm and depth 20 cm showing higher efficiency than pedestrian tiller.

b) Operation while riding on tractor is by far comfortable than walking behind the two wheel tiller.

c) You have only to make one touch button for starting HINOMOTO 4-wheeled compact tractor.

d) Main requirement for operator is steering and without frequent care of tractor-driven attachment, it automatically works.

e) Lifting or lowering attachment can be done by manipulation of lever with three fingers.

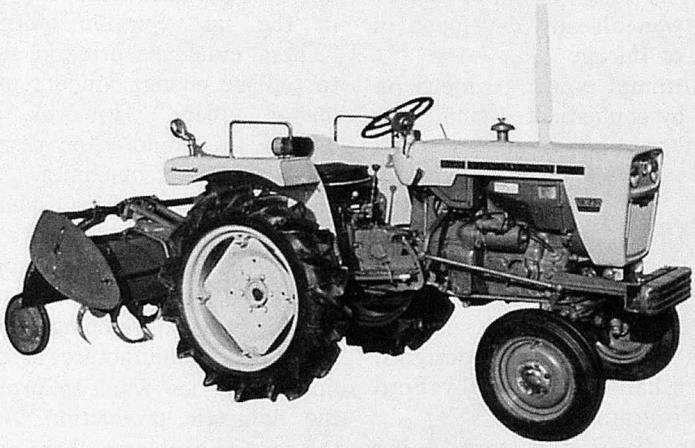
f) Easiness of operation enables even old man, woman and young boy to do tilling work after about 1 hour's guidance and practice.

g) HINOMOTO can run on narrow passages and simple bridges because of the merit of lightness in weight.

Easy steering and comfortable sitting on the seat like in a car releases young men from painful working on foot in dirty muddy field and we trust they should have pride, find pleasure and recreation in farming.

Elaborate and perfect finishing of work is done efficiently without any special skill but with ease and pleasure, and such a finishing causes better growth of plants, consequently increased harvest.

It is advisable to inspire utilization of tractors on the level of regional groups and organize technical orientation meetings to train agricultural leaders for each regional groups. Leaders are to give guidance to the practice of tractors to general farmers for better efficiency in work in widespread areas.



Hinomoto tractor, MC-220 (22 ps, diesel)

Self-sufficiency of foods, which is realized by small tractors, encourages the development of various industries in a country and provides the basis of stabilizing national economy. Self-sufficiency of foods, cultivation of self-dependant industry sprit among the youths, sound reflections of the national unity from the strong ties between the government and the general public of agricultural field----these are what we intend to offer as the results of your utilizing HINOMOTO compact tractors. (**by Tatsuo Tanoue** · President)

What is a Profitable Machine?

--from the interview with Mr.W.H.

New Holland International Div. Sperry Rand Corp.

(New Holland, Pennsylvania, U.S.A.)

As to the question on the policy of New Holland for agricultural mechanization in Asian developing countries, Mr. W. H. Erb, New Holland International Division, answered as follows:

Agricultural mechanization in Asian developing countries is basically important. New Holland has been doing our business mainly in Europe and North America. We also started the business in Middle and South America, Africa and Asia. But the business in these areas is not yet so big.

It is very difficult for me to answer the question how we can totally promote the agricultural mechanization in these areas. The land, weather and social conditions are different in each countries. There are many kinds of opinions how we should promote agricultural mechanization in Asian developing countries, as the problem includes various elements to be considered. Multiple-cropping will be the most important method for their agriculture, because the population increasing rate and density is very high in Asian developing countries. There are basically three kinds of patterns to promote agricultural mechanization in these areas. They are,

1. Animal power to mechani-

zation by big size machinery which was already developed in U.S.A. or Europe

2. Animal power to mechanization by sophisticated small size machinery like a power tiller which was well developed in Japan

3. Animal power to mechanization by basically simple machinery which is easy to be produced in these countries, such the machines as were newly designed by Dr. Khan in IRRI or by Ford DNT Program.

As to the first pattern of big size mechanization, New Holland has the experience to have introduced ten units of big size rice combine into Malaysia under the governmental project. We sent an engineer to guide users. The combine itself had no problem, but the unbalance between the machine and the circumstances caused the biggest problem. For example, we had to solve the problems: how to transport a big combine from one field to another, how to transport the threshed paddy and how to dry and store the big amount of paddy. Though the final result of the project is not yet clear, it can be said that undeveloped infrastructure of agricultural mechanization is the biggest problem.

As to the second pattern of the mechanization by Japanese small sized and sophisticated machines, it can be said that introduction of them is generally successful in many areas. But other Japanese machines like a power-tiller or a rice transplanter need several improvements to fit fully to the tropical conditions. It is also needed to study more about the economical aspects of them.

As to the third pattern of the agricultural mechanization by the basically simple machines like Dr. Khan's idea, it can be said that these machines can be easily operated by the farmers in these developing countries and produced by cottage industry in five or six years. But there are critical opinions like those expressed in the last Surinam Meeting; "These machines are too simple to replace enough amount of the human labors." However, it is needed to promote the research on these type of machines.

As to the domestic production of agricultural machinery, it is extremely difficult for a company to establish the exact strategy, though every developing country and every manufacture in developed countries want to promote the domestic production. As to the service problems, there are so many difficulties in these countries, although the supply of parts and the provision of after-service is more essential for the harvesting machine like a combine or a baler than a tractor. It comes from the cost which is influenced by sales volume and sales price. For example, it is very difficult to stock the enough spare parts of big combines unless they can sell more than 40 or 50 units during a year.

Usually a dealer has to go far to do after-sales services. It takes time and money, then they have to sell the spare parts at high price to pay for the service cost. It is so expensive that farmers cannot buy spare parts and are coming to order a small factory to make spare parts while quality is not so good. It is also difficult to find a suitable trainee because it is very common that trained persons easily change their place to work.

Now, New Holland has long history of hay making machinery. The future of hay making in Asia is very important and hopefull. It may be essential to do more study and extension activity on how to make good hay, in the case they do beef production utilizing dry seasons.

The most important thing for marketing of agricultural machinery in Asian developing countries is to find profitable machines or products which can make profit for a dealer, a user and a manufacturer. The marketing channel is naturally formed by these products.

We cannot find yet what is the profitable machines in spite of our long research to find new products for Asian developing countries and their markets. The development of new machines based on the conditions of developing countries is fine and needed, but the risk is also big. It is most cheap and easy way to apply the machine born in developed countries.

As to the role of governmental help for promoting agricultural mechanization, it is essential. Their agriculture cannot be improved without any governmental help. Especially I hope that they will make efforts to largely stimulate agricultural production supporting the new methods like multiple-cropping system.

To Increase Production On-The-Spot

Yanmar Diesel Engine Co., Ltd.

(1,4-chome, Yaesu, Chuo-ku, Tokyo, Japan)

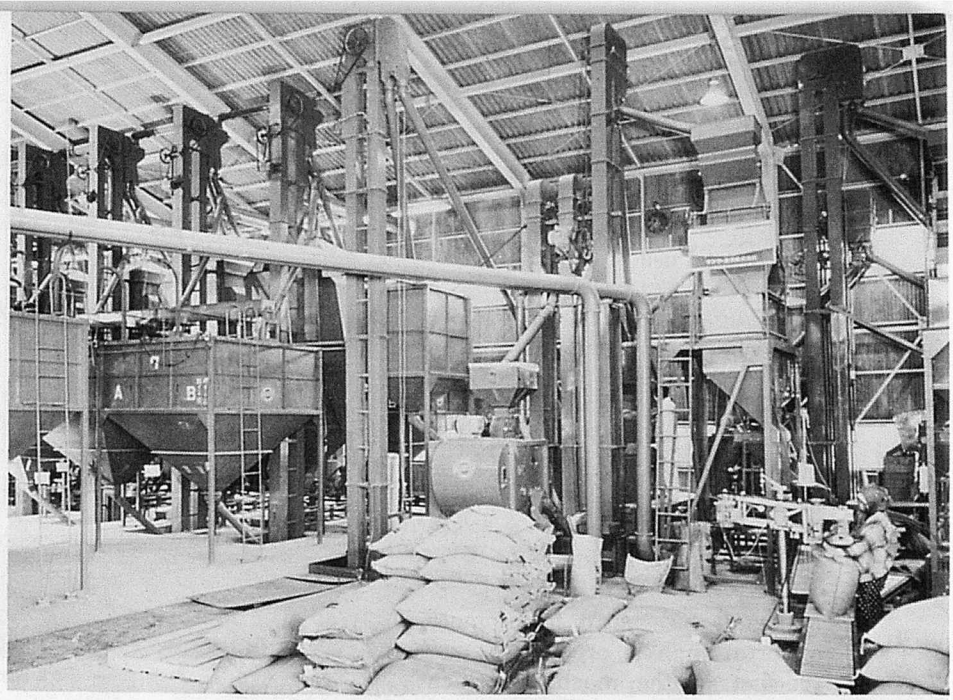
The other day the present writer had a chance to have a talk with Mr.N.Iwano, Export Department of Yanmar Diesel Engine Co., Ltd. who had much experience in exporting Yanmar agricultural machines. The subject concentrated on the present condition of exportation of agricultural maches to Asian developing countries.

Regular exportation of agricul-

tural machines by Yanmar Deisel Engine Co., Ltd. dated back to 1962 when they first began feasibility study in Asian countries east of Iran. The study made it clear that those countries had enormous potentiality as a market, and they decided to investigate it under a long-ranged plan. It also uncovered the demand for power tillers and attachments, and for improvement of design of preparing-processing machines for rice cropping which fits to local conditions. Then, they sent technical experts there to find out that and how they should improve Japanese agricultural machines. As the first step to intensification of export, Yanmar Diesel Co., Ltd. founded a key-station in Singapore for the purpose of promoting after-service and sales activities, where they hired five full-timers.

As of 1972, the total amount of exports of engines for agiricultural use together with other agricultural machines is approximately 13 billion yen. Compared with 70% on average of ten years before, the land utility rate in Asia has now reached 130%, which shows rapid growth of agriculture owing to introduction of new varieties and multiple-cropping through irrigation.

Japanese agricultural machines have been exported only to the countries where they can be used with partial improvements. But this mode of exportation has shown no remarkable increase since 1970. This is more attributable to shortage of machines which satisfy the local needs and increase of demand for development of new design, than to shortage of foreign currency for developing coutries, revaluation of the yen and policies to encourage home-manufacture. For example, export of largesizde diesel tillers is showing slight derase becase becrease largesized tractors and inexpensive small-sized puddlers are pushing into the market.



Yanmar dryer and huller plant in a rice center

In stead of cooperation among advanced and developing countries in promoting home-manufacture, we have faced with difficulties, that is, the production cost is much higher than that of import. The local production cost of attachments, for example, is 30% higher than those made in Japan. The most serious problem in exportation, therefore, is that machines are too expensive for local farmers. In order to lower the price, we must think about production on-the-spot and new desigh. Some developing countries have already been exporting transplanters of long seedlings. Rice transplanters, combines and binders also have bright future.

In promoting home-manufacture we must improve the matching between local industrial standard and "JIS", price of materials, and late provision of parts from cooprative factories.

Development and improvement of design of machines for local use are delayed by the following reasons: 1) insufficient survey by manufacturers, 2) excessive self-confidence of engineers of manufacturers who have not seen the status in developing countries and 3) manufacturers' lack of adventurous spirit caused by their unreliable estimation of market volume which pays their investment.

One of the scourges in distribution of agricultural machines lies in provision of parts. The parts we can initially export are limited to the amount corresponding to 10-18% of the machine's price. The import licenses for additional parts, however, are not given so smoothly and promptly. Therefore, the initially imported parts naturally become expensive in order to cover the machine's durable period. Passing through Japanese manufacturers, export firms and import firms on-the-spot, sole-agents, sub-dealers to farmers, the price of the parts swells up to 280-300%. Between sole-agents and farmers lie sub-dealers at present, which are not specialized dealers of agricultural machines and have not sufficient service ability. In this connection, establishment and amplification of specialized sales agents of agricultural machines are one of the urgent necessities in expanding rational distribution system.

For distribution of agricultural machines, some improvements are also needed on financial assistance. In the form of an agricultural loan, for example, government of each developing country gets financial assistance from international finacial agencies and advanced countries. But such benefit seldom reaches at farmers, stopping at central banks in vain. Difficulty in collecting money once loaned to farmers through local banks is one of the reasons. Establishment of some agricultural loan system through the

medium of specialized banks for agricultural use or agriculturl co-operatives is earnestly needed.

As regards training, we invite certain persons among soleagents to Japan. Though the choice of trainees is the task of sole agents themselves, it sometimes turns out a failure. That is, they often prove to be of no use or change their jobs after coming back to their home countries.

Yanmar Diesel Engine Co., Ltd. makes it his motto to promote exportation and production on--the-spot of the machines which can be of use for long time to farmers in every under developing country. (by **Noboru Iwano** · West Asia and Middle East Africa Section, Overseas Operation Div.)

Iseki power tillers operated by Asian peoples

The Diffusion of Practical Knowledge

Iseki Agricultural Machinery Mfg. Co., Ltd.

(2-2, Nihonbashi-dori, Chuo-ku, Tokyo, Japan)

we understand for agricultural mechanization as follows. Regardless of developing coutries and advanced countrices, the agricultural machines had been generally introduced and will be done to them with the intention of attaining the improvement in labour and land productivity. And their primary element capable of introducing the agricultuarl machines is consisted of factors which have been complicated by important problems concerning with the foundation of nation, i.e., labour, income, land foundation and social factors.

We have already introduced a large of agricultural machines to their countries, and we acknowlege that we have playing an important role in contributing to their modern agricultural mechanization, but also we don't acknowleg that the only agricultural mechanization is equal to their modernization.

We are now endeavouring with oure bese to accomplish not only the mere tender of metallic machines to them in one working stage, but also the diffusion of practical knowledge, i.e., cultivation method, harvest method, management method, etc., after due consideration for each condition from farming management project to agricultural products distribution. Especially, we hope to play a main role in solving the employment problem which deeply disturb in broad-spreading of agricultural machines and international division of labour, with our accumulation of technical knowledge over 50 years.

For paddy farming, we also confirm that the small and middle integrated mechanization system of pabby culturing, which we or Japan completed with our experience for many years, is fitted with the effective agricultural mechanization in their developing countries.

Finally, we hope that we will be able in contributing to their agricultural consolidation and enlargement of productivity, through the agricultural mechanization, under such condition of backing that the developing coutries themselves execute any appropriate policies and on the other hand, the advanced countries positively cooperate with them, and as the result, the economic modernization and development of their countries through the agricultural development (**by Shigeki Hino** · General Manager, Overseas Division)

Production based on Special Condition

Satoh Agricultural Machine Mfg. Co., Ltd.

(Kinsan Bldg., No.5,4-chome, Nihonbashi-Muromachi, Chuo-ku, Tokyo)

We, Satoh Agricultural Machine Mfg. Co., Ltd., can't take standardized measures for developing countries because market structure and agricultural condition are more various there than in advanced countries. Consequently we must often change

our measures in accordance with each market. Since export was considered not as effective demand but as subsidiary method to increase sales, we couldn't approach developing countries positively. Our measures for them are as follows;

1. **Development of agricultural machinery suitable for developing countries**

Exported agricultural machinery manufactured for domestic market are not suitable foe users of developing countries at present. We actively deal with these problems concearned and promote development of agricultural machinery suitable for those countries. For example,

(a) agricultural machinery assembled with few parts

(b) not complicated, but simple and durable agr. machinery

(c) agr. machinery based on users' demanand in those countries

2. **Education and training of dealers**

We can't succeed in developing agricultural machines unless we can satisfy users. How to export them to developing countries, that is to say, merchandising, makes another problem. Many of dealers, depending only on the their experience, haven't sufficient knowledge and don't know sales method in those countries. Satoh will stress the following mottoes together with sales promoting policies.

(a) education and training for agr. machinery sales (on-the-spot and in Japan)

(b) Offer of technical data

(c) Aid to sales promotion

Measures for control of dealers who play an important part in agr. machinery sales are as follows;

(a) Communication of necessary knowledge, information, intention of developing products and competitive relation with other manufacturers

(b) protection of the right of sales

(c) price maintenance

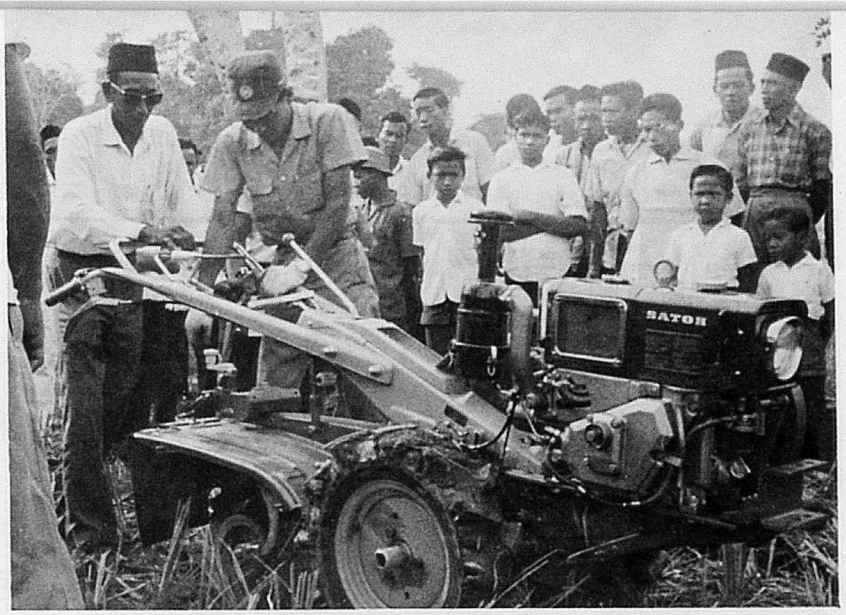
(d) aid to propagation and service

(e) guide to selling technique

(f) continuous and smooth supply of parts

3. **Bringing up Manufacturers on-the-spot by technical provision.**

We are going to bring up manufacturers on-the-spot manufacturers through providing techniques positively. Cooperating with them we will develop suitable machinery for agricultural mechanization. Under certain circumstances we intend to carry out overseas investment.(**Goro Okochi** · Manager of Overseas Department)



Sales demonstration of a Satoh power tiller in Malaysia

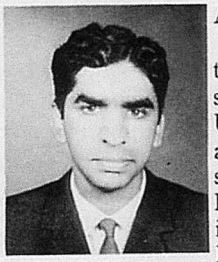
Introduction of Co-Operating Editors

Manbahadur Gurung

Born in 1945. From 1964 engaged in Govt. service with the HQ (Head quarter) of Regional Agriculture Farm Bhur, Bhutan, and carried out the both works accordingly (Agriculture & Horticulture) as a Sub-Inspector of Agriculture. (Address: Royal Govt. of Bhutan, Bhutan)

Bala Krishna Shrestha

Born in 1940, he graduated in Agricultural Engineering (Farm Power and Machinery) from Israel Institute of Technology, Technion, Israel in 1966. An assistant agri. engineer on farm tools and machinery research and development in Nepal (Home address: 4/141, Pulchowk, Behind the Fire Brigade, Latipur, Nepal)

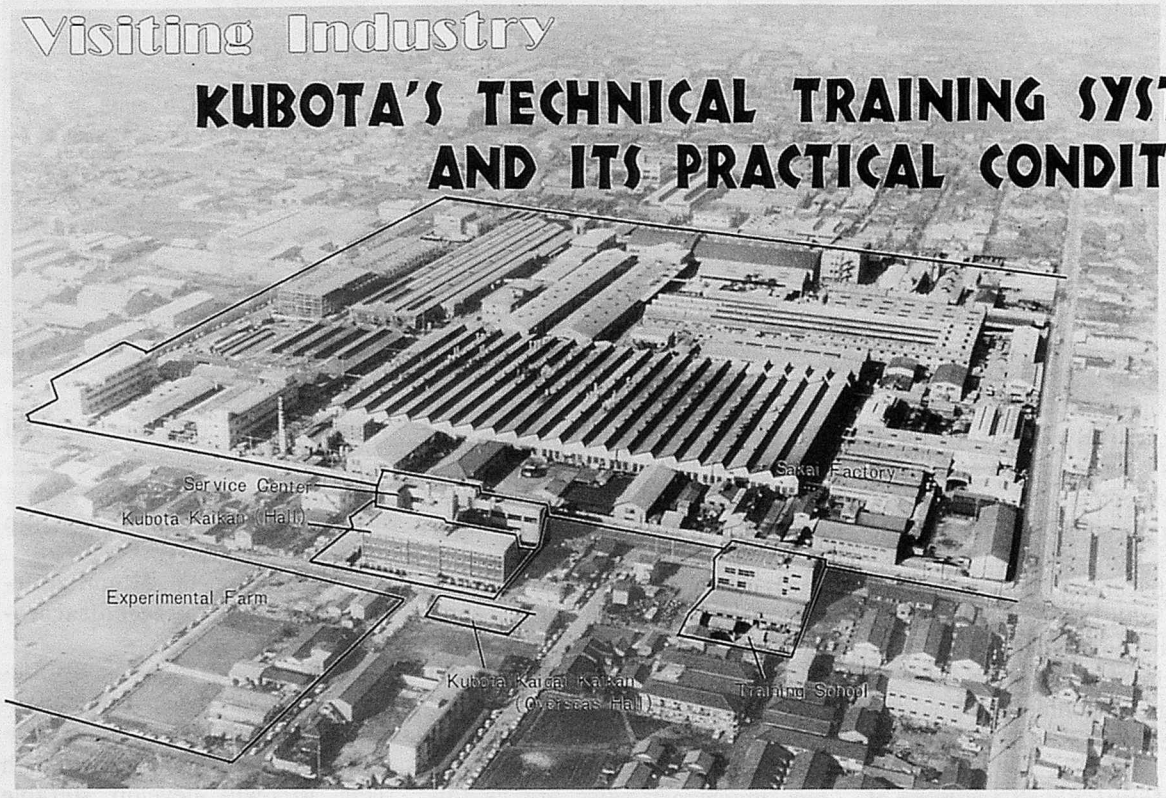


A. M. Michael

Professor, Water Technology Centre, Indian Agricultural Research Institute, New Delhi-12. He served the University of Udaipur for 13 years and the Punjab Agricultural University for 2½ years before joining the Indian Agricultural Research Institute in 1968 as Senior Research Engineer. He is Joint Secretary and Editor-in-Chief ISAE News of the Indian Society of Agricultural Engineers.

Visiting Industry

KUBOTA'S TECHNICAL TRAINING SYSTEM AND ITS PRACTICAL CONDITION



Complete View of Sakai Factory

Capitalized at 33,254,440 yen. Kubota, Ltd. achieved the annual sale of ¥202,500,000,000 in 1971. Kubota is the general manufacturer with 16 business sections which range from agricultural machines to pipe, molding, industrial machines, housing, environmental control facilities, etc. Promoting "From man-building to rice-growing" Kubota is striving for "Realization of rich human environments" which involves the basic industries such as water services, iron, construction and agricultural & fishery industry down to general household appliances and environmental control systems.

The agricultural machinery section as well as that of pipe is the principal business section of this company. They manufacture engines, walking tractors, 4-wheel tractors, various implements and attachments, pumps, transplanters, implements for seedling growing, facilities for spraying and dusting, binders, combines, grain threshing machines, self-propelled threshers, hullers and dryers. They also fabricate and sell many kinds of agricultural facilities like rice polishers, rice centers, country elevators, cooperative seedling growing centers, horticultural plants together with many dairy plants and equipments and small-sized construction machines. Kubota, having the share of 40%, is playing the leading role of this industry.

Kubota Technical Training Institute belongs to the Service Department of its Sakai Factory which is the specialized manufacturing factory of agricultural machines. It was founded in July 1949 in order to train the personnel of Kubota's special agents. But later, in accordance with the rapid diffusion and development of Kubota's agricultural machines, they extended the sphere of object to general applicants, agricultural demonstration agents, agricultural commissions and technicians of the related unions.

Furthermore, they established Kubota Kaigai Kaikan, the exclusive lodgings for foreign trainees, in September 1957, giving the lead to other private enterprises in solid technical training for foreign studentes.

As of the end of 1971, the total number of trainees summed to 363,086; 341,800 of general applicants, 20,400 of special agents' personnel and others, and 886 from foreign countries. Foreign students are from 36 countries in all : Okinawa, Taiwan, Mainland China, Hong Kong, Vietnam, Laos, Cambodia, Thailand, Malaysia, Philippines, Burma, Indonesia, Nepal, India, Pakistan, Ceylon, Afghanistan, Bhutan, Iran, Greece, Australia, Ethiopia, Egypt, Arab, Ghana, Nigeria, Tanzania, New Guinea, Canada,

Paraguay, Ecuador, Brasil, Venezuela, Peru and Guatemala. They are totalized 18,006 man-days (actual number of trainees × training days), that is, 1,200 man-days p.a.. In 1971, there were 1,065 man-days of trainees; 40,000 of general domestic applicants, 30,000 of personnel of domestic, special agents and 43 of foreign students. The visitors count about 30,000 p.a. summing to approximately 1,700,000 in all.

FACILITIES and FUNCTIONS

Kubota Technical Training Institute consists of five main facilities. They are the training school, Kubota Kaikan, Kaigai Kaikan, Service Center and the experimental farm.

The training school, a perfectly air-conditioned ferro concrete building, extends over 2,082 square meters. It has three stories. The first floor consists of practice rooms where students excercise how to assemble and reassemble every type of machines. The second and third floors have ten lecture rooms including small ones as well as large ones which are put to the use of fundamental courses. It accommodates 500 students as a whole.

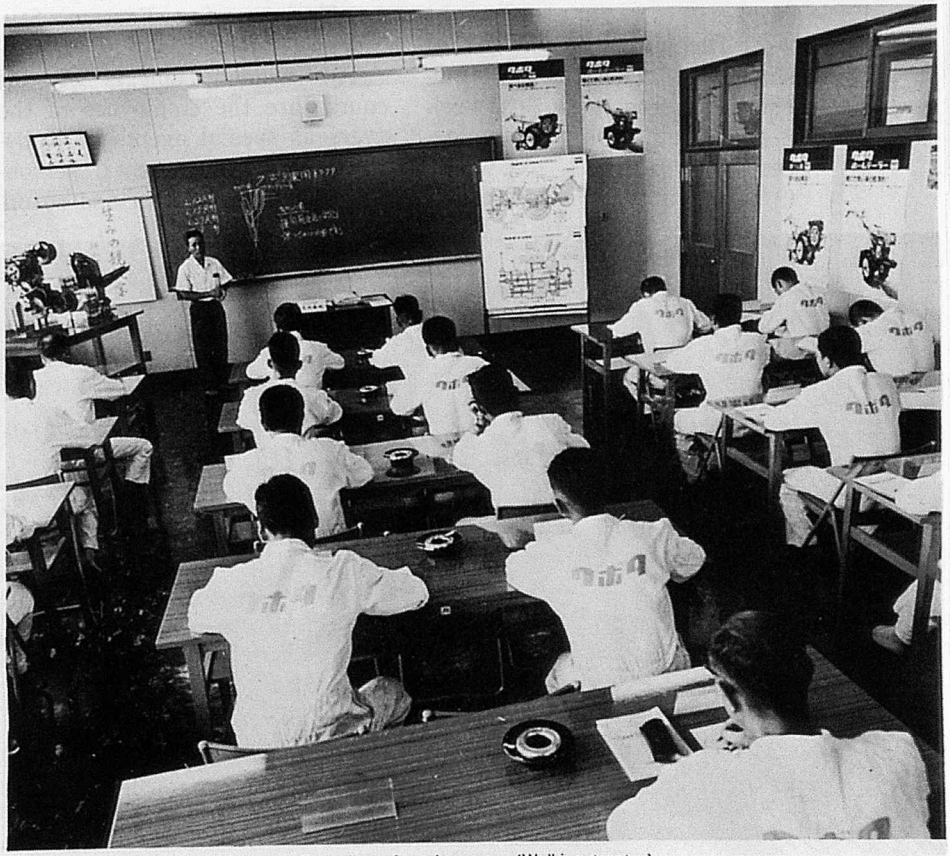
Kubota Kaikan, contiguous to Service Center, is the lodging facilities, which cover 3,531 square meters. This airconditioned ferro reinforced concrete building has one basement, four floors and a pent house. The basement is given over to machine rooms. The first floor consists of a big refectionary with the seeting capacity of 300 persons, a kitchen, bathrooms and so on. In the kitchen especially, from the viewpoint of sanitation, they are paying close attention to preparing nutritious diets for students by using the high efficient cooking equipments such as an autmatic washing and sterilizing machine of tablewares, an automatic frying machine and so on. Rooms above the second floor are use of lodging: 13Japanese-Style rooms and 51 Western--Style ones. Among the 51 Western-Style rooms, 12 rooms (acceptable 24 persons) are for exclusive use of foreign students, that is, the number of foreign students to be admitted is 44, including the 20 receivable at the ten rooms in Kaigai Kaikan. Kubota Kaikan is provided with a projection room, an amusement room and a reading room on every floor and telephone in each room, just like a highclass hotel.

Service Center, covering 1,572 square meters, is a three-storied ferro-concrete building, too, which is used as the rest place for visitors and technical trainees. The first floor is given over to a shaw-room of agricultural machines, offices, etc. On the second floor are the wide-screen projection room with 240 seats and the Hall I which admits 100--150 persons. The third floor is composed of the Hall II with accomodation of 200-250 persons and the Hall III with capacity of 100-150 persons which are utilized as the waiting room for visitors or technical training room.

STAFF and ANNUAL COST

The above mentioned facilities are generally called Kubota Technical Training Institute. In the training school, there are 14 lecturers and an officer. In Cervice Center there employed 3 officers and 13 women; 6 guides, 5 receptionists and ushers. At the lodging facilities 50 persons are working in all; ten for dining, six for lodging and nineteen others.

All the fee for training and lodging in Kubota Technical



Snapshot of a classroom (Walking tractor)

Training Institute is free of charge excepting that a part of food expenses of the trainees from the special agents should be charged to their employers. Exclusive of the personal expenses, one hundered and tens million yen is invested including the expenses for reception of plant visiotors.

Rice plantation by a rice transplanter

KINDS and PERIODS

According to the difference of the objects the period of traning varies as follows.

1. Training for general applicants ···2 days
2. Training for employees of the special agents
   - 2-1 Technical training of new machines for employees ···6 days per machine
   - 2-2 Technical training by models of machines for employees ···2 weeks
   - 2-3 Technical training of smallsized construction machines for employees ···1 week
   - 2-4 Training for new employees ···3 weeks (2 weeks are for study of all machines and 1 week on selected machines)
   - 2-5 Training for first class technicians ···4weeks
   - 2-6 Training for salesmen (Business Dept. mainly take this charge.) ···2 days
   - 2-7 Training for managers ···6 days
   - 2-8 Training for successors ···2 months
3. Training for Foreign Students

The training objects of this course are the employees of the overseas special agents of Kubota, foreign governmental personnel invited by Kubota and so on. Though the training period is not equal according to wishes of the trainees, this is a model course of 45 days which covers all kinds of machines.

Let's introduce a schedule of students here.

Breakfast is over by eight in the morning. When they stand in a row to take 10-minutes exercises at the training school. From 8 : 10 for fifteen minutes, they must make a speach on Japanese agriculture, the problems in agricultural mechanization, or problems in the integrated agricultural mechanization in the country of each student. Lessons last from 8 : 30 to 16 : 30 with the interval from 12 : 00 to 13 : 00. Dinner is from 17 : 30 to 18 : 30. Thenceforth, they can spend their time freely, whether they may amuse themselves with entertainments at their quarters or discuss with lecturers personally. As the common language, English is used in principle. They can request the help of an interpreter only in the special case.

(by Editorial Dept., Shin-Norinsha Co., Ltd.)

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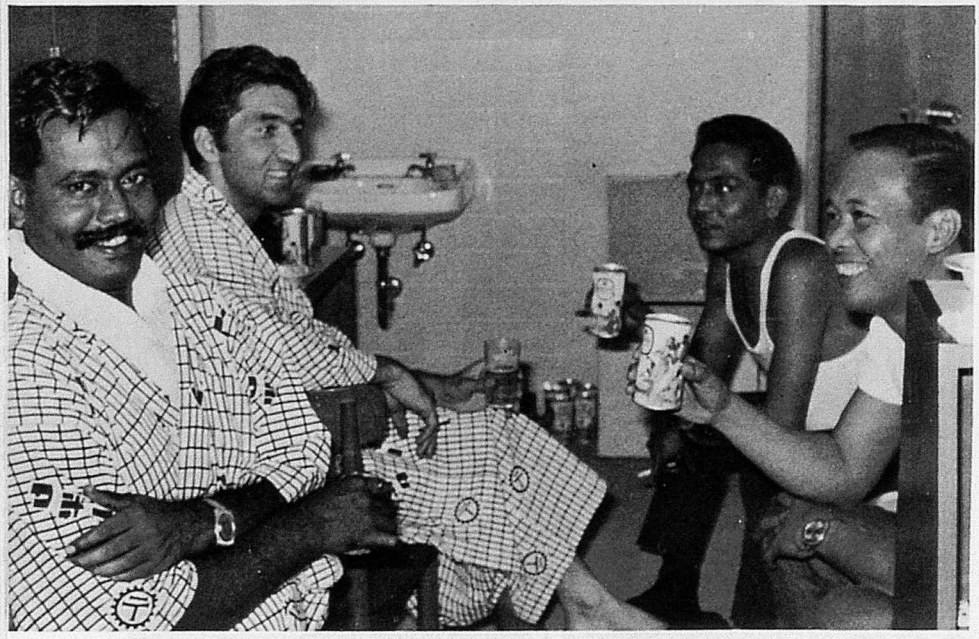


After-dinner chat

Report from Research Organization

What is C.E.E.M.A.T. doing on Agricultural Mechanization in Tropical Countries?

Ch. Gaury

Director of C.E.E.M.A.T.
Parc de Tourvoie 92 Antony, France

WHAT IS C.E.E.M.A.T. ?

Eight organizations are specialized in France in the tropical agricultural research. These are :

- the "Centre Technique Forestier Tropical (C.T.F.T.)" (Technical Tropical Forestry Centre)
- the "Institut d'Elevage et de Medecine Vétérinaire des Pays Tropicaux (I.E.M.V.T.)" (Institute for Stockbreeding and Veterinary Services in Tropical Countries).
- the "Institut Français de Recherches Fruitiéres Outre-Mer (I.F.A.C.)" (French Institute for Fruit Research Overseas)
- the "Institut Français du Café, du Cacao et autres plantes stimulantes (I.F.C.C.)" (French Institute for Coffee, Cocoa and other stimulating plants)
- the "Institut de Recherches Agronomiques Tropicales et des Cultures Vivriéres (I.R.A.T.)" (Institute for Tropical Agricultural Research and Food Crops)
- the "Institut de Recherches sur le Caoutchouc en Afrique (I.R.C.A.)" (Institute for Rubber Research in Africa)
- the "Institut de Recherches du Coton et des Textiles Exotiques (I.R.C.T.)" (Institute for Research on Cotton and Exotic Textile Plants)
- the "Institut de Recherches pour les Huiles et Oléagineux (I.R.H.O.)" (Institute for Oils and Oil-Yielding Plants Research).

These eight organizations are combined as "Group of Study and Research for Tropical Agriculture Development" (Groupement d'Etudes et de Recherches pour le Développement de l'Agronomie Tropicale - G.E.R.D.A.T.).

The "Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical - C.E.E.M.A.T." (Research and Experimental Centre for Agricultural Mechanization in the Tropics) was founded in 1962 on the initiative of the French Ministry for Cooperation - Converted later into the Secretary of State for Foreign Affairs - to be the common tool of the eight above-mentionned organizations, for everything dealing with farm machinery in developing countries of the tropical zone.

C.E.E.M.A.T. also serves as technical adviser to these countries as regards farm machinery and can, on their request, carry

out trials of machines in their official experimental stations with the collaboration of their own technical departments.

THE C.E.E.M.A.T. ORGANIZATION

C.E.E.M.A.T. headquarters are located in Antony in the suburbs of Paris, near the very important National Research and Experimental Centre for Agricultural mechanization of the French Ministry of Agriculture (Centre National d'Etudes et d'Experimentation de Machinisme Agricole - C.N.E.E.M.A.) the activity of which concerns the agricultural mechanization in temperate countries; C.E.E.M.A.T. can, thus, benefit from the technical assistance of the C.N.E.E.M.A. Engineers and equipment of the same.

As C.E.E.M.A.T. is active in tropical countries particularly, the plant is not very important in Antony. It consists of a building with offices for the Engineers, the documentation and study-rooms for trainers, and a separate laboratory-workshop where theorical trials of some machines are carried out and prototypes developed.

C.E.E.M.A.T. is composed of the management, three sections and secretariat.

Engineers and technicians are divided in these three sections as follows :

1) documentation, information, training
2) tests and experiments
3) economic research.

The first section keeps posted a very comprehensive documentation concerning all the equipment used or convenient for tropical crops and which is manufactured all over the world. It keeps up a permanent correspondance with research centres the object of which is similar, as also with numerous foreign specialists.

A documentary card-index makes possible to reply rapidly to questions asked about special cases. Through the review it publishes quarterly "Machinisme Agricole Tropical" ("Tropical Agricultural Mechanization"), C.E.E.-M.A.T. can also provide technical information of general scope to manufacturers, official technical departments of tropical Countries and farmers.

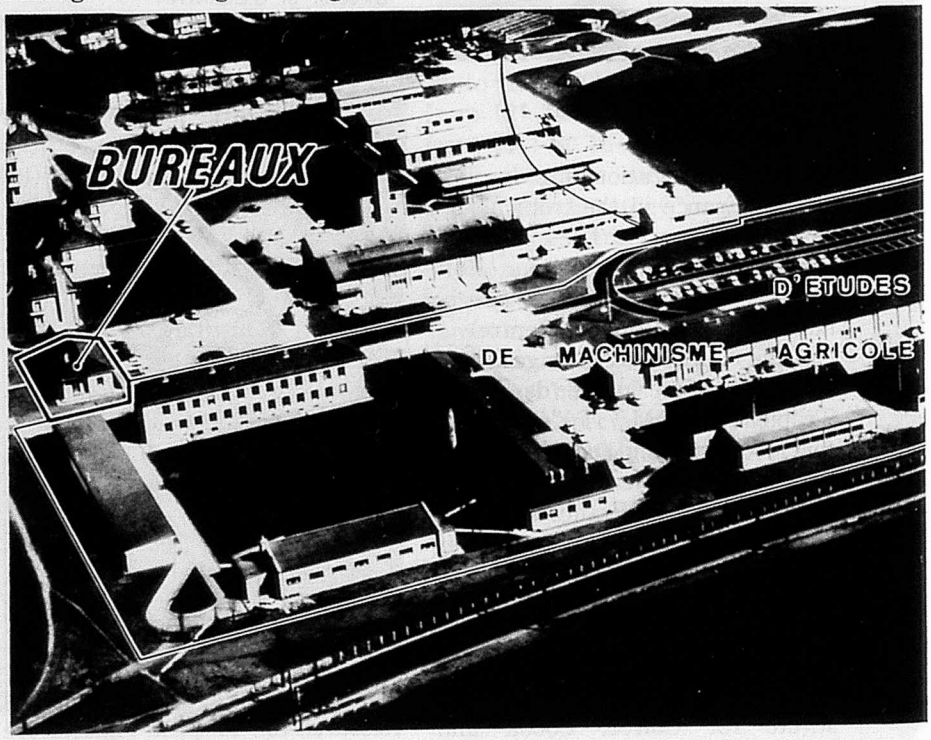
In addition to that, this section ensures the improvement of numerous Engineers and technicians as far as tropical agricultural mechanization is concerned, in France as well as in some tropical African countries. This activity is very important because the introduction of more and more complex farm machinery into countries which have a shortage of specialists, sets a training problem which conduced C.E.E.M.A.T. to organize, on the request of interested countries, courses in agricultural schools to train training-staff, as also on-the-spot refresher-training courses for behoof of their supervisory staff of different levels.

The second section carries out theorical tests in Antony and pratical ones in the Experimental Stations of Tropical Africa and Madagascar in regard to agricultural machinery convenient for solving the problems set by the agricultural research Institutes, Companies for agricultural technical assistance, and technical departments of tropical countries, with a view to increasing the agricultural production and yield.

The Center provides with the necessary information manufacturers who want to make an equipement proviously designed for crops in temperate countries suitable with tropical ones. It also studies prototypes, either alone or in collaboration with manufacturers when no available machine is fully satisfactory for a definite work.

This Section is also interested in cleaning, handling, drying and storage questions of tropical agricultural products.

The third section carries out economic research prior to recommand the use of equipment known, on the other hand, as technically satisfactory, as mechanization must be preconized only when it is efficient and does not lead to economic troubles for the Countries (e.g. excessive outflow of foreign currency).



C.E.E.M.A.T. (Research and Experimental Centre

THE MAIN C.E.E.M.A.T. REALIZATIONS SINCE ITS FOUNDATION

In 1962, when its foundation, C.E.E.M.A.T. aimed to contribute to develop the agricultural mechanization by means of animal-draft in all the tropical countries there it was possible to. Using sometimes systems especially developed for this purpose, the Centre realized numerous tests in collaboration with the French manufacturers concerned and the Experimental Stations in Africa and Madagascar, managed by some of the eight French Institute for tropical agricultural research. The Centre made systematical on-the-spot researches on draft-animal power and conditions for using them when available, in different Countries. This led it to establish, on the one hand, a series of test codes collected in a special book particularly intended for the national Centres specialized in testing machinery and recently founded by certain States in tropical Africa, and, on the other hand, to write out an important manual on animal-drawn cultivation. These works were published and dispached in 1968 by the French Ministry of Cooperation. The later one is known as very significant for those who are using animal-drawn mechanization, because it constitutes a very comprehensive guide, F.A.O. (Food and Agriculture Organization of the United Nations) has been also interested in and asked, in 1970, the French Secretary of State for Foreign Affairs the authorization to make the translation into English for behoof of technicians in tropical English-speaking countries.

The study on animal-drawn farm machinery was carried on during 1970 with the collaboration of a French Manufacturer and led to develop a lint-cotton-planter on the request of several African countries, and on 1971, with the collaboration of the Malian Farm Machinery Department, to test various prototypes manufactured by this Department.

All these studies have contributed to give a rational trend in the technical agricultural development of several countries, Mali particularly.

On 1965 a testing program of systems was established by the C.E.E.M.A.T. specialists with collaboration of those from the Institutes of agricultural research and technical assistance Companies. This program was realized with the collaboration of several Manufacturers and completed in 1970 with the development of a high powered sprayer for treatment of oil-palm-trees.

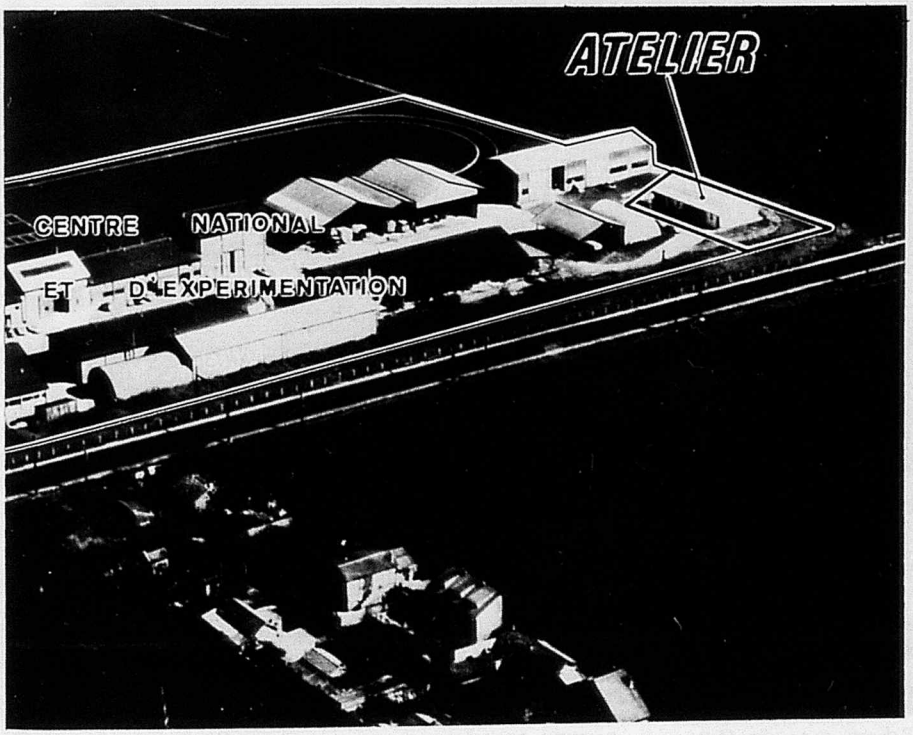
C.E.E.M.A.T. is also interested in agricultural motorization questions. At the beginning of 1972, it will finish writing out a "Manual of Tropical Crops Motorization" (Manuel de Motorisation des Cultures Tropicales) on behalf of the French Secretary of State for Foreign Affairs. It is now studying, in collaboration with several Institutes of Agricultural Research and Technical Departments of some countries, how to make walking-tractors suitable with the specific conditions of tropical crops. The Centre is interested in the mechanization of some crops, such as yam, which are still hand realized in Africa.

Besides the direct experiments undertaken in tropical countries, C.E.E.M.A.T. serves as technical adviser to the national Centres for testing farm machinery recently founded in several countries (Madagascar, Ivory Coast, Mali). Due to the rapid development of these centres activities and also the guidance required for the local young technicians, the importance of this activity is steadily increasing.

The Centre is presently writing out a manual on handling, cleaning, drying and storage of tropical agricultural products.

Besides the trails, writing out books and technical assistance overeseas, C.E.E.M.A.T. dedicates a significant part to train specialists in tropical farm machinery. This activity is made as theorical, practical and training courses.

Theses courses are taught in some Schools in France as well as in Africa : Cameroun, Mali. Niger, Republic of Centrafrica. In



for Agricultural Mechanization in the Tropics)

almost all these schools, practical courses are joined to theorical ones. In Africa the purpose essentially consists in training training--staff.

Training courses are taking place in France and in Africa. In France they can be organized on the request of some Institutes of agricultural research, Companies for technical assistance, and Schools, on behoof of their staff or students who then attend to grouped courses, as also African, Malagasy, Asian and South American technicians of very different levels who, most frequently are sent as individual trainers by their Government to improve their knowledge on a particular point. In this case, the duration of the training-courses varies from one week to six months and sometimes one year.

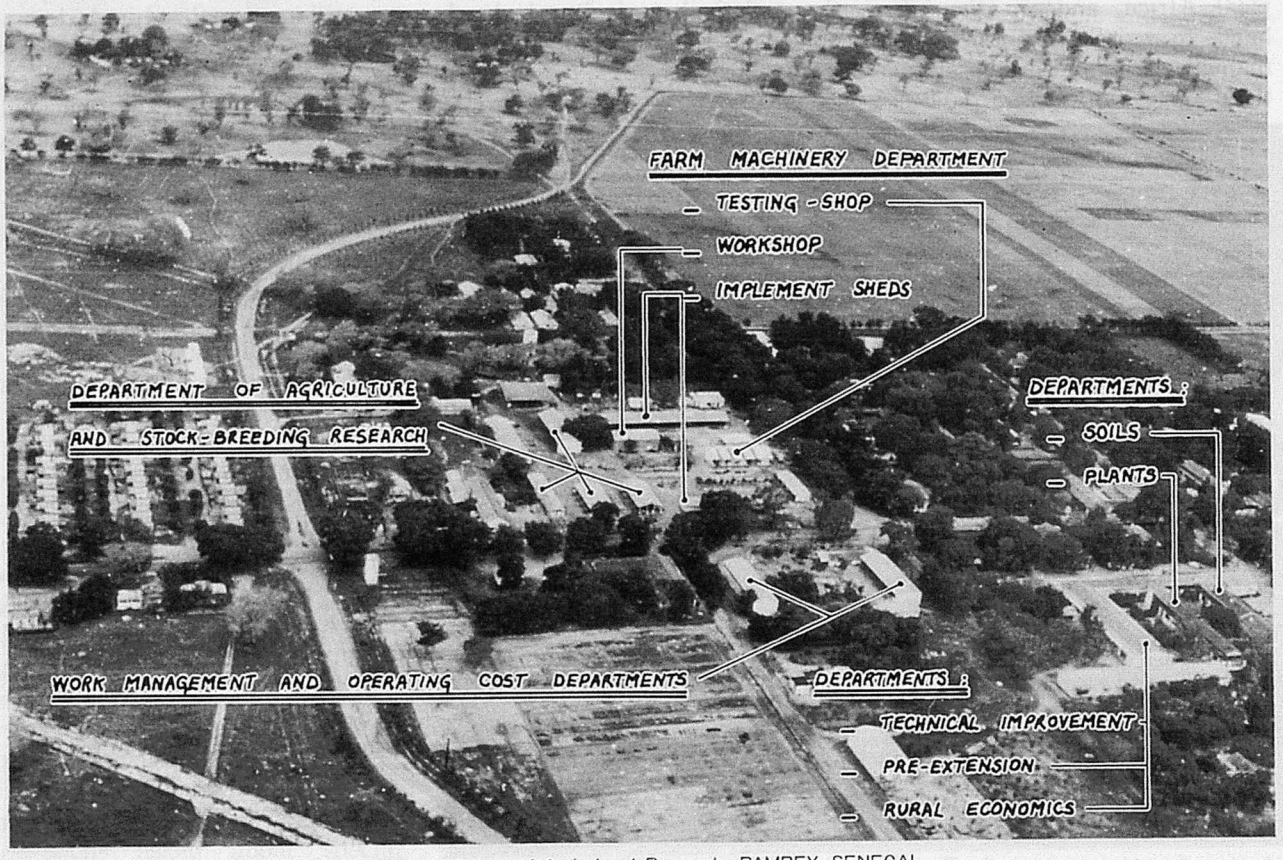
Training-courses and Seminars are organized for extension service agents of some countries such as Mali, Niger and Republic of Centrafrica and intended to teach them how to make rational use of the farm equipment available in these countries.

The Economic Research, the CEEMAT is carrying out, leads to establish "cards" of work-times and costs on which can be based studies concerning the efficiency of mechanized operations, particularly the motorized ones included in plans of land-reclamation for the realization of which foreign financial aid is necessary.

COLLABORATION BETWEEN C.E.E.M.A.T. AND INTERNATIONAL ORGANIZATIONS

C.E.E.M.A.T. is collaborating with various international organizations, particularly E.E.C. (European Economic Commission), F.A.O. (Food and Agriculture Organization), I.R.R.I. (International Rice Research Institute), and I.I.T.A. (International Institute of Tropical Agriculture).

It attends to international conferences the program of which deals with agricultural mechanization. So, in 1971 C.E.E.M.A.T. has been or is going to be represented at the following meetings : Seminar on farm machinery in Africa organized on January in Senegal by the Ford Foundation, I.I.T.A. and I.R.A.T.; Seminar on grain storage in humid tropical countries due to the same responsibles, on July in Nigeria; Conference on the regional agricultural research in the Guinean zone of Africa organized on August in Nigeria by F.A.O.; meeting of Specialits in the mechanization of rice production and processing, organized on September in Surinam by F.A.O.; and I.S.S.C.T. Congress (International Society of Sugar Technologists) organized on October at the New-Orleans (U.S.A.). ■ ■



National Centre of Agricultural Research, BAMBEY, SENEGAL.

Agricultural Engineering International Program of Michigan State University

Merle L. Esmay

Professor of Agricultural Engineering
and Coordinator of the Department International Program,
Michigan State University.
East Lansing, Michigan 48823. U.S.A.

The international program of the Agricultural Engineering Department at Michigan State University (MSU) is dedicated to improving the food supply, the economic base of agriculture and the rural living conditions in the less developed countries of the world. For implementation of these broad objectives, the department has developed as a center for the study and enhancement of meaningful agricultural mechanization in developing countries. The international program includes numerous phases:

1. Educational at the MUS campus
   - A. Training Foreign Graduate Students
   - B. Visiting Foreign Scholars
   - C. Teaching
   - D. Research
   - E. Training Program Development
2. Research in less developed countries
   - A. Rice harvester for Asia
   - B. Tropical Africa mechanization study
   - C. Cooperative mechanization in East Pakistan
   - D. Feasibility study of mechanization in Korea
   - E. Rice drying and storage research in Indonesia
3. Institution Building Assistance Programs
   - A. Taiwa
   - B. Colombia
   - C. Argentina
   - D. Nigeria
   - E. Indonesia
4. Faculty Member Consultation
   - A. Asian productivity organization
   - B. Asia Foundation
   - C. UNDP80 at La Molima, Peru
   - D. Saudi Arabia - Training Schools
   - E. India - Dairy Engineering
   - F. Brazil-Food Engineering
   - G. Asia Scoiety of NYC - SEADAG Program
   - H. East Eurpe & Middle-East Training for mechanization
5. Work with FAO
   - A. World Food Congress
   - B. Staff Exchange
   - C. Training Program Publication
   - D. Pending Mechanization Proplsals

The personnel of the Agricultural Engineering Department consist of 26 faculy members (10 Professors, 6 Associate Professors, 3 Assistant Professors, and 7 Instructors). All faculty members are involved in training foreign graduate students and consulting with visiting foreign scholars.- Over half (14 of the 26) of the faculty menbers have had experience in one or more less developed countries. Two recent retirees of the department are still active in international programs. Until 1970 Dr. C. W. Hall was a faculty member of the Agricultural Engineering Department. He is now Dean of Engineering at Washington State University.

EDUCATIONAL PROGRAMS AT MSU

A major emphasis has been placed on graduate programs in agricultural engineering at MUS for the past two decades. Since 1955 one-third or more of the approximately 50, continuously active, graduate students in agricultural engineering at MUS have been foreign students. Teaching, research and individual counseling programs have been developed to provide the best possible training and educational experiences for graduate students. The development of leadership qualities has been stressed.

Agricultural Engineering
Master of Science and Doctor of Philosophy
Graduates from MSU 1945 to 1971

	Domestic	Foreign	Total
M.S. in Agricultural Engineering	136	55	191
M.S. in Agricultural Mechanization	13	30	43
Ph.D. in Agricultural Engineering	82	36	118
TOTALS	231	121	352

Foreign students have consistantly been a significant part of the graduate program in Agricultural Engineering. The responsible positions these graduates have successfully assumed around the world speaks well for their graduate eduction. Emphasis has been placed on providing the student with some breadth of knowledge along with depth in the major field.

Graduate students from developing countries are encouraged to take minor field courses in education, communications, agricultural economics and development administration whenever possible. There is a broadening unfilled demand for planning and implementation specialits who are basically trained in technology and have additional capabilities in systems analysis, management, economics, sociology and communications. Essentially all macroplanning for agricultural mechanization in the United States and throughout the world has been and is still being done without adequate input of trained technogists. This has come about not by a conspiracy, but rather because most enineers and "mechanization specialists" have been so narrowly trained that they lacked the necessary qualifications and breadth of scope for policy level planning and decision making.

The Agricultural Engineering Department, in attempting to fulfill some of this need for broadly trained technologists, is placing more emphasis on "agricultural mechanization" or what might be called the "mechanization science" field. These graduates are basically agriculturalists with extensive knowledge about planning, utilization and operation of machinery, power sources, water management, structures, environment and processing. Mechanization thus pertains to the development, adaptation, implementation and operation of mechanical systems for agriculture. The systems science approach is providing a new analytical tool for this developing field.

Agricultural mechanization technologists must be concerned with the sociological and environmental quality implications of mechanization. This includes such parameters as labor utilization, waste-product management, minimizing product quality losses, operator training, comfort and safety, machine use efficiency, product yields, handling systems, sales and distribution, income disparity and adult education.

It is becoming more apparent that the industrialized nations are setting a poor example as they look to bigger and better machines as the main way to a better life. Technology has been regarded too much as an irresistable force of nature to which man must submit, rather than a precious and controlled intellectual resource that can be managed to design and to build a finite world sphere — a system that is technically sound and socially stable and acceptable.

A graduate course entitled "Agricultural Mechanization in the Less Developed Countries" has been developed at MSU which pursues the when, why and how of meaningful mechanization for agriculture. The various effects of mechanization on the rural people and society in general are studied and discussed. Foreign students are encouraged to take the course, as well as domestic students interested in international programs and problems.

Numerous visiting scholars spend from a day up to a few weeks or in some cases up to a year in the Agricultural Engineering Department at MUS. They generally are not interested in the formal graduate degree programs but rather in concentrating on a specific program of study and research. Most often they will come to work specifically with one of the departmental faculty members.

RESEARCH PROGRAMS AT MSU

The Agricultural Engineering Department has worked towards the development of more internationally oriented research. This has included research in the laboratories and adjacent fields at East Lansing, Michigan and studies in other countries. These research activities; (1) have provided graduate students the opportunity to work on problems relevant to some of the less developed countries, (2) have provided additional internationally oriented experience for faculty members and (3) helped relate some of the faculty member technical assistance consultation assignments more closely to departmental programs. Hopefully the research has helped solve some problems for developing countries.

A new principle of a **stripper-type rice harvester** for Asian conditions was developed and incroported into a prtotype model from 1962-64.This research, conducted by faculty members and graduate students, was funded by MSU/Ford Foundation grants.

An **African Mechanization Study** was conducted from 1967--69 under an MSU/AID contract to (1) document the present status of mechanization, (2) plan agricultural mechanization systems, and

(3) develop specific action projects in mechanization. The study was interdisciplinary between agricultural engineering, soil scinece and agricultural economics. The equatorial countries involved were Ethiopia, Kenya, Uganda, Ghana, Gambia, Ivory Coast, Nigeria and Tanzania.

The **cooperative approach** to **agricultural mechanization** was studied in Comilla, East Pakistan by a graduate student and faculy member from 1968 to 1970. The Academy for Rural Development at Comilla had operated a pilot cooperative machinery center for some ten years. The objectives of this research was to develop a simulation model, based upon the experience of this cooperative, that might be applicable in other developing countries. The research was supported by MSU, Ford Foundation and the Midwest University Consortium for International Assistance (MUCIA).

In 1970 the Agricaltural Engineering Department began participation in a fairly broad agricultural education MUS / MUCIA /AID project in **Indonesia.** This project is designed to establish collaborative programs between similarly oriented departments in Indonesia and the MUCIA Universities. Exchange professors and graduate students will plan and implement selected research and teaching programs. As a result of one faculty menber spending 3 months in Indonesia with the two national agricultural mechanization departments and some young Indonesian staff members working on graduate programs at MSU, some collaborative research on rice drying, handling and storage has been started. This collaborative program is planned for a period of at least from 5 to 10 years. Senior Indonesian faculty members will also be involved in short-term studies and observations at MSU and there will be follow up short-term assignments of MSU professors in Indonesia.

A **Training Program** for **Agricultural Machinery Operators** was developed from 1969 to 1971 by faculty members and graduate students of the Agricultural Engineering Department at MSU. This program was supported by MSU, John Deere Manufacuring Co. and FAO in response to the recognized need for better training programs for machinery distributors and overnmental agencies around the world. The training system for the operation, care, maintenance and adjustment of tractors and associated equipment was developed and tested with Spanish-speaking Mexican and Puerto Rican migrant laborers in Michigan. Additional testing in a less developed country is being planned through FAO.

A **Feasibility Study** for **Agricultural Mechanization** in **Korea** is being participated in by members of the MSU Agricultural Engineering Department during 1971 and 1972. This involves the development of recommendations for the most applicable types of machines and power units for Korean conditions; as well as for effective manufacturing, distribution and maintenance programs. A computer model is being developed for the analysis of specific machines for the various cropping functions under the constraints of the Korean climatic soils, cropping, economic and labor patterns.

INSTITUTION BUILDING

Faculty members of the Agricultural Engineering Department have been involved in **technical assistance programs** in various countries over the past two decades. In the broad sense these programs are directed towards helping build and improve educational institutions in the developing countries. Agricultural Engineering MSU faculty members work on short and long-term basis directly with the Agricultural Engineering Department faculty members in the varous countries to help them improve their teaching, research and extension programs. In most cases some young faculty members from the host countries of these programs came to MSU for graduate study or for specific training programs.

The earlier **institution building programs** were somewhat divorced from the Agricultural Engineering Department. The faculty members who accepted assignments on these programs returned to the department and reverted to regular academic responsibilities quite unrelated to the international activity. Innovations of the recent Indonesian/MUCIA program, described previously, include the integration of the developing country program with that of the MSU Agricultural Engineering Department; so in actuality a collaborative program between the two faculties is established.

The Taiwan/MSU/AID technical assistance program involved 48 man months of agricultural engineering faculty time from 1960 to 1964. Emphasis was put on the development of agricultural engineering and mechanization teaching research and extension programs at the two colleges of agriculture and mechanization at Taipei and Taichung. Some young staff members came to MSU for graduate study and one senior faculty member came for a six month special study and observation program.

The *Nigerian* /MSU/AID technical assistance program included 66 man months of agricultural engineering faculty time from 1962 to 1967. This program developed a new agricultural engineering/mechanization department from its early conception. Staff development, teaching and facilities provision were the primary objectives. As a part of the staff development phase a few young Nigerian staff members did gradute work at MSU.

At *Balcarce, Argentina* 27 man months of agricultural engineering faculty time was put into the development of the mechanization phase of a small faculty of agriculture from 1968 - 1970. This program was also supported by an MSU/AID contract. Besides the participation in the institution building process, one agricultural engineering faculty member made a separate study of the institutionalizing process of the Balcarce Faculty of Agriculture from 1967 to 1969. This study was supported by Ford Foundation thorugh the Pittsburgh University Institution Building consortium.

FACULTY MEMBER CONSULTATION

Faculty members of the MSU Agricultural Engineering Department that have been involved in international work are listed here with title, field of expertise and countries in which they have served on some type of consultation assignment.

Albrecht, Carl F.,
Assoc. Professor, Teaching: Agricultural Mechanization, Columbia 2 years 1956-58

Bakker-Arkema, Fred W.,
Prof., Drying and Processing
Holland and Europe 6 months 1971
Columbia, S. America, 1972

Bickert, William C.,
Assoc. Professor, Electric Power and Processing
Nigeria, Nsukka 3 months 1967
New Zealand and Australia 3 months 1972

Boyd, James L.,
Prof., Agricultural Structures and Animal Waste Management
Nigeria, Nsukka, 2 months 1962, and 2 years 1963-65
Western Europe, 6 months 1968

Cargill, Burton R.,
Professor, Fruit and Vegetable Mechanization and Storage
Nigeria, Nsukka, 2 years, 1965-67.

Esmay, Merle L.,
Professor, Agricultural Structures and Environmental Control, Educdtion and Institution Building in Developing Countries
Taiwan, 2 years 1962-64
Argentina, Balcarce, 3 trips 1967-69
Venezuela, Maracay, 1968
Pakistan, Comilla, 1962, 1970
Japan, Tokyo, Asian Productivity Organization, 2 months 1969
Indonesia, Bogor and Jogjakarta, 3 months 1971
Korea, Seoul, two 6-week periods, 1971-72

Farrall, Arthur W.,
Professor Emeritus, Dairy and Food Engineering
India, Ludiana, 1968
Brazil, 1970

Gerrish, John B.,
Instructor, Animal Waste Management
Nigeria, Nsukka, 2 years 1965-67

Hansen, Clarence M.,
Professor, Agricultural Power and Machinery
Colombia, Palmira, 2 years 1952-1954
Europe, 3 months 1968

Kidder, Ernest H.,
Professor, Soil and Water Engineering
Argentina, Balarce, 3 months 1970

Loudon, Thoedore L.,
Instructor, Soil and Water Engineering
Afghanistan, 2 years, 1966-68

Mackson, Chester L.,
Professor, Agricultural Power and Machinery and Mechanization Training
East Europe, East Africa Middle East, 6 months 1968
East Europe, 2 trips 1970 - 1971

McColly, Howard F.,
Prof. Emeritus, Agricultural Power and Machinery
China Mainland, 2 years 1947-48
Taiwan, Taipei, 2 years 1960-62
Pakistan, Comilla, 1962
Saudi Arabia, 1966
Japan and Southeast Asia, 4 months with APO 1967

Stout, Bill A.,
Professor and Chairman of Agricultural Engineering, Agricultural Power and Machinery and Physical Properties of Biological Products
Asian Countries, 1962
Italy, Rome with FAO, 1 year 1963-64
Nigeria, 1966
Senagal, 1971
Europe, 1971

White, Robert G.,
Assoc. Professor, Agricultural Power and Machinery
East Europe, 1969, 6 months 1972

Wilkison, Robert H.,
Assistant Prof., Agricultural Power and Machinery
Argentina, Balcarce, 2 years 1968-70

PUBLICATIONS

Significant publications resulting from the international activities of the MSU agricultural engineering faculty members are listed by the year of publiration:

Hall, C. W. and N. A. Gonzales (1960) "Colombia's Contribution to South American Dairying", *Dairy Engineering* 77, (8) pp. 268-272.

Hall, Carl W. (1962) "Planning Small Dairy Plants for Education and Research Institutes in India", *Indian Dairymen,* 14(5)L, pp. 1-5.

McColly, H. F. (1962), "Introduction of Farm Mechanization in the Comilla Cooperative Project", Pakistan Academy for Rural Development, Technical Publication No. 15, p. 28.

Hall, Carl W. (1963) "Improving Agriculture Through Engineer-

ing", National Academy of Science, National Research Council, Washington, D.C., Proceedings Agricultural Research Institute, 12:149-158.

Hall, Carl W., (1965) "Mechanization and Labor in Newly Developing Countries-Latin America", National Academy of Science, National Research Council, Washington, D.C., Proceedings of Agricultural Research Institute. 14:119-128.

Stout, B. A. (1966) "Equipment for Rice Production", FAO, Rome, Italy, Tech. Bulletin, No. 84.

Cargill, B. F., (1966) "A Philosophy for a Better Way of Life", Nsukka, Nigeria, *Engineering Journal* Vol. 1, p. 23.

Esmay, M. L. (1967) "How Fast Should Taiwan Mechanize Agricaltural Production", Michigan State University, *International Program Series* No. 2.

McColly, H. F. (1967) "Agricultural Mechanization in East Asia", Michigan State University. *Interanational Program Series* No. 2.

McColly, H. F., and C. Ozaki (1967) "Survey of Farm Mechanization in Asia", Asian Productivity Organization, Aoyama Dai-ichi Mansions 4-14, Akasaka, 8-chome, Minato-ku, Tokyo 107 Japan.

Stout B. A. (1967) "Mechanical Rice Production - Philosophy and Equipment", Michigan State University *International Program Series* No. 2, pp. 18-37.

Kline, C. K., D. A. Green, R. L. Donahue, and B. A. Stout. (1969), "Agricultural Mechanization in Equatorial Africa", Michigan State University Institute of International Agriculture Research Report, No. 7, 465 pages.

Esmay, M. L. (1970), "Storage and Preservation of Food Grains", Contributed 3 of the 12 chapters in the 300 page training manual. Asian Productivity Organization. Aoyama Dai-ichi Mansions, 4-14, Akasaka, 8-chome, Minato-ku Tokyo 107, Japan.

Esmay, M. L., and B. A. Stout (1970) "Implementation of Improved Foreign Student Agricultural Engineering Graduate Programs in the United States", ASAE St. Joseph, Mich. Paper No. 70-575.

Esmay, M. L. (1970) "Paddy Rice Drying and Storage", Indian Society of Agricultural Engineers, Journal of *Agricultural Engineering,* P. A. U. Ludhiana, India, Vol. VII, No. 4.

Esmay, M. L. (1971) "A Second Generation Problem of the Green Revolution-Food Grain Storage", *Agricultural Mechanization in South East Asia,* Farm Machinery Industrial Research Corp., Shin-Norin Building, 7, 2 chome, Kanda Nishikicho, Chiyoda-ku, Tokyo, 102 Japan. Spring issue.

Esmay, M. L. (1971) "Institutionalization of the Facultad de Agronomia at Balcarce, Argentina", Michigan State University Institute of International Agriculture Research Report, No. 8, 188 pp.

Esmay, M. L. (1971) "How do We Best Train the Foreign Student in the United States?", Proceedings of the Symposium on Graduate Educations in Agricultural Engineering, ASAE Headquarters, St. Joseph, Michigan.

Esmay, M. L., J. B. Holtman and L. W. Faidley (1971), "A Systems Approach to Rice Mechanization in Indonesia", Proceedings of the San Francisco Rural Development Seminar, Southeast Asia Development Advisory Group (SEADAG), Asia Society of New York City.

Esmay, M. L. (1971) "Agricultural Mechanization and Product Technology Program Development in Indonesia", MUCIA /INDO/USAID Project, Michigan State University, Agricultural Engineering Department, Report No. 1.

Esmay, M. L. (1971) "The Role of Agricultural Engricultural Engineers Internationally", Presented for the Student Meeting of ASAE Chicago, Ill. December 7. Copies available Michigan State University, Agricultural Engineering Department, East Lansing, Mich.

Faidley, L. W., and M. L. Esmay (1971) "Introduction and Use of ImprovedRiceVarieties:WhoBenefits?" Michigan State University, Agricultural Engineering Department, Preprint No. 1.

Faidley, L. W., and M. L. Esmay, (1971) "An Agricultural Machine Demand Model", ASAE, St. Joseph, Mich. Paper No. 71-A556.

Stout, B. A. (1971) "The Use and Future of Heavy Tractors and Implements in West Africa", Proceedings of Seminar at Bombay, Senegal on Mechanization of Agriculture in W. Africa, Sponsored by the International Institute for Tropical Agriculture, IBADEN, Nigeria.

PROGRAM INFORMATION

The Agricultural Engineering Department prepares annual summaries of its teaching, research and extension programs. Each of these summaries may be obtained by writing the department chairman,

Dr. B. A. Stout
Agricultural Engineering Department
Michigan State University
East Lansing, Michigan 48823

An application for admission to the agricultural engineering graduate program may be obtained by writing the department chairman, or the graduate coordinator,

Prof. E. H. Kidder
Agricultural Engineering Department
Michigan State University
East Lansing, Michigan 48823

Additional information about the international program of the Agricultural Engineering Department may be obtained by writing the department chairman or the author of this paper. ■ ■

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500—650 kg, 1,000—1,300 kg per hr.
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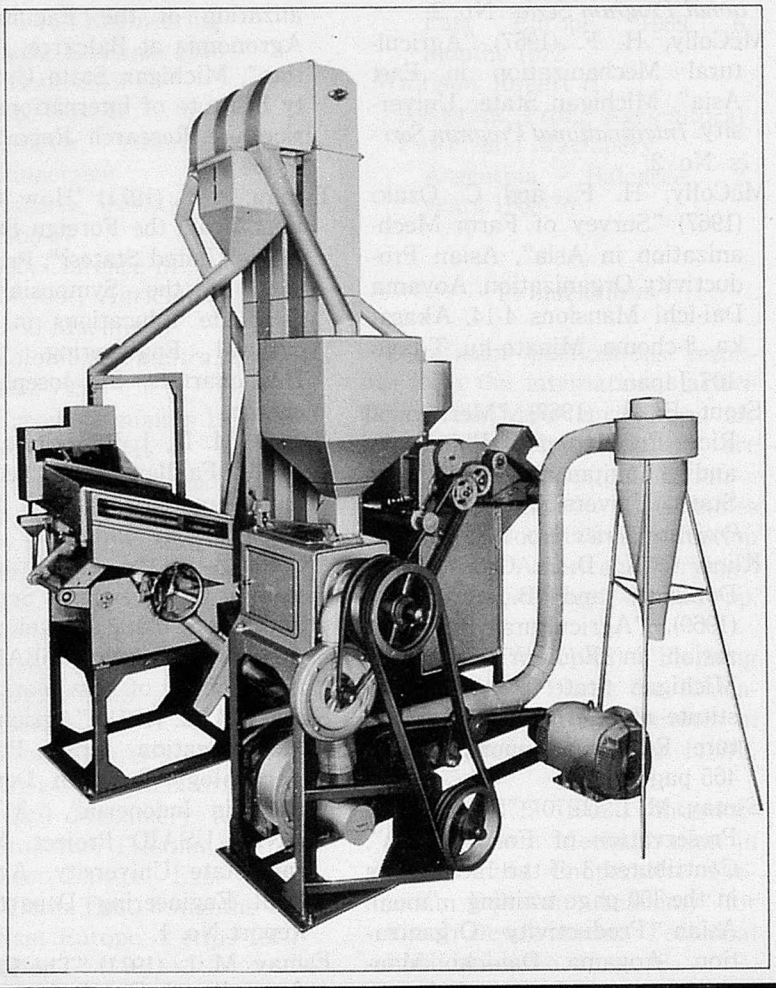

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1. Low cost for its capacity.
2. Easy operation.
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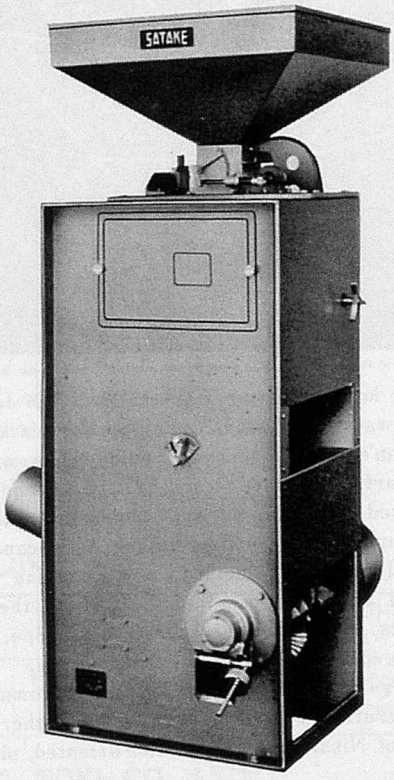
SPECIFICATIONS

Capacity: 700 – 750 kg per hr. (paddy)
Required Power: 10 – 15 H.P.
Dimensions: L686 x W725 x H1,591(mm)



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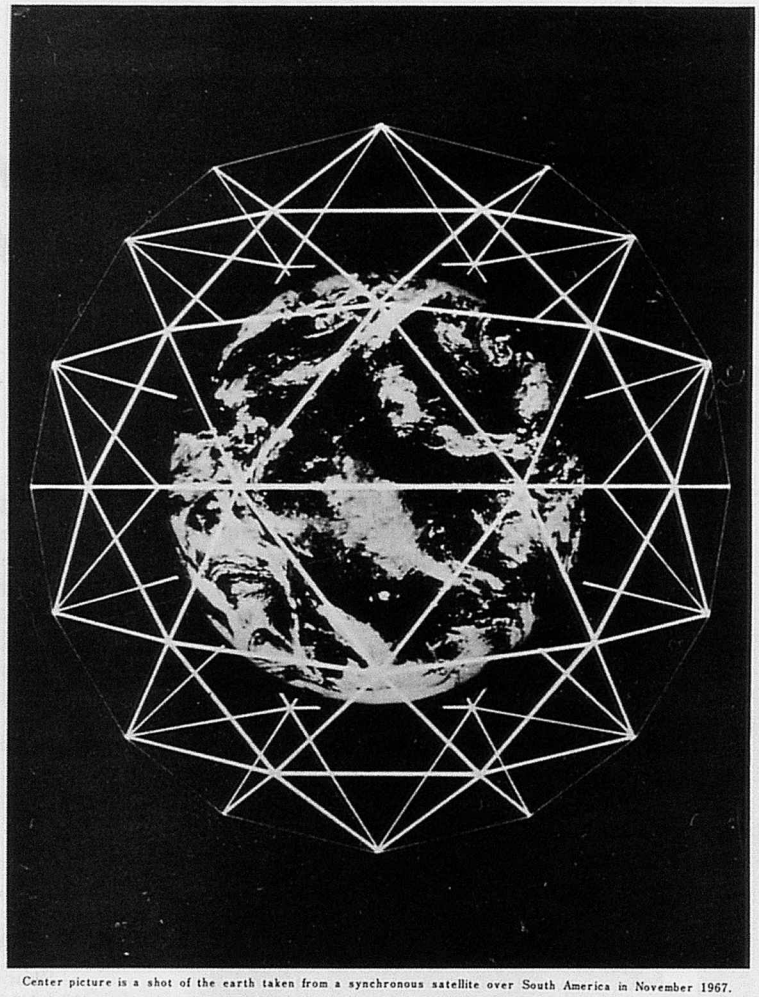
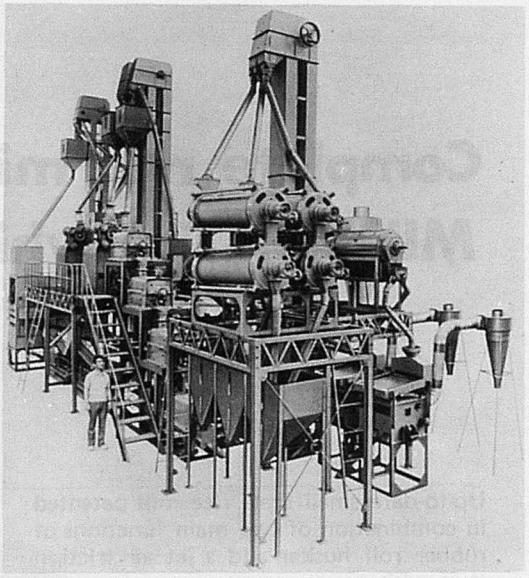


Center picture is a shot of the earth taken from a synchronous satellite over South America in November 1967.



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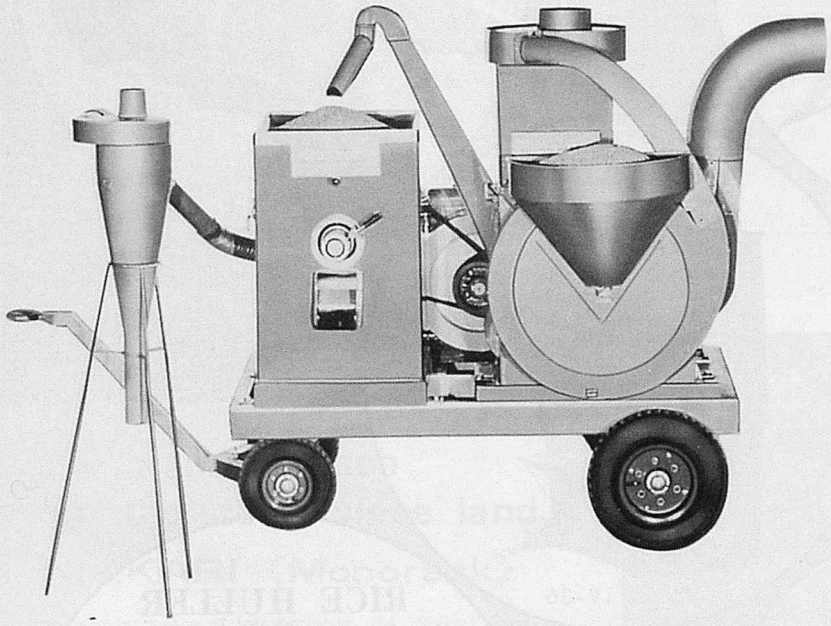

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2. Produces polished rice 10 seconds after putting the paddy rice into the machine.
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Polisher	ML50EX	790/500/850	126	800rpm		

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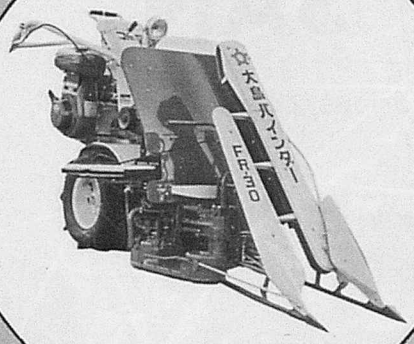

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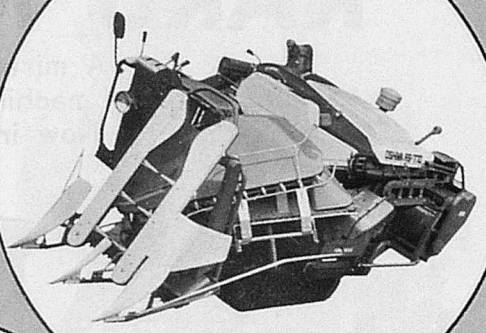

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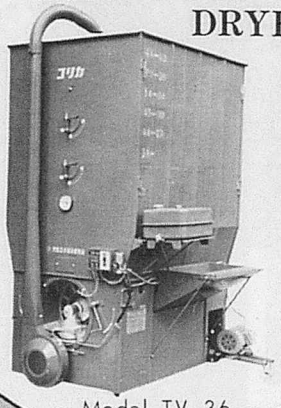

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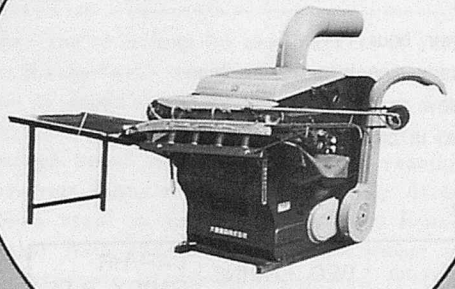

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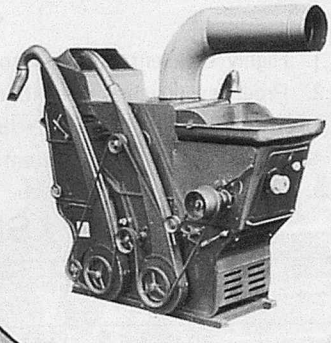

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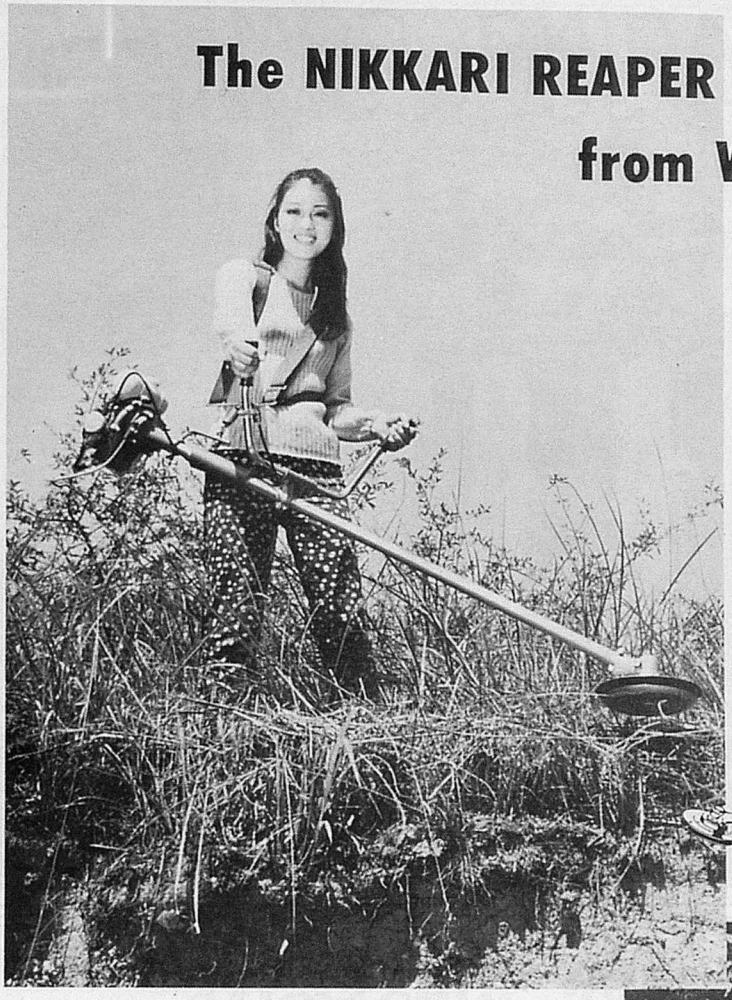

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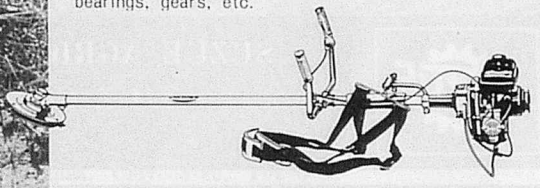

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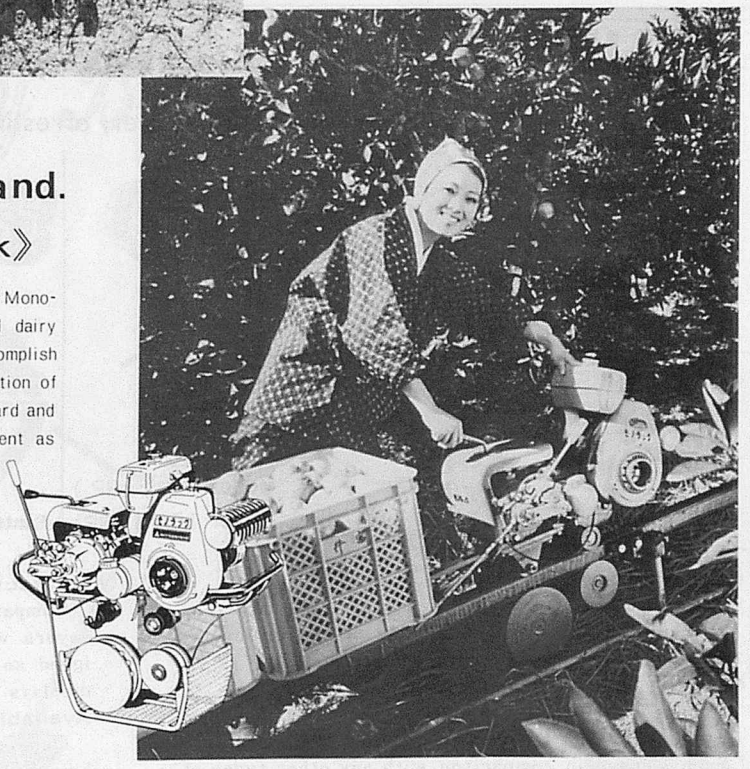

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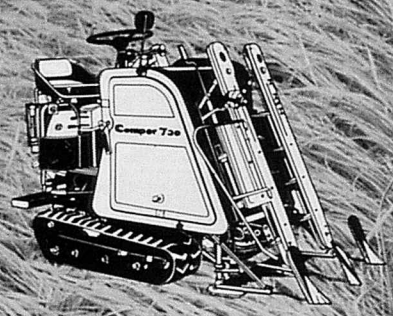

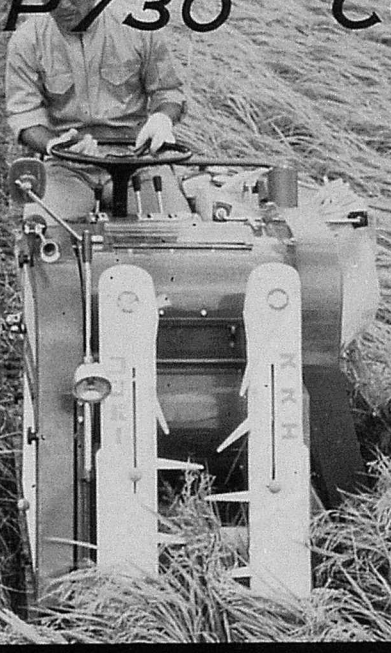

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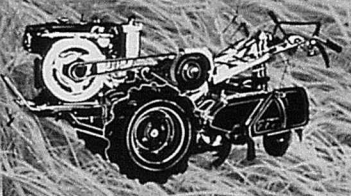

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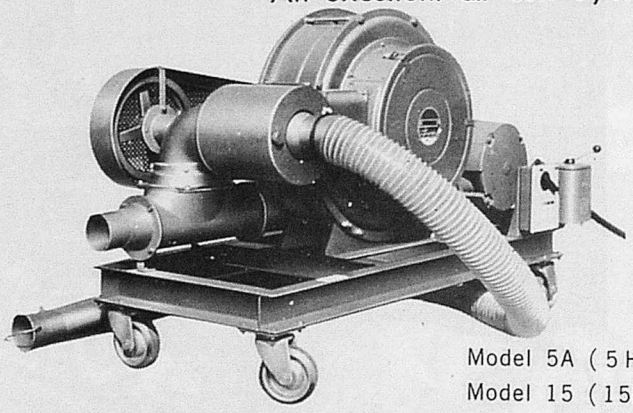
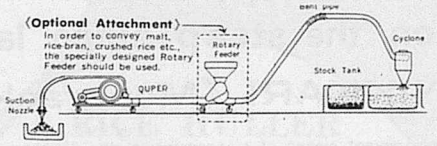
"QUPER,, ·····the most up-to-date grain conveyer

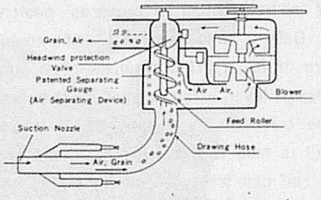
An excellent air conveyer, arresting all over the world's attention.



Model 5A (5 HP)
Model 15 (15HP)



〈Rough Sketch of Patented Separating Device〉



International Pat. (U.S.A. Pat NO. 3600041)

<Features>

* Continuous Conveyance

The patented air separating device guarantees synchronous drawing and forcing of the grains resulting in continuous conveyance.

* Saving Grains from Damage

Quper has been designed to keep grains from passing through the blower, so they are quite free from damage in comparison with any other types of conventional throwers.

* Compact Size and High Efficiency

Comparing with any other conventional air conveyers with cyclonic devices, Quper has been designed so compactly that it is easy to handle and displays high operational efficiency.

* Available for All Kinds of Grain

Quper is quite suitable for conveyance of soybeans, red beans, rice, wheat, unhulled rice, plastic pellets and etc.

MARUMASU KIKAI CO., LTD.

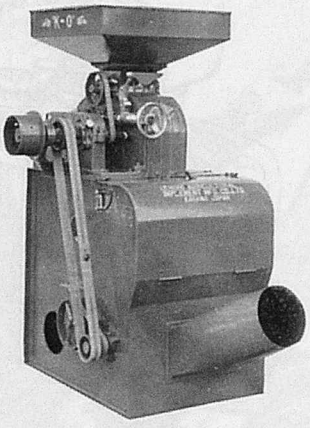
Head office : Kamiichi-Machi, Toyama pref, Japan.
Phone : Kamiichi (07467) 2-2231 Mell No. 930-03

K-O AGRICULTURAL MACHINES

Automatic Thresher JL55K

Double separating system assures beautiful separation.
Ceaseless-operation is possible owing to the smooth shaker system.
Simple method for exchanging concave, no need to detach the drum.

This type has a huller and a winnower combined in it, chaffs can be separated from hulled rice.
Another new feature is a suction fan which collects chaff. Therefore you need not worry about dusts and chaffs from operation.



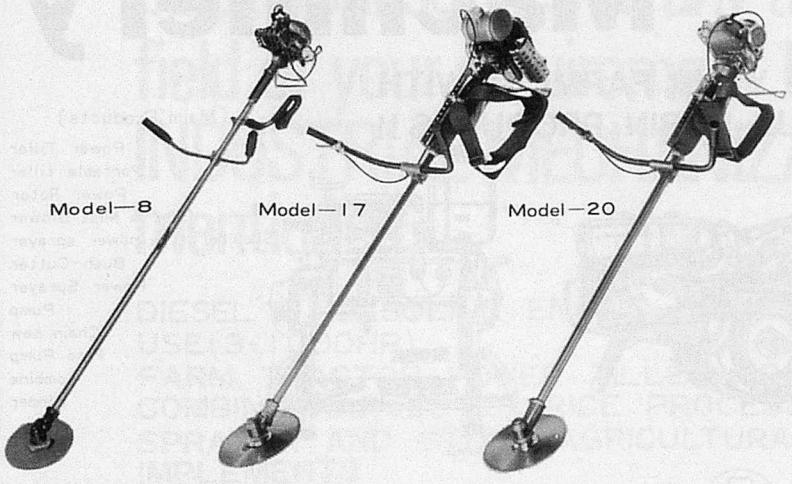
Combination Huller MRT60

UEMORI AGRICULTURAL IMPLEMENT Mfg. Co., Ltd.

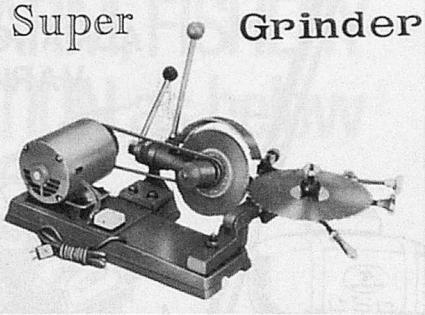
Head Office : Kan-Onji-cho, Kan-Onji City, Kagawa, Japan
Tokyo Branch: 1-1, Izumi-cho, Kanda, Chiyoda-ku, Tokyo

Almighty Brush Cleaner

KREIS CUTTER



Super Grinder

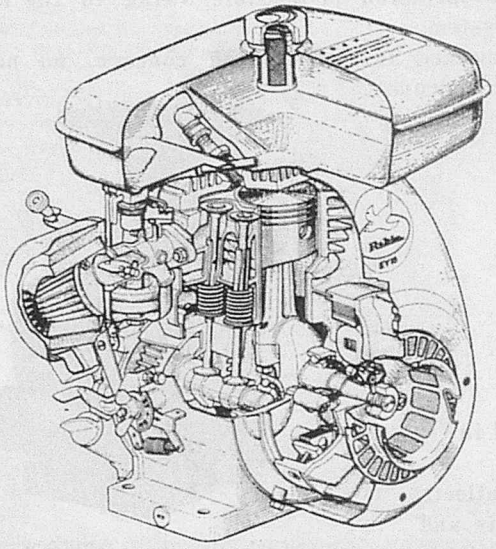


KREIS
MADE IN JAPAN

NIPPON KREIS CO., LTD.

4—15 San—chome, Uchi—kada, Chiyoda—ku, Tokyo, Japan.

Fujiheavy's Robin Engines



2 and 4 Cycle Engines-
a wide range up to 20 HP
for agricultural, industrial
and recreational uses!

LASTING SERVICE WITH SUPERB PERFORMANCE

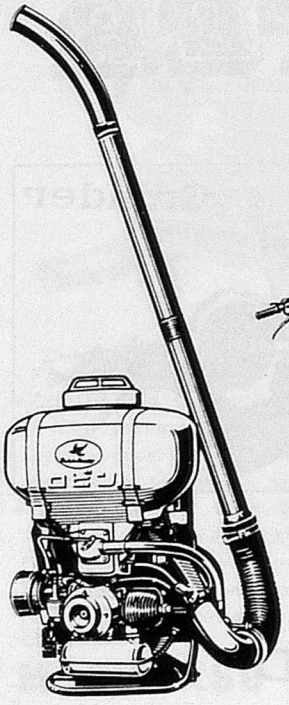
FUJI HEAVY INDUSTRIES LTD.

TOKYO・JAPAN

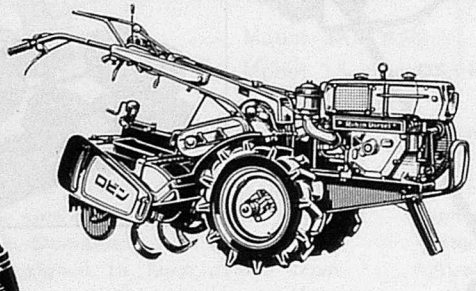
Robin

Fuji Robin's Agricultural Machinery

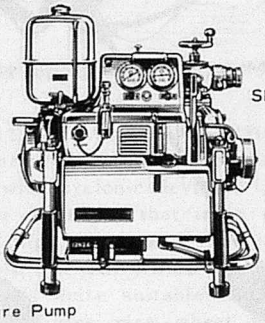
ADVANCE YOUR FARMING WITH VARIOUS ROBIN PRODUCTS!!



Dust & Mist Blower



Power Tiller



Fire Pump

(Maim Products)

Power Tiller
Portable tiller
Power Rotor
Dust & Mist Blower
Shoulder type power sprayer
Bush-Cutter
Power Sprayer
Pump
Chain saw
Fire Pump
Combine
Binder

Robin

FUJI ROBIN INDUSTRIES LTD.

SHINJUKU-BLDG. 1-8-1 NISHI-SHINJUKU SHINJUKU-KU,
TOKYO, JAPAN

IFM NewsLetter

INTERNATIONAL FARM MECHANIZATION RESEARCH SERVICE
c/o SHINNORIN-SHA 2—7 KANDA NISHIKI-CHO CHIYODA-KU,
TOKYO, JAPAN., TEL. 03—291—5718, 3674

Dear friends

International Farm Mechanization Research Service was established in 1968 with the pourpose of promoting efective communications and researches on agricultural mechanization especially in developing countries.

We will gladly welcome everybody to join us who want to promote free and vital communications on agricultural mechanization over many barriers like sectionalism.

Our body is really independent one supported by every member's free and active mind to make better world.

Whenever you need more informations, please write me!

Yours Sincerely
Yoshikuni Kishida
Head of Directors

Diazinon

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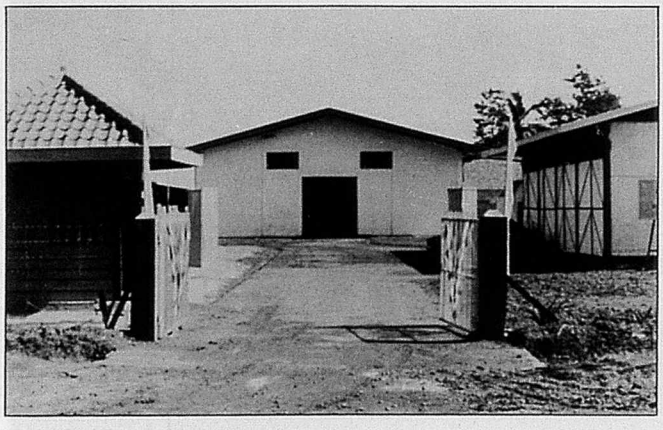
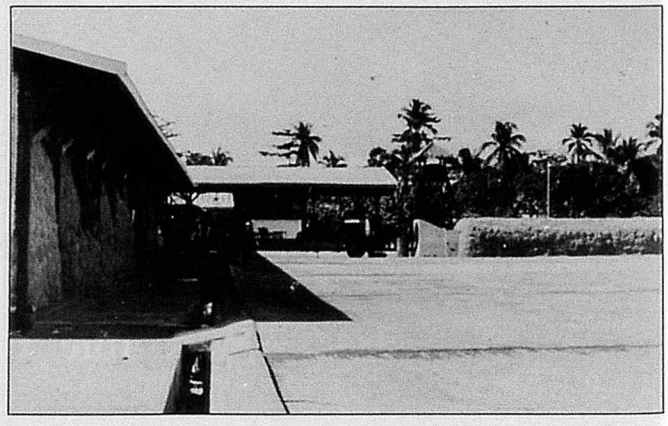
Find an agricultural project and will develop it !

⟹ Sumitomo Shoji





Modern Rice Mill being operated by **SUMISHO KAPIN** Agricultural Development Co. in Indonesia.

Engines for land use

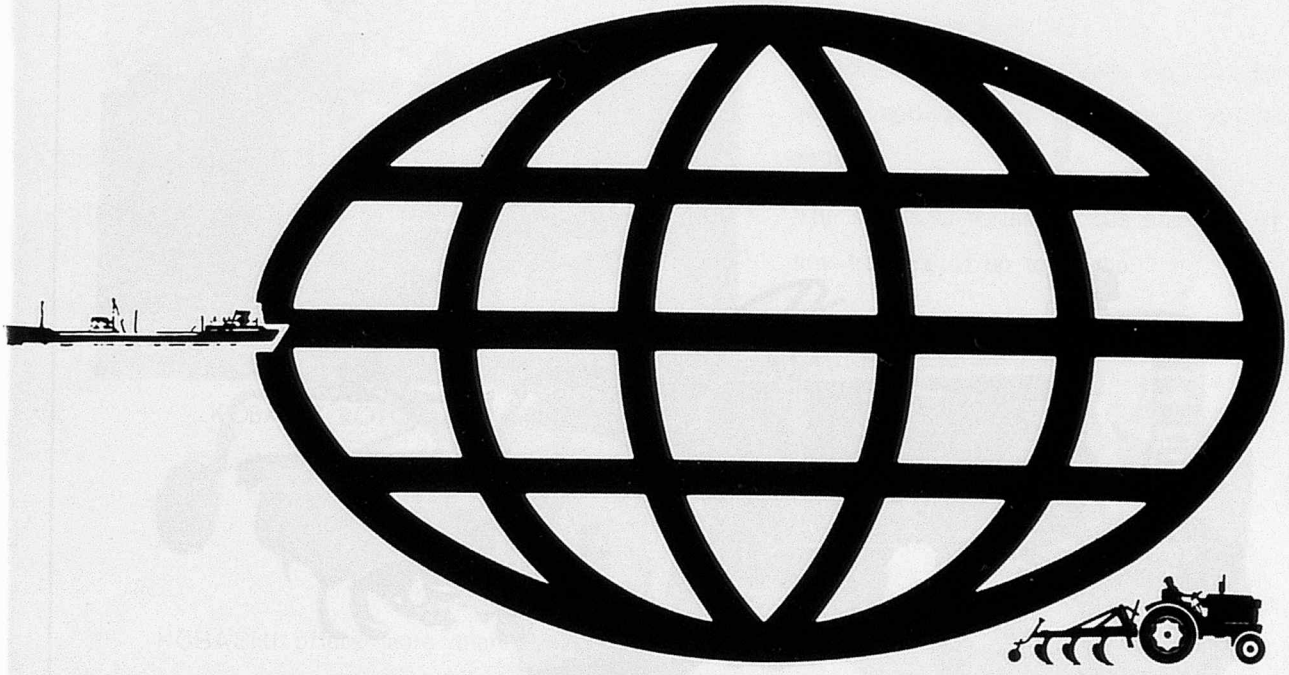
Agricultural, Civil and Construction Engineering, Pumps, Generators, etc.

Marine Engines

Main Propulsion for;
Fishing Boat, Sight-seeing Ferries, Freighters,
Launches and Tugs, Yachts, etc.

Agricultural Machinery & Implements

4 Wheel Tractor
Hand Tractors of various sizes,
Sprayers,
Threshers, Hullers



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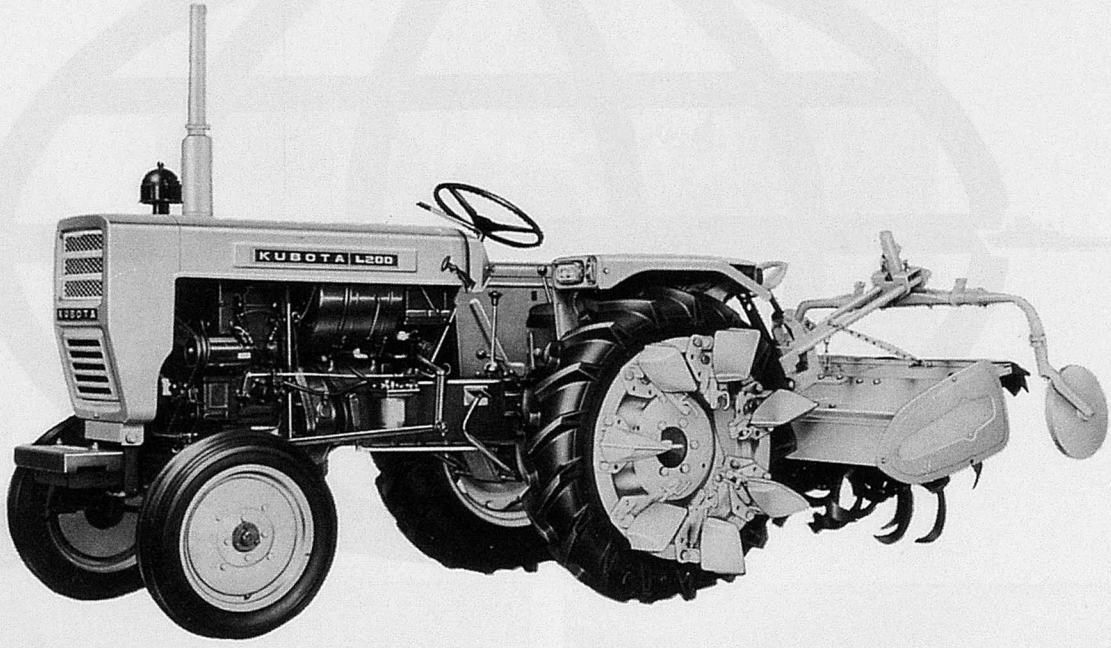
Marubeni...

...a beginning



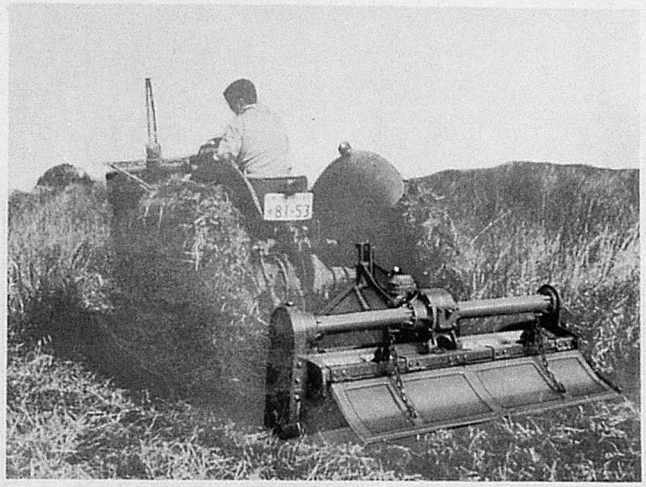
All developing countries have to start somewhere. And most wise countries usually do by calling on **Marubeni**. Just like these products which meant a start towards higher productivity, less labor and more income. It and thousands of others just like it were supplied by us because we're the biggest exporter to all over the world.

Maintaining the latest technology, and extending a helping hand are two very basic features of our corporate structure. Supplying both to Asian countries has kept us very busy. Because Southeast Asia was also a beginning for us... the beginning of our worldwide network which now includes some 99 offices.

Marubeni CORPORATION

Tokyo: C.P.O. Box 595, Tokyo 100-91, Japan Cable: MARUBENI TOKYO
Transportation & Construction Machinery Export Dept.
Agricultural Machinery Export Sec.

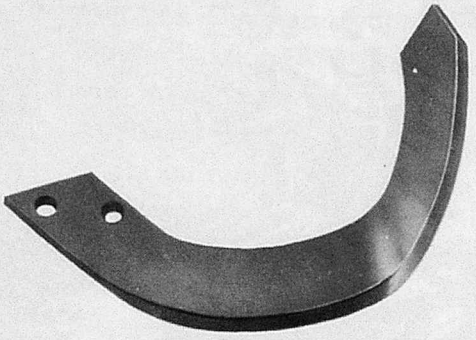
KOBASHI ROTOR & KOBASHI BLADES



KOBASHI ROTOR Model RBS-1600

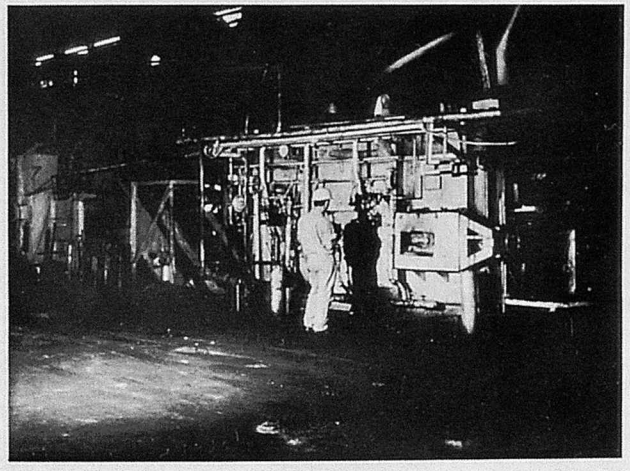
The RBS Series KOBASHI ROTORS represent the latest mechanical advances in rotary cultivation.
Designed not only for heavy duty but for normal cultivation on the farm or in the paddy.

The series comprise various sizes to fit any tractors of up to 75 hp.



KOBASHI'S Original, Tough Blades

KOBASHI offers more than 600 types as the specialist of Tine Blades with a monthly capacity of 1 million pieces.



Automatic Heat-Treatment Furnace for Tiller Blades

KOBASHI with wide knowledge and experience as Tine Blade Specialist is at your disposal for consultation on technical know-how or design work of manufacturing plant for any type of tiller blades.

Please write for full details and illustrated catalog to :

KOBASHI KOGYO CO., LTD.
2-1491, Yoshino-cho, Omiya City Saitama Pref., Japan Phone : 0486-64-1545

Asia's abundant potential

for progress

Kubota — your partner in resource development

With its vast resources of land and water, Asia should be able to more than support its needs for food and clothing. But the land must be properly worked and the water properly distributed. What is urgently required is systemization and mechanization. And that is what Kubota can provide.
As Asia's largest manufacturer of agricultural equipment, Kubota knows the land and its needs. Much of this company's complete line of machinery is designed specifically to give the best results under conditions prevailing in Asia, whether it be wet paddy farming, sugar cane fields, or banana plantations. Kubota has already helped to greatly increase production in many areas. Find out how it can benefit you.

The Basic Necessities Giant

KUBOTA

Kubota,Ltd. / Tokyo. Osaka, Japan

POWER TILLERS

Complete tilling — to meet all your needs

POWER TILLERS manufactured by Kubota, such as models KMB, K700, K500 and KF, are extremely versatile and efficient. They go easily into wet, muddy paddy fields for fast, complete work, making sharp pivot turns so that the entire area is worked, even in small, oddly shaped fields. Tilling, harrowing, weeding, etc., on dry land is just as effective. The wide variety of attachments available permit all types of jobs to be done, at any time of day or year.

MODEL	Engine model	Engine output	Speeds	Tiling width (Standard-max. with extension shaft)	Number of rotary blades (Standard)
K500	ER50-2	5-6.5HP/ 2,200rpm	Forward 6 Reverse 3	480—600mm	16 pcs.
K550	ER50-2	5-6.5HP/ 2,200rpm	Forward 6 Reverse 2	480—600mm	14 pcs.
K700	ER65-2	6.5-8HP/ 2,200rpm	Forward 6 Reverse 2	510—600mm	18 pcs.
KF	KND70	7-9HP/ 1,600rpm	Forward 4 Reverse 1	480—750mm	14 pcs.
	KNDR70L	7-9HP/ 1,600rpm			
KMB200	KND90	9-12HP/ 2,000rpm	Forward 6 Reverse 2	600mm	20 pcs.
	KNDR90	9-12HP/ 2,000rpm			

ENGINES

Big power with economy

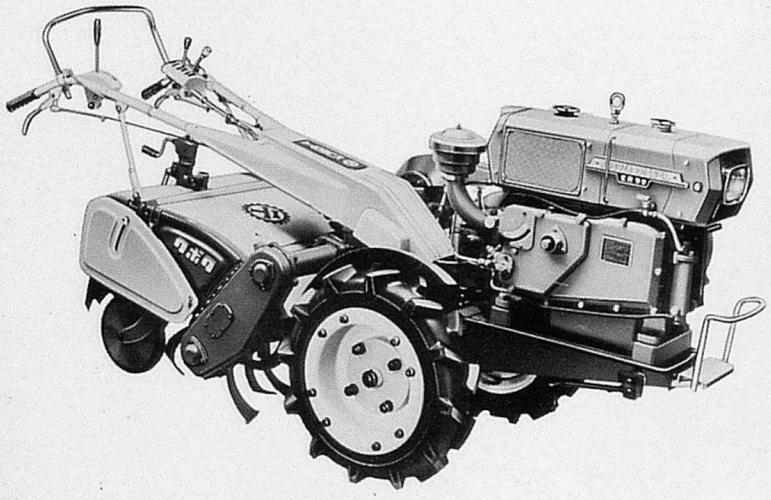
Economical DIESEL ENGINES made by Kubota, in the ER, KND series, etc., provide power for all farm needs. Light in weight, but with great durability and power, they are used on power tillers and other equipment, and to operate all kinds of farm systems. Kubota's GASOLINE and KEROSENE engines are also extremely tough and serviceable.

MODEL		Output	rpm.	Net weight
HOPPER COOLING	KND 3	3~4HP	2,000	60 kg/132 Lbs
	KND 40	4~5HP	2,000	65 kg/143 Lbs
	KND 5B	5~6.5HP	2,200	75 kg/165 Lbs
	KND 70	7~9HP	1,600	112 kg/246 Lbs
	KND 90	9~12HP	2,000	135 kg/297 Lbs
	KNDR 70L	7~9HP	1,600	100 kg/219 Lbs
	KNDR 90	9~12HP	2,000	145 kg/318 Lbs
RADIATOR COOLING	ER 30	3~3.5HP	2,000	55 kg/121 Lbs
	ER 40	4~5HP	2,000	60 kg/132 Lbs
	ER 50	5~6.5HP	2,200	65 kg/143 Lbs
	ER 65	6.5~8HP	2,200	75 kg/165 Lbs
	ER 75	7.5~9HP	1,800	108 kg/238 Lbs
	ER 90	9~12HP	2,000	145 kg/319 Lbs
	ER 100	10~13HP	1,800	153 kg/337 Lbs
	ER 150N	15~18NP	1,800	247 kg/543 Lbs
	UH 3A	15~18HP	1,800	265 kg/583 Lbs

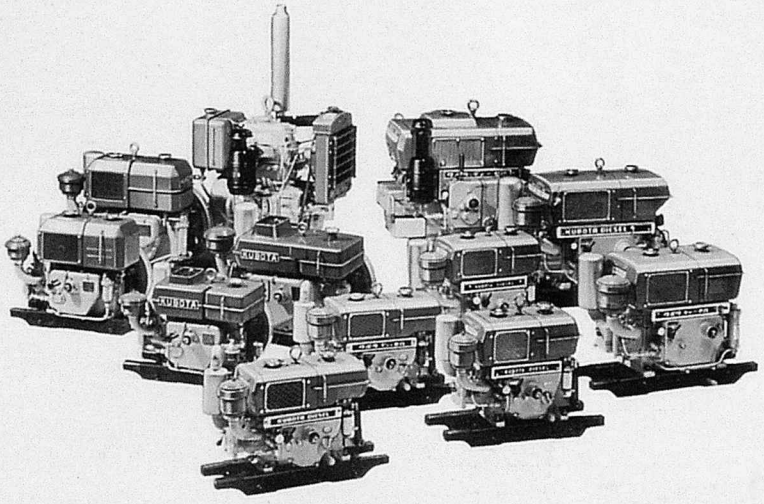
IRRIGATION SYSTEMS

The water of life for arid areas

Irrigation systems are manufactured by Kubota in many different sizes, suitable for individual fields or entire agricultural areas. This company's PIPE, of ductile iron, asbestos-cement, or PVC, and PUMPS and VALVES are widely used in complete irrigation systems, to grow larger crops in areas where water is scarce.



Sakai Plant



Among the world's largest...

In several different fields, including power tillers, two wheel tractors and ductile iron pipe, Kubota is the world's largest manufacturer. The modern facilities at its Sakai plant keeps production at the very highest quality level.

Kubota equipment goes to all parts of the world, and this company studies actual conditions in each area and develops the machines that suit them. The high technological level maintained by Kubota ensures fine performance in all conditions.

The Basic Necessities Giant

KUBOTA

Kubota,Ltd.

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