

MINISTRY OF AGRICULTURE AND FOOD INDUSTRY
PROJECT IMPLEMENTATION UNIT OF 2KR
REPUBLIC OF MOLDOVA

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR SUPPLY OF AGRICULTURAL
TRAINING EQUIPMENT FOR THE NATIONAL TRAINING
CENTER FOR AGRICULTURAL MECHANIZATION
IN
THE REPUBLIC OF MOLDOVA

AUGUST 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

UNICO INTERNATIONAL CORPORATION

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PREFACE

In response to a request from the Government of the Republic of Moldova, the Government of Japan decided to conduct a basic design study on the Project for Supply of Agricultural Training Equipment for the National Training Center for Agricultural Mechanization and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Moldova a study team from February 19 to March 15, 2007.

The team held discussions with the officials concerned of the Government of Moldova, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Moldova in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Moldova for their close cooperation extended to the teams.

August 2007

Masafumi Kuroki
Vice-President
Japan International Cooperation Agency

August 2007

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Supply of Agricultural Training Equipment for the National Training Center for Agricultural Mechanization in the Republic of Moldova.

This study was conducted by UNICO International Corporation, under a contract to JICA, during the period from February 2007 to August 2007. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Moldova and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Wataru Shiga
Project manager,
Basic design study team on the Project for
Supply of Agricultural Training Equipment
for the National Training Center for
Agricultural Mechanization,
UNICO International Corporation

SUMMARY

SUMMARY

Background of the project

The Republic of Moldova became independent in 1991 after the collapse of the Soviet Union, and since then has been known as the poorest in the European region due to lack of proper economic policies. Per capita GNI in fiscal 2005 was US\$930 (IBRD, 2007). The national economy declined through the 1990s, but this trend reversed in 2000, and the record of economic growth has been achieved since then including 7.1% growth in 2005. The average economic growth for the six-year period from 2000 to 2005 was 6.2%.

Moldova being blessed with rich farmland extending over about 75% of the nation's area, and a relatively warm climate, has traditionally been dependent on agriculture. The composition of GDP in fiscal 2005, by industry, shows a share of 17% for primary industry, 24.5% for secondary industry, and 58.5% for tertiary industry (National Bureau of Statistics, 2006). The agricultural sector, comprising farm output and production of processed agricultural products made from that farm output accounts for 30% of the GDP, and 59% of exports, so it is clear that agriculture is the major industry in Moldova. Despite having a 41% share of the labor force, agriculture contributes smaller part of the GDP; it is readily understood from this that the Government of Moldova sees it as being of great importance to shift toward development of agriculture towards being more capital-intensive.

Agricultural reforms were begun and elimination of the prohibition of private ownership of land took place in late 1990s, but many private farmers were unable to make a transition from the collective farm arrangements, and the modernization of agricultural was hampered. This led the Government to implement a series of legal reforms including introduction of the leasing system of farmland, and promotion of a reorganization of farmland whereby farm management could be improved. In recent years, there has been improvement of farming technology and of distribution of agricultural equipment, while at the same time the supply of agricultural credit has been improved, enabling economically-favored farmers to either rent or purchase land, and the number of instances of the incorporation of farms and management of them as large businesses has increased. The improved liquidity in the market for farmland, greater efficiency in farm production, and progress in mechanization that has taken place has had, as one result, increase in the demand for both used and new agricultural machinery.

The Moldovan Government, that has given attention to the development of the farming regions where about 60% of the nation's population are dependent upon agriculture for their livelihood, drafted the Economic Growth and Poverty Reduction Strategy Paper (2004-2006) for achieving such objectives as to improve health and medical care, social welfare, job security, and household income. Within those efforts are targets for creating employment opportunities and improving income on a sustained basis by making the most of the dynamism of the private sector and the principle of market competition – in the agricultural sector. However, agricultural production has the inherent weakness of

being subject to great fluctuations caused by change in the weather, and droughts and early frosts have reduced annual yields even to the extent of impacting the national economy, so the Government, in order to ensure more stable productivity in agriculture, drafted the Agro-Food Sector Development Strategy which was revised in 2006 to cover a long term of 2006-2015, indicating official intent to forge ahead with development of the sector. Further, in order to promote agricultural mechanization as one aspect of those efforts, the Ministry of Agriculture and Food Industry (MAFI) is preparing a policy document called Vision for Development of Agricultural Mechanization which calls for invigorating Moldova's national resources in agricultural technology (technology, equipment, and the human resources).

In order to support the improvement of agricultural productivity and the subsequent economic growth in Moldova, the Government of Japan has provided assistance since 2000 for the increased food production (now termed grant assistance for underprivileged farmers, 2KR), and in all, including by use of funds generated by 2KR activities and of revolving funds from 2000 to the end of August 2007 Moldova has acquired more than 2,700 pieces of agricultural machinery, that have contributed substantially to the modernization of agriculture. Among the agricultural machinery acquired under the 2KR program are items from the developed countries that embody the latest technology, but in overall terms the techniques for operating such machinery and repairing it are not sufficiently established in Moldova. Further, there are few dealers in agricultural machinery who provide proper repair services, there is a shortage of technical personnel in this field, and the relevant service network is underdeveloped. A long time is required to have machinery repaired, and the difficulty in getting repair work done in a timely fashion, particularly during cultivation and harvests, is a factor that limits the advance of effective mechanization in agriculture. Thus, the development of human resources in the field of agricultural machinery is a matter of great importance.

Request for assistance

Against this background, MAFI, having recognized that the diffusion of appropriate technology for operation and repair of agricultural and other machinery is indispensable for the ongoing process of agricultural mechanization, has used revolving funds to establish the National Training Center for Agricultural Mechanization, as a public training organization under the Ministry, as an effort to update and improve technical capabilities of Moldovans engaged in work involving agricultural machinery and an effort to reduce the shortage of persons having such technical skills. The Center is to provide training in the use of new agricultural machinery, and the technology for its operation, maintenance and repair, to persons presently working in agriculture or for agricultural companies, or working at repair and maintenance of agricultural machinery. The ultimate purpose of this Project is to develop human resources for immediate mobilization in agriculture in Moldova by improving the training provided to the diverse levels of personnel who are to use or work with agricultural machinery. The Project involves the improvement of workshop equipment and on-farm agricultural machinery for use by the Center, where over 1,600 persons are to be trained each year. Construction of the Center was

completed by Moldovan side in March of 2007, but budgetary constraints that had limited the ability of the Government of Moldova to acquire the machinery needed for training and the equipment for the Center workshops led to the Government request for grant aid assistance from the Government of Japan. The Project would purchase and supply such machinery and equipment to the Center.

Summary of study results, and the content of the project

In response to the initial request by the Government of Moldova and to investigate project conditions, the Japan International Cooperation Agency (JICA) dispatched preliminary study missions to Moldova and verified the requirements of Moldovan side, identifying the requested equipment comprising 112 items for workshop training, 21 items for field (on-farm) training, 7 items for classroom instructions. Subsequently, JICA dispatched a mission in February 2007, to undertake a detailed study of the training needs, and confirm the adequacy of the arrangements for training and state of preparation of the Center.

As a result of this study, the training concept was confirmed to provide courses on “Farm Management and Preventive Maintenance” to the farmers, “Machinery Operation” to the students, and “Repair and Maintenance” to the students, mechanics and teachers based on practical curriculum for each course. Based on the contents of training curricula, items of equipment that are to be used in the workshop and field were selected taking into consideration of the following conditions, i.e. equipment should; be of such a level appropriate to the trainees to acquire required skills; be of such that its operation, storage and management would not have substantial requirements in terms of techniques, time required, and costs; be of international standard; of such that spare parts and supplies should be procurable through its local agent; be suitable for training in major farm operations; be capable of performing farm work at the time required; be compatible with equipment in general use on Moldovan farms; be of the kind that persons who have been trained in the use of that equipment will be able to readily acquire in the domestic market, etc. Based on the above, the equipment plan was formulated which included the following items of equipment.

[I. Workshop Training Equipment]					
1. Washing Equipment					
Hot & cold water and steam combination washer	1	Nozzle tester	1	Injector reconditioning machine	1
Jet parts washer	1	Cylinder gauge	1	Fuel injection pump service tool kit	1
Cleaning equipment with abrasive	1	Valve spring tester	1	Valve refacer	1
Parts cleaner	1	Engine dynamometer with accessories	1	Air valve lapper with suction cap	1
Nozzle cleaning kit	1	Diesel compression gauge set	1	Valve seat grinder (Round grinding machine)	1
Giraffe type crane	1	Diesel timing and tacho tester	1	Valve seat cutter set	1
Manual forklift	1	Computerized engine analyzer	1	7. Reparaion Equipment	
2. Disassembling and Assembling Equipment		CO-HC exhaust emission analyzer	1	Tire changer, heavy duty	1
Mobile work bench with vise	1	Cylinder head and cylinder block pressure tester	1	Hydraulic tire removing tool	1
Hydraulic garage jack	2	Wheel alignment tester set	1	Engine positioner	1
Transmission jack	1	4. Selection and Control Equipment		Air compressor	1
Hydraulic shop press (25t)	1	Scope	1	Dynamic balancing machine for crankshaft	1
Air hose reel	4	Diesel smoke meter	1	Brake shoe adjusting tool set	1
Air impact wrench	4	Magnetic crack detectors for crankshafts	1	Brake pipe flaring tool set	1
Portable lubricator for grease	2	Ultrasonic flaw detector with accessories	1	Portable brake compression tester set	1
Portable lubricator for oil	4	Connecting rod aligner	1	Brake spring plier	1
Grease gun with micro hose	1	5. Electrical Equipment Reparaion Equipment		Brake anchor pin remover	1
Scissors lift	1	Silicon quick charger	1	Micro-hone set for brake cylinder	1
Air hydraulic jack	1	Battery tester	1	Brake drum gauge	1
Differential gear jack	1	Digital Multimeter for automotive with accessories	1	[II. Field Training Equipment]	
Master pin remover	1	Starter generator test bench with accessories	1	9. Field Training Equipment	
Hydraulic hose crimping machine	1	Plug cleaner and tester	1	Combine harvester	9
Set of tools for disassembling engines	1	6. Mechanical and Locksmith Equipment		Agricultural tractors 80HP or more	18
Hydraulic shop press (100t)	1	Work bench with vise	2	Balers round, 300 kg bales	6
Overhead crane	1	Crankshaft grinder	1	Reversible plows	6
Puller / hydraulic puller / hydraulic gear puller set	2	Lathe with accessories	1	Disc harrow	6
Work bench with vise	15	Radial drilling machine	1	No-till precision planter	3
3. Testing and Running Equipment		Cylinder boring & milling machine	1	No-till drill	3
Portable hydraulic tester with accessories	1	Cylinder honing machine	1	Fan sprayer	3
Hydraulic pressure gauge set	1	Bench drill press	1	Transplanter	2
Balancing test bench for turbo charger	1	Universal milling machine with accessories	1	Combinator	3
Multi purpose vacuum tester	1	Gas welder set (CO ₂ , Argon)	1	Baler square, 30 kg bales	6
Diesel injection pump tester	1	DC arc welder	1	Bedding equipment	2
		TIG arc welder	1	10. Equipment for Mobile Technical Service	
		Valve true gauge (Device for measurement of valve)	1	Service car	1

Duration of construction and estimated project cost

In the event that the project is implemented as a grant aid cooperation undertaking of the Government of Japan, the consultant would carry out the tasks of review of the specifications and other aspects of the equipment, and supervision of the tender, and the supplier would procure the equipment. In the event that no delays are encountered the entire process from the Exchange of Notes to be signed by both governments would require about 13.5 months (implementation planning, about 4 months, procurement, shipping, installation, about 9.5 months).

In the case that the planned equipment is supplied on a grant aid basis it is thought that the Moldovan side would contribute such works as procurement of communication facilities and computers, preparation works for installation of the equipment, registration fees for agricultural machinery, and banking charges for grant aid procedures.

Further, the increment in annual maintenance cost to be borne by the Moldovan side, in the event that the equipment is acquired as planned, is estimated to be on the order of MDL 3.48 million. This would be the equivalent of about 23% of the fiscal 2009 estimated income of the Center, and it is planned that the operating expense is to be treated as a part of the facilities usage expense of the Center, and payment for training, and it is expected that adequate funding will be available. Repair of the equipment provided for this project would be done within the Center using planned equipment, so no significant increase in repair cost is expected. Further, although there will be an increase in the use

of utilities when the Center training courses are in operation, it is expected that income would be generated by the training courses and no difficulty is expected regarding the cost of utility usage.

Verification of appropriateness of the project

The following gives the effects that are expected if the planned equipment is provided to the Center.

Present Status and Existing Problems	There has been an increase in acquisition in Moldova of agricultural machinery embodying new technology, but because of insufficient diffusion of proper techniques for operation and repair of such machinery the number of disabled or broken machines that have been idled because of inability to repair them has increased, and this has caused a decrease in the productivity and productive capacity of the agricultural sector. Thus there is urgent need for developing skilled technicians who can be of immediate value in remedying this situation.
Measures Proposed by this Project	Equipment used for training in workshops and on farms would be provided for use in the curriculum of the National Training Center for Agricultural Mechanization, construction of which has already been completed by the Moldovan side under jurisdiction of the Ministry of Agriculture and Food Industry.
Direct Effects; Extent of Improvements	<ul style="list-style-type: none"> • The number of persons to be trained per year would be increased (to a maximum of 1,655) by the sustained operation of training activities by the Center, thereby contributing to the advancement of mechanization in Moldova's agriculture. • It will become possible to spread knowledge about modern farm management and preventive maintenance of new agricultural machinery among agricultural producers (648 farmers/year). • It will become possible to disseminate professional skills of safe and effective operation and maintenance of agricultural machinery for the students at the agrarian university, the technical university, and agricultural colleges, will be able to take compulsory and elective subjects that call for on-farm practice (309-557 students/year). • It will become possible to transfer techniques in maintenance of the new agricultural machinery and repair of it among students, mechanics and repair personnel and teachers (per year: 72 students, 348 mechanics and repair persons, and 30 teachers).
Indirect Effects and Extent of Improvements	<ul style="list-style-type: none"> • Training in the techniques of operating, maintaining and repairing agricultural machinery will shorten time requirements for farm work, reduce the rate of mechanical breakdowns, and shorten the idle period caused by breakdowns; the usable life of the machinery will be prolonged, and the area farmed using mechanized methods will increase. As a result increase in farm output can be expected. • Application of methods of effective farm operation that have been learned through training in new methods of farm operation (leading to increase in the area of land under cultivation, increase in unit yields, and conversion to higher-value crops) by trainees has the potential to raise the level of productivity of land, and increase output. • By means of acquisition by youthful members of the population (from farms, who have moved to the cities to work) of new knowledge and techniques related to mechanized farming, it will be possible to anticipate an invigoration of agriculture based rural regions.

One of the strategic goals in the Economic Growth and Poverty Reduction Strategy Paper (2004-2006), as an aspect of promoting the transition to a market economy, is accomplishment of sustained growth of agricultural output through mobilization of the private sector and introduction of the principle of free competition. In particular, the development of human resources has been accorded high importance as a means of promoting social and economic development, and the rectification of imbalances, in the rural sector. Further, the master program for the agricultural sector, Agro-Food Sector Development Strategy, calls for building a new agricultural production system, modernization and mechanization of production technology coupled with diversification of agricultural services, and the improvement and expansion of development of human resources for agriculture. The Ministry of Agriculture and Food Industry, moreover, in its Vision for Development of Agricultural Mechanization, has indicated that it is a matter of some urgency to improve the system of supply of agricultural machinery, the system for repair of such machinery, and improvement of information systems, in order to achieve the objectives of stable and sustained farm production through the promotion of mechanization; development of highly skilled human resources is essential for this.

Within this context, this Project, for the improvement of machinery and equipment for training at the National Training Center for Agricultural Mechanization, would contribute to the economic development of the agricultural and rural sector where a large number of the Moldovans live, and to improvement of the livelihood of the residents there, in conformity with the above-stated objectives of the Government of Moldova. Effects to be gained through implementation of this project would accrue to the nation's farms, companies, and related organizations and the like, through the medium of the trainees from the Center. If improvement is achieved in productive activities on farms by equipping those trainees with the knowledge and skills needed to operate and maintain the agricultural machinery in question, machinery that promises achievement of high levels of productivity, Moldova could look forward to an improvement in the balance of payments, as a result of the greater international competitiveness of farm products and processed agricultural products for export; in turn this has potential for helping the recovery of the national economy, invigorating the rural economy, improving the welfare of the people, stabilizing society, and promoting democracy. The Project is not in the category of those directed at basic human needs, but it is thought that its implementation will work to make improvements in that regard. Because this Project would also contribute to the long-term utilization of agricultural machinery provided since 2000 as assistance to underprivileged farmers, it is expected that it would have a heightened multiplier effect in conjunction with the 2KR program.

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ABBREVIATIONS

2KR	:	Grant Assistance for Underprivileged Farmers
Center	:	National Training Center for Agricultural Mechanization
CIS	:	Commonwealth of the Independent States
CNFA	:	Citizens' Network for Foreign Affairs
DFID	:	Department for International Development (UK)
EBRD	:	European Bank for Reconstruction and Development
E/N	:	Exchange of Notes
EU	:	European Union
FAO	:	The Food and Agriculture Organization of the United Nations
GDP	:	Gross Domestic Product
GNI	:	Gross National Income
IBRD	:	International Bank for Reconstruction and Development
IFAD	:	International Fund for Agricultural Development
JICA	:	Japan International Cooperation Agency
JPY	:	Japanese Yen
MDG	:	Millennium Development Goals
MAFI	:	Ministry of Agriculture and Food Industry
MDL	:	Moldovan Leu
NGO	:	Non-governmental Organization
NPO	:	Nonprofit Organization
ODA	:	Official Development Assistance
PIU-2KR	:	Project Implementation Unit of 2KR
PTO	:	Power Take-off
SIDA	:	Swedish International Development Cooperation Agency
TMS	:	Technical and Machine Stations
UNDP	:	United Nations Development Programme
USAID	:	United States Agency for International Development
WB	:	World Bank (IBRD)

CHAPTER 1 Background of the Project

Chapter 1 Background of the Project

1-1 Background Situation

The Republic of Moldova became independent in 1991 after the collapse of the Soviet Union, and since then has been known as the poorest in the European region due to lack of proper economic policies. The national economy declined through the 1990s, but this trend reversed in 2000, and the record of economic growth has been achieved since then including 7.1% growth in 2005. The average economic growth for the six-year period from 2000 to 2005 was 6.2%. Per capita GNI in fiscal 2005 was US\$930 (IBRD, 2007).

Being deprived of natural resources, Moldova is dependent on imports for its energy and industrial raw materials. The factories that had been established in Moldova by central-control officials during the Soviet era have been unable to secure a flow of raw materials from the supply sources that had been available prior to independence. Part of the reason for this is that those supplier countries have suffered from loss of productive capability owing to decline in exports, a decline resulting from economic weakness in the post-Soviet era. Many factories have been forced to close, or undergo restructuring. The resultant situation created a surplus of manpower, of which a considerable portion left for other European or CIS countries in search of work. It is said that the funds remitted to Moldova by about 600 thousand of its nationals who are working in other countries is largely being used for purchases of durable consumer goods and real estate, and the growth of tax revenue that is generated by such purchases is a major component driving GDP growth since 2000. The inflow of earnings of migrant workers, however, does not translate to strengthening of the economic infrastructure for future growth, and hence the government is planning on promoting sustained growth through the working of the real economy.

Moldova being blessed with rich farmland extending over about 75% of the nation's area, and a relatively warm climate, has traditionally been dependent on agriculture. The composition of GDP in fiscal 2005, by industry, shows a share of 17% for primary industry, 24.5% for secondary industry, and 58.5% for tertiary industry (National Bureau of Statistics, 2006). The agricultural sector, comprising farm output and production of processed agricultural products made from that farm output accounts for 30% of the GDP, and 59% of exports, so it is clear that agriculture is the major industry in Moldova. From the industrial sector, statistics (for fiscal 2005) show that food processing and feedstuff production comprise 50.8% of all manufacturing, of which wine production provides a major contribution, 20%. Further, the distribution of the workforce shows that the agricultural sector has 40.7%, industry and construction has 16.0%, and the services sector has 43.3%; agriculture thus has high labor absorption potential, as may be expected. Despite having a 41% share of the labor force, agriculture contributes only 17% of the GDP; it is readily understood from this that the Government of Moldova sees it as being of great importance to shift toward development of agriculture towards being more capital-intensive.

Agricultural reforms, which were begun in 1996 in Moldova, included breaking up of the former collective farms and elimination of the prohibition of private ownership of land. Farmers were given from 1.5 to about 2.0 hectares of farmland, and in a relatively short period of time, more than a million independent farm households were formed. The Government had hoped that the agrarian reforms would give rise to small holdings where labor-intensive production would provide high productivity and high value added, but insufficient agricultural technology and farm management capability, as well as dependence on high-cost, limited-availability of agricultural machinery and other inputs (seeds, fertilizer, agrochemicals, etc.) that had to be imported meant that many farmers were unable to make a transition from the collective farm arrangements, and the modernization of agriculture was hampered. This led the Government to implement a series of legal reforms including introduction of the leasing system of farmland, and promotion of a reorganization of farmland whereby farm management could be improved. In recent years, there has been improvement of farming technology and of distribution of agricultural equipment, while at the same time the supply of agricultural credit has been improved, enabling economically-favored farmers to either rent or purchase land, and the number of instances of the incorporation of farms and management of them as large businesses has increased. The improved liquidity in the market for farmland, greater efficiency in farm production, and progress in mechanization that has taken place has had, as one result, increase in the demand for both used and new agricultural machinery (tractors, combines, and other power-driven implements).

Turning to the present status of agricultural mechanization in Moldova, and concentrating on major types of machinery, in 2004 in Moldova there were 40,420 tractors, 3,942 combines, 13,910 plows, 14,330 cultivators, 9,745 drills/planters, and 5,123 sprayers; in all instances these numbers represent great decreases since attainment of independence. It is understood that the stagnant economy in the years immediately following attainment of independence, namely in the 1990s, resulted in little new investment in equipment, and the advancing obsolescence and breakdown of machinery from the Soviet era reduced the actual utilization of agricultural machinery, but with the turn-around of the economy in 2000 the number of newly acquired machines began to increase, leading to an increase in the total number of machines in the country. We can observe among agricultural producers (agricultural corporations, cooperatives, independent farmers, and so forth) an increase in interest in the mechanization of farming, but the operating efficiency of the large scale machinery that are a legacy of the Soviet era and were intended for use on large scale farms has not been high subsequent to the agrarian reforms and the splitting up of ownership of the land, and as one result there has been a decline in the unit yields of grains. Moreover, central government authorities in Moscow had provided support and assistance during the Soviet era with the intention of ensuring achievement of production targets they had set, but no such arrangement was created after independence. This has resulted in further obsolescence of existing farm machinery, and because of the age of that machinery, certain replacement parts became difficult to acquire, and the number of machines that have therefore fallen into disuse has increased.

The Moldovan Government, that has given attention to the development of the farming regions where about 60% of the nation's population are dependent upon agriculture for their livelihood, drafted the Economic Growth and Poverty Reduction Strategy Paper (2004-2006) for achieving the objectives stated in the very title of the document, and is striving to improve health and medical care, social welfare, job security, and household income. Within those efforts are targets for creating employment opportunities and improving income on a sustained basis by making the most of the dynamism of the private sector and the principle of market competition – in the agricultural sector. Because it did not prove possible to achieve the targets in the Economic Growth and Poverty Reduction Strategy Paper by 2006, the time horizon for the effort was changed to 2007, and the Government is working on a long-term national development plan that would succeed this Strategy Paper and seek to achieve balanced growth.

However, agricultural production has the inherent weakness of being subject to great fluctuations caused by change in the weather, and droughts and early frosts have reduced annual yields even to the extent of impacting the national economy, so the Government, in order to ensure more stable productivity in agriculture, drafted the Agro-Food Sector Development Strategy, by means of which the Government intends to invest in the agricultural sector, to build agricultural support systems so as to ensure diversification and sustained production of agricultural products and agricultural services; promote the supply of farmland, farm machinery, and farm equipment; and realize the application of modern land use techniques, the use of modern propagation facilities, and improvement of the uniformity of agricultural products. This plan was revised in 2006, to cover a long term of 2006-2015, indicating official intent to forge ahead with development of the sector. 2KR assistance provided since 2000 is highly evaluated in this document, which also states, "PIU-2KR is playing a vital role in promoting farm mechanization so as to achieve high productivity."

Further, in order to promote agricultural mechanization as one aspect of those efforts, the Ministry of Agriculture and Food Industry (MAFI), Agricultural Mechanization Department, is preparing a policy document called Vision for Development of Agricultural Mechanization. The objectives embodied in this Vision include invigorating Moldova's national resources in agricultural technology (technology, equipment, and the human resources), and, importantly, both the building of a system for promotion of agricultural mechanization on the basis of a more-advanced agricultural technology, as well as improvement of the overall environment so as to facilitate participation of private corporations in the supply of agricultural services. The following are under study as specific targets in respect to this, and notable among them is the development of human resources (through improvement of education, of training facilities, and of educational and training equipment) in support of mobilization of private interests on behalf of the agricultural sector. In order to take up these policy challenges, the Moldovan Government is working at the development of human resources, with emphasis given both to methods of farm management that are suitable for a market economy, and to the diffusion of appropriate technology for operation, maintenance, and repair of agricultural machinery.

1-2 Background of Request for Grant Aid Assistance

In order to support the improvement of agricultural productivity and the subsequent economic growth in Moldova, the Government of Japan has provided assistance since 2000 for the increased food production (now termed grant assistance for underprivileged farmers, 2KR), and in all, including by use of funds generated by 2KR activities and of revolving funds from 2000 to the end of August 2007 Moldova has acquired more than 2,700 pieces of agricultural machinery, that have contributed substantially to the modernization of agriculture. Among the agricultural machinery acquired under the 2KR program are items from the developed countries that embody the latest technology, but in overall terms the techniques for operating such machinery and repairing it are not sufficiently established in Moldova. Further, there are few dealers in agricultural machinery who provide proper repair services, there is a shortage of technical personnel in this field, and the relevant service network is underdeveloped. A long time is required to have machinery repaired, and the difficulty in getting repair work done in a timely fashion, particularly during cultivation and harvests, is a factor that limits the advance of effective mechanization in agriculture. Thus, the development of human resources in the field of agricultural machinery is a matter of great importance.

Against this background, the Ministry of Agriculture and Food Industry, having recognized that the diffusion of appropriate technology for operation and repair of agricultural and other machinery is indispensable for the ongoing process of agricultural mechanization, has used revolving funds to establish the National Training Center for Agricultural Mechanization, as a public training organization under the Ministry, as an effort to update and improve technical capabilities of Moldovans engaged in work involving agricultural machinery and an effort to reduce the shortage of persons having such technical skills. The Center is to provide training in the use of new agricultural machinery, and the technology for its operation, maintenance and repair, to persons presently working in agriculture or for agricultural companies, or working at repair and maintenance of agricultural machinery. The ultimate purpose of this Project is to develop human resources for immediate mobilization in agriculture in Moldova by improving the training provided to the diverse levels of personnel who are to use or work with agricultural machinery. The Project involves the improvement of workshop equipment and on-farm agricultural machinery for use by the Center, where over 1,600 persons are to be trained each year. Construction of the Center was completed in March of 2007, by the use of revolving funds of 2KR, but budgetary constraints that had limited the ability of the Government of Moldova to acquire the machinery needed for training and the equipment for the Center workshops led to the Government request for grant aid assistance from the Government of Japan. The Project would purchase and supply such machinery and equipment to the Center.

In response to the initial request by the Government of Moldova and to investigate project conditions, the Japan International Cooperation Agency (JICA) dispatched preliminary study missions to Moldova in August 2005 and February 2006, which verified the requirements of Moldovan side. Subsequently, JICA dispatched a mission in February 2007, to undertake a detailed study of the

training needs, and confirm the adequacy of the arrangements for training and state of preparation of the Center.

TABLE 1-1 List of Requested Equipment

Washing Equipment	Hot & cold water and steam combination washer, Jet parts washer, Nozzle cleaning kit, Air blow gun, Water recycling cleaner unit, Giraffe type crane, Parts rack, Manual forklift, etc.
Disassembling and Assembling Equipment	Work bench with vise, Hydraulic shop press, Air hydraulic jack, Transmission jack, Hydraulic garage jack, Scissors lift, Portable hydraulic jack, Portable lubricator , Piston holder set, Nozzle and injector puller, Set of tools for disassembling / assembling, Overhead crane, Forklift, Parts rack, Tool storage cabinet, Parts wagon, Sling chain kit with wire rope, etc.
Testing and Running Equipment	Hydraulic test stand, Balancing test bench for turbo charger, Multi purpose vacuum tester, Diesel injection pump tester, Engine dynamometer with accessories, Engine analyzer, CO-HC exhaust emission analyzer, Cylinder head and cylinder block pressure tester, Wheel alignment tester set, etc.
Selection and Control Equipment	Scope, Battery and coolant tester, Diesel smoke meter, Magnetic flaw detector, Ultrasonic flaw detector with accessories, Connecting rod aligner, Dial indicator, Cylinder gauge, Parts rack, Set of measuring tools, Inside, outside micrometer and caliper set, etc.
Electrical Equipment Repair Equipment	Silicon quick charger, Battery tester, Digital multimeter for automotive with accessories, Electric system tester and tools set, Parts rack, Tool storage cabinet, Hand truck, Starter generator test bench with accessories, Plug cleaner and tester, Electric soldering iron, etc.
Mechanical Processing Equipment	Work bench with vise, Lathe with accessories, Drilling machine, Bench drill press, Universal milling machine, Welder set, Crankshaft grinder, Crankshaft straightening press, Crankshaft support, Cylinder boring & milling machine, Cylinder honing machine, Ball peen / plastic / test / copper / wooden hammer, Electric drill, Metal cutter, Parts rack, Chisel and punch set, Valve true gauge, Injector reconditioning machine, Valve refacer, Valve seat grinder, Set of tools for lubricating and other mechanical work, etc.
Repair Equipment	Tire changer, heavy duty, Hydraulic tire removing tool, Set of tools for tire vulcanization and repair, Wheel balancer, Engine positioner, Disc assembling unit, Brake shoe adjusting tool set, Portable brake compression tester set, Micro-hone set for brake cylinder, Brake drum gauge, Wheel dolly, Brake shoe grinder, Brake disc lathe, Dynamic balancing machine for crankshaft, etc.
Painting Equipment	Painting booth, Airless spray unit, Air compressor, Set of tools for painting
Field Training Equipment	Combine harvester, Agricultural tractor, Reversible plow, Baler, Disc harrow, Planter, etc.
Equipment for Mobile Technical Service	Service car

Equipment for Training Classes	Tractor chassis instruction model, 4-stroke gasoline engine instruction model, 4-stroke diesel engine instruction model, Diesel distributor injection pump model, Plunger barrel injection pump plastic model
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1-3 Conditions Regarding the Project

Moldova is a landlocked nation, with Romania to the west and Ukraine to the other three directions; it lies from 45 degrees 29 minutes to 48 degrees 30 minutes of longitude and from 26 degrees 37 minutes to 30 degrees 10 minutes of latitude. The national land area is 33,850 square kilometers. The Prut River, in the west of Moldova along the border with Romania, flows from the north to the south, and in the southern part of Ukraine enters the River Danube before emptying into the Black Sea. In the east of the country, Dniester River flows from the north to the south and flowing into the Black Sea in Ukraine. The land between these two great streams is characterized by gently sloping hills and has black soil that is well suited to cultivation. Dealul Balanesti in the east has the highest elevation in Moldova, 430m. The climate throughout the nation is in general humid continental (a part of the country, in the south, has a climate close to that of the marine west coast, and the steppes) and there is a wide diurnal and annual range of temperatures.

Because this project belongs to Category C of JICA's Guidelines for Environmental and Social Considerations (issued April 2004), realization of the project would not involve any factor that would be harmful to human health and safety, or to the natural environment. The project site, where construction of the Center building was completed, is located within state farmland in Chisinau; there are no human settlements in the immediate vicinity, and selection of the site cannot impart material impact on the regional community. It is to be expected that a small amount of oil would be in the water draining from washed equipment at the Center but there already is a waste water treatment pit, in line with regulations of the Law on Water Protection Zones (1995), outside the room where the machinery will be washed, and arrangements have been made for the oil to be separated out of the water before the water is conveyed to the city's sewer main, so no problem is anticipated in connection with environmental and social considerations. Also, pursuant to Moldovan standard for buildings there are no harmful building materials, such as asbestos, among the building materials used to make the Center.

CHAPTER 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Target of the Project

Agriculture in Moldova is a leading industry, contributing 30% of the GDP and 59% of total exports if agricultural products and processed goods are combined, signifying that stable agricultural production is an indispensable factor for Moldova to accomplish sustained economic growth. Policy support being provided by the Government of Moldova for the promotion of farm mechanization in order to improve agricultural productivity and increase agricultural output induced a change that has required the recent importation of farm machinery the technology of which is not familiar to agricultural producers, mechanics and repair personnel in Moldova. This has had the effect of creating a shortage of the pool of skills, in terms of both number of persons and aggregate technical capability, for operating, maintaining and repairing the machinery. Consequently, the machinery is not being efficiently utilized. In line with an overall goal to achieve the increase of agricultural productivity and henceforth to sustain a stable economic growth, the Government of Moldova has established the National Training Center for Agricultural Mechanization, under the Ministry of Agriculture and Food Industry as a training entity that can upgrade the technical abilities of Moldovans currently working in the farm mechanization area and can solve the problem of shortage of manpower. In order to achieve this goal the ministry has planned hands-on practical training on the methods of use of the new machinery, its operation and maintenance for agricultural producers working farms or employed by agricultural companies as well as students enrolled in farm- and farm machinery-related courses at universities and colleges, as a means of relieving the shortage of personnel having technical abilities related to the machinery. Plans have been made for the improvement of the Center building and the training equipment in connection with this. The objective of this project is to improve Center training activities for persons from all levels in the republic, so that they can be of immediate value to the agricultural sector.

The immediate objective of this project is to improve the agricultural training equipment for practical use in workshops and farm fields, so as to contribute to achievement of the goals stated above, and to provide training opportunities in the maintenance and operation of farm machinery. It is expected that about 1,600 persons a year will be provided with improved training as a result of this project. The Center building has been essentially completed in March 2007, funded entirely by the Government of Moldova, and this project will procure and provide equipment for training activities at the Center.

2-1-2 Examination of Training Needs

(1) The Basic Concept of Training

Training at the Center has the purpose of contributing to the sound development of agricultural mechanization in Moldova, and to the stabilization of agricultural productivity. For these goals to be attained, the efficient and effective utilization of farm machinery throughout the nation is essential. The basic concept, therefore, is that trainees at the Center are to acquire an understanding of the basic structure of farm machinery, study how to use the machinery effectively, study the methods of preventive maintenance and repair of the machinery, and practice actual use of the machinery in farm plots so as to operate the machinery safely and effectively.

(2) Confirmation of Training Requirements

By learning, during the field study, the views of stakeholders of this project, and using information obtained through visits to the relevant organizations, the following requirements of the training program were confirmed.

1) Supervising Entity (The Ministry of Agriculture and Food Industry)

A downward trend of the number of farm workers in Moldova, and an increase in the average age of the workers, have become evident in recent years, as many workers, and young ones in particular, have left the farms to work in European countries. It is therefore vital to ensure that agricultural output can be effectively helped to grow through mechanization. The diffusion of modern farm machinery including that purchased through 2KR program has facilitated a substantial increase in the utilization of farmland, but the technical capability needed to maintain and repair this equipment is not as yet adequate. Moldova is dependent on imports for most of its farm machinery, but even in the case of equipment made in the country, it is necessary to import the steel and other main inputs, so that improving the nation's pool of technical skills for maintaining and repairing the equipment will increase the effective use of the equipment, that will be kept in good condition, and use of the equipment over the long term will contribute toward reducing the outflow of funds from Moldova. The Ministry therefore is supportive of the activities of the Center, and is willing to assist in its operation through the supply of personnel and financing.

2) Educational Institutions

Students enrolled at the State Agrarian University and agricultural colleges in Soroca and Svetlii are required by their curricula to participate in practical field trainings. But because the equipment that dates to the Soviet era has for the most part either become broken or damaged, or is out of date, there are hardly any pieces of the existing equipment that still have any value, and actual practice in fields affiliated with these schools cannot adequately

take place. Moreover, there are almost no instances of instruction in how agricultural machinery is constructed, or of hands-on practice in disassembly and reassembly of machinery. Although need exists to study the construction of new agricultural machinery, and to have the opportunity to practice the use of the new equipment that is becoming more widely used in Moldova, but because of budgetary constraints, it is not possible to provide all the schools with the equipment for hands-on learning experience. Therefore, if the equipment at the Center can be utilized as field training, students at these institutions would make beneficial use of that opportunity.

3) Repair Service Providers of Agricultural Machinery

Repair services by private-sector parties can normally accommodate work needed on engines, transmissions, and the drive system including wheels. Few persons, however, are capable of repairing precision components such as fuel-injection pumps, or complicated components such as hydraulic components. It was common to regrind crankshafts when that part of old equipment no longer functioned well, but the machine tools used for this sort of work date from the Soviet era, and hence are old and low in terms of precision. Given that the trend is for importation of new equipment to increase, there are many persons who would be eager for the opportunity to get trained in repair techniques that match the new technology embodied in the imported machinery.

4) Agricultural Producers

The company responsible for repair and maintenance of agricultural machinery sold by 2KR program keeps records of all breakdowns and repair of machinery supplied under that program, and analyzes the information collected. That analysis indicates that there are many instances of relatively minor accidents that occur because of insufficient mastery at the farms of the skills needed to operate the equipment, and this has lowered the rate of utilization of the equipment. There is widespread need to eliminate and reduce the occurrence of minor accidents that occur because of insufficient technical ability to operate equipment, or accidents that can be avoided by possession of proper, general knowledge about repair and maintenance of the equipment. It is thus very important that the Center carry out training in preventive maintenance of agricultural machinery. The 2KR program has been given a high evaluation by farmers and other agriculture-related persons because of the new technology it has brought to Moldova as well as the favorable terms of payment, but it is desirable that the new technology become diffused and established in view of the certainty that there will be need for maintenance and repair services as the new machines both increase in number and age over time, and in this respect there is formidable need for the Center.

5) Donor Agencies

Institutions active in the agricultural sector in Moldova, such as FAO, IFAD, the EU and CNFA (USAID) are aware of the Center, and consider it to be important as a contributor to the country's agricultural mechanization. Technical cooperation provided by these

institutions has included seminars and workshops, but up to this time there were few facilities in Chisinau having sufficient space and proper equipment, and there were difficulties in identifying venues for these events. Several of these institutions and related organizations¹ have already visited the completed building at the Center and indicated interest in holding seminars there. There are also institutions that wish to use the Center facilities for their own projects once the Center's equipment is in place, and thus the existence of the Center is highly evaluated by this group of stakeholders.

(3) The Training Needs Survey Subcontracted to a Local Firm

A survey of training needs was carried out by a local firm as a part of the work undertaken during the field study. The number of responses was 541, and the composition of the stratified sample is about 79% of the total being agricultural producers, about 12% being parties providing agricultural machinery related services (i.e., contract tilling), about 2% being manufacturers or retailers of farm machinery, and about 7% being in education or involved in research.

The survey results are summarized as follows.

- Of the total interviewees, 78.1% own their own agricultural machinery, and 21.9% (all small-scale farmers) rent machinery and do not own any.
- 62.95% of agricultural producers and 49.3% of the persons supplying agricultural machinery services report having trouble with their equipment (especially the case for old or second-hand equipment, and for parts problems).
- More than 30% of the agricultural producers report need for facilities and equipment for the repair of equipment, and facilities for repair of prime movers.
- Of the agricultural producers, 14.1%, and of the persons supplying agricultural machinery services, 25.0%, replied that there was a problem regarding the technical skills and knowledge of employees (reflecting a shortage of young specialists and existence of older, unqualified persons).
- Very strong interest in attending training sessions related to agricultural mechanization was indicated by 70.5% of the agricultural producers, 93.7% of the persons supplying agricultural machinery services, and a majority of the machinery dealers.

Further, with regard to the content of the training, many persons stated that they felt the following courses were desirable.

- Preventive maintenance (as part of overall farm management, and check-up and repair of equipment) --- For agricultural producers, agricultural machinery services

¹ Including consultants and NGOs assigned by CNFA or other institutions.

providers, and for machinery dealers.

- Specialized knowledge concerning the use, maintenance and repair of modern agricultural machinery --- For equipment operators and repair shop personnel, and for engineers and researchers.
- Method of properly using agricultural machinery --- For agricultural producers, agricultural machinery services providers, and students.
- New methods of teaching the use, maintenance and repair of agricultural machinery --- For educators (teachers).
- Deeper knowledge of modern maintenance and repair techniques --- For students.

Thus, it was confirmed that all levels of stakeholders of this project in Moldova have great requirements for training in the field of agricultural mechanization. The extracted report on the Training Needs Survey is annexed to this report as Appendix-6.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

At the stage of the field study, the request made by the Government of Moldova was that to plan on all of the following training curricula (modules) being implemented, for agricultural producers, students and educators.

- Module 1: Farm Management and Preventive Maintenance
- Module 2: Machinery Operation
- Module 3: Repair and Maintenance

Also, it is planned that Module 3, Repair and Maintenance, would be separately offered for machinists and repair mechanics only.

It is judged that there is a low level of urgency of training students and educators at the Center in Module 1, because the module's contents comprise general considerations of farm management when there has been mechanization, and of maintenance of agricultural machinery, as it closely resembles subjects taught at agricultural schools, so it was taken that this module would be offered only for agricultural producers. Nevertheless, educators at the university and colleges who have been teaching for many years are likely to require an updating of their knowledge and techniques, and it is planned that such persons will attend Module 1 as appropriate.

In connection with Module 2, it is judged that there is no need for persons presently engaged in agricultural production, or for educators, to spend a long period learning the techniques of operating machinery. But because there is need for students, who will be working

with the new agricultural machinery in their futures, to learn how to properly operate the equipment, so it is taken that training in this module would be for students, in accordance with the high priority assigned to them due to educational requirement. Nevertheless, the Training Needs Survey results included expressions of desire on the part of agricultural producers and persons supplying agricultural machinery services that their employees who operate equipment (many who are also repair mechanics) be given training in operation of the new equipment. We can think that behind this is the managerial attitude of seeking to reduce breakdowns and raise agricultural productivity by providing operators and repair mechanics, who have become used to working with the old Soviet era equipment, with the opportunity to learn how to operate the new, imported machinery. This requirement should be addressed by offering short training courses, based on the individual type of agricultural machinery, for persons presently employed in agriculture.

As became verified from the results of the Training Needs Survey, with regard to Module 3, because there is a great demand for acquiring agricultural machinery maintenance and repair techniques, curricula will be provided for separately training students, machinists and repair mechanics, and educators. With specific regard to students, training will include the basics of preventive maintenance, investigation of the causes of breakdowns and malfunctioning, and the repair process, so that the entire span of maintaining and repairing the equipment is covered. This is because their schools lack the facilities and equipment to give them the experience they can obtain at the Center. In the case of the machinists and repair mechanics, who already have acquired experience on farms and in service shops, emphasis will be placed on acquiring and improving skills in working with new equipment, and primarily imported equipment. Educators will be trained so that they can revise their own teaching of maintenance and repair in accordance with the increasing use of the new machinery – equipment that they do not have at their own institutions, and in order to obtain knowledge and techniques that can be used in educational activities, they will be provided with opportunities for practical, on-hands experience at the Center but only in the first year of its operation. The conceptual representation of training at the Center, based on the above, is as follows:

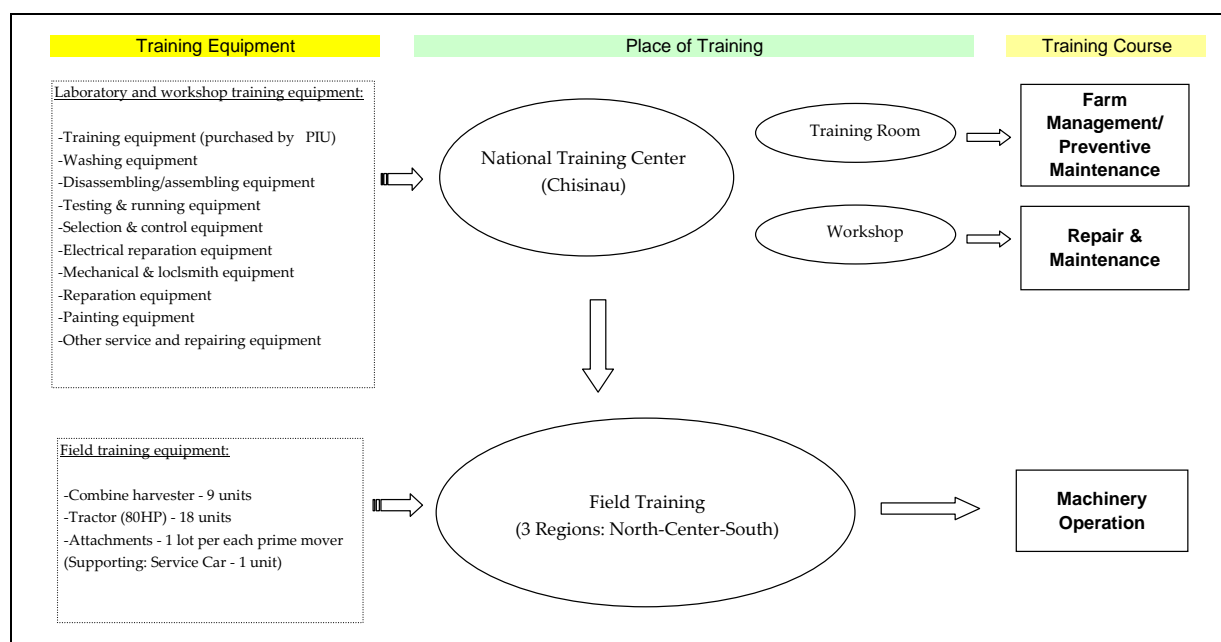


Fig. 2-1 The Training Concept

(2) Design Policy

The contents of the training at the Center were analyzed on the basis of the above concept. A summary of the Training Program is given in Table 2-1.

Table 2-1 Summary of the Training Program

No.	Course Description	Beneficiary	Period (days)	Outline of Course	Objective of Training
1	Farm Management/ Preventive Maintenance	Farmers	5	This course plans to provide all type of farmers (agricultural producers), irrespective of their operational size, with modern farm management methodology and effective and efficient use of modern agricultural machines, both theoretically and practically. The training is to be conducted at the Center in Chisinau.	The farmers will obtain practical knowledge of profitable farm management methodology through mechanization, and practical skill for maintaining the machinery in best working condition. The trainees are expected to play roll of leading staff at their own farm or company.
2	Machinery Operation	Students (incl. Farmers, Operators, Mechanics)	30 (Max.)	This course provides students of universities and colleges with practical skills and knowledge of agricultural machines. The training will be conducted at the field of collaborating farms, and students will be trained on job starting from daily inspection of the machinery, followed by operation of machines, attaching/detaching of implements, techniques on safety drive and operation, and adjusting of machines during operation for various agricultural works. Optional class of individual implement is to be provided, too.	The students will obtain practical skills for daily maintenance as well as safe and efficient operation techniques of the machines. Students, after graduation, will be able to join agricultural producers (farms, companies, service providers) as ready-to-work employees. Students are also entitled for the driving license of agricultural machines (Category H). Active farmers, operators, and/or mechanics will benefit from this course in terms of safe and effective skills of operation.

3	Repair & Maintenance	Students	20	This course provides students of universities and colleges with practical skills and knowledge of repair and maintenance through training using machines actually brought to the Center for repair. The training include series of workshop practice such as washing, testing and fault finding, disassembling and assembling, repair of electrical system, engine and hydraulic system, welding, painting, etc.	Through practical training on new technology for repair and maintenance, students will be able to deepen their knowledge on modern agricultural machines, and will obtain sufficient skill as mechanics ready to work at job places after graduation. The skill of such trained students will enhance the capability of users in repair of agricultural machines.
4	Repair & Maintenance	Mechanics	5	This course provides mechanics and operators of farms and related companies with professional skills and profound knowledge on repair and maintenance of the modern agricultural machines. Since the training targets those presently on the job having professional experiences and skills, emphasis will be placed on training such techniques for repair of engines, injection pumps, hydraulic system, etc.	Active mechanics and operator will obtain professional skills on preventive maintenance and repair of agricultural machines, and upgraded skills to operate them appropriately. By obtaining upgraded skills and knowledge of fault finding, they will be able to respond to the needs for repairs at their work places more quickly, and thus cases for outsourcing of repairs, or even replacement of parts, are expected to be reduced.
5	Repair & Maintenance	Teachers	5	This course provides teachers of universities and colleges with professional skills and knowledge on whole process of repair and maintenance at the workshops of the Center, by using machines actually brought in for repair.	Teachers will be expected to improve the teaching methodology of theoretical studies by linking the theoretical to practical through their practical knowledge obtained in this course.

Detailed course plans for the Training Program are shown in Table 2-2.

Table 2-2 Course Plans of the Training Program

Course	Course Description	Principal Trainee	Module	Period (days)	Class Size (trainee / class)	Number of Class / Time	Number of Course / Year	Total Number of Trainee /	Equipment to be used
1	Farm Management/ Preventive Maintenance	Farmers*	Module 1	5	12	2	27	648	Lab. Equipment + Field equipment
2	Machinery Operation	Students+ Farmers etc.	Module 2	30**	4	See Table 2-3.		309~557	Field equipment
3	Repair & Maintenance	Students	Module 3-1	20	12	2	3	72	Workshop equipment + Field equipment
4	Repair & Maintenance	Mechanics	Module 3-2	5	6	2	29	348	Workshop equipment + Field equipment
5	Repair & Maintenance	Teachers***	Module 3-3	5	2	1	15	30	Workshop equipment + Field equipment
Total								1,407~1,655	

* Teachers may participate as required.

** Max. days for the compulsory training of students (other optional courses are available for students, farmers, operators, mechanics, etc.)

*** Only for the first year.

With regard to the contents of the Training Program, planning was performed as detailed below, on the basis of the modules. The training curricula are shown as Appendix-7.

1) Farm Management and Preventive Maintenance (Module 1)

This training is to be conducted at the National Training Center for Agricultural Mechanization. Because the training would be given to agricultural producers (representing small independent farms, agricultural companies, cooperatives, joint ventures and kolkhoz) including those who have purchased 2KR agricultural machinery, but regardless of the scale of their operations, the training with respect to understanding agricultural machinery, new methods of farm management, and preventive maintenance of agricultural machinery can be accomplished in a short time.

In “Farm Management,” the major contents comprise key points of production management and managerial control, through study of work improvement (reduction of labor requirements, improvement of work efficiency and quality, standardization of work volumes) that can be expected from agricultural mechanization and the economics of agricultural mechanization; mechanization planning; the economic efficiency of agricultural production services; bookkeeping, accounting and managerial analysis; and contracts and contracting – the broad scope of farm management.

“Preventive Maintenance” covers training in the basics of the subject, and includes daily-routine and scheduled inspections; early discovery of problems and corrective measures (repair), and proper operation of agricultural machinery. The subjects to be taken up at the Center are these:

- a) Basic structure of agricultural machinery and understanding of it through actual use of the machinery
- b) Method of daily-routine and scheduled inspections
- c) Methods for early discovery of problems
- d) Measures to be taken and repair methods when a problem is discovered

Because the target of the farm management and preventive maintenance training is persons presently engaged in agriculture, training will be along the lines of Module 1, over a period of five days and using the classrooms, workshops and machinery yard of the Center. Each training group is to be made up of 12 persons who will be assigned to one or another of the several classrooms and workshops. Because the workshops are arranged to have functions different from one to another, effective implementation of the training is possible. Plans are to recruit as instructors college professors with extensive experience in this field and veteran equipment maintenance persons from the private sector.

2) Machinery Operation (Module 2)

Training in the actual operation of machinery in the farm plots is primarily for the benefit of students at the Agrarian University, agricultural colleges, and the Technical University (optional) and will follow the curriculum of Module 2. Short courses of practical training for farmers, operators/mechanics will also be provided. The duration of the training is

to be max. 30 days in the case of compulsory training for the students (Table 2-3).

Table 2-3 Detailed Plan of Machinery Operation

Training	Power-driven Machinery	Attachments	Day/class	Number of Students/Trainees										No. of Class (4 pax)	Total Training Days
				Agrarian University				Soroca Agr. College	Svetlii Agr. College	Technical Univ.		Farmers, Mechanics	Total No. of Trainees		
				Agr. Engineering	Agronomy	Horticulture	Others			Machine Building	Eng'g Manageme				
Basic Training in Operation and Traction	Tractor	-	(2)	75	70	90	112	30	40	20	20	100	557	139	278
Harvesting Practice	Combine Harvester	(Headers-3 types)	8	75	70	10	34	30	40	6	6	100	371	92	736
Whet Straw Harvest Practice	Tractor	Round Baler	3	75	70	10	34	30	40	-	-	50	309	77	231
	Tractor	Square Baler	3	75	70	10	34	30	40	-	-	50	309	77	231
Plowing Practice	Tractor	Reversible Plow	3	75	70	90	34	30	40	-	-	50	389	97	291
Clod-breaking and Levelling Practice	Tractor	Disc Harrow	3	75	70	90	34	30	40	-	-	50	389	97	291
	Tractor	Combinator	2	75	70	90	34	30	40	-	-	20	359	89	178
Seeding and Planting Practice	Tractor	No-till Drill	2	75	70	90	34	30	40	-	-	20	359	89	178
	Tractor	No-till Planter	2	75	70	90	34	30	40	-	-	20	359	89	178
Spraying Practice	Tractor	Fan Sprayer	2	75	70	90	34	30	40	-	-	20	359	89	178
Ridge Raising/Transplanting Practice	Tractor	Bedding Equipment	1	75	70	90	34	30	40	-	-	20	359	89	89
	Tractor	Transplanter	1	75	70	90	34	30	40	-	-	20	359	89	89

Note 1) Number of student shows that for compulsory training except for the one in *Italic* which shows number of trainees for optional course.

Note 2) For the compulsory training for students of Agrarian University and 2 colleges, an agreement should be concluded between PIU-2KR and these institutions for accreditation.

For field training, combine harvesters and tractors with necessary attachments and implements will be provided and the trainer will be a person experienced in using these. The concept and basis of class organization are as follows. The basis for forming a class is as illustrated in Fig. 2-2.

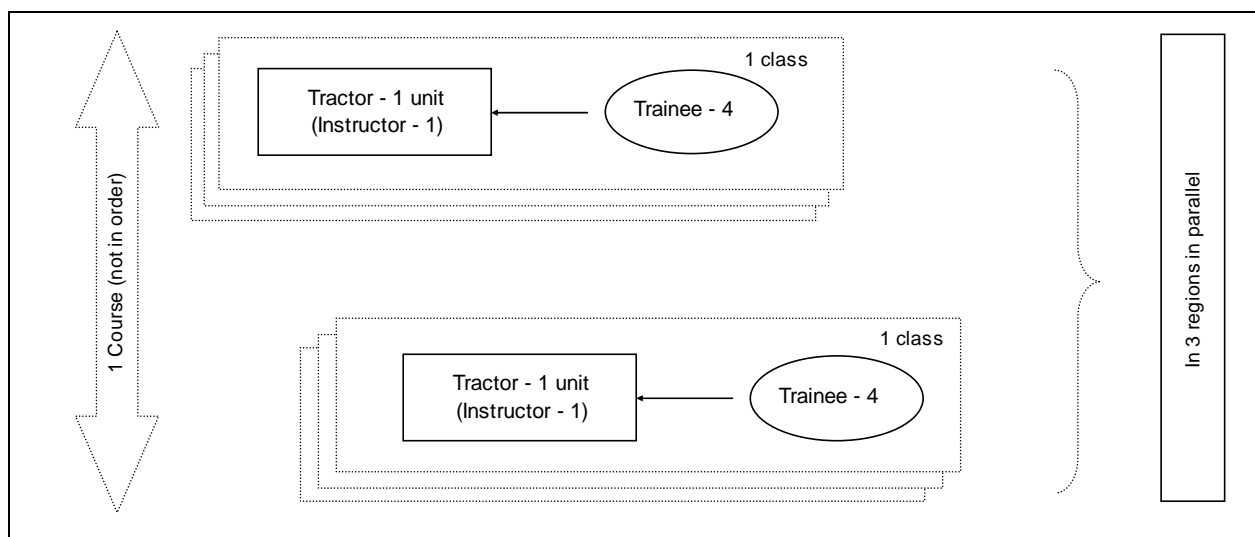


Fig. 2-2 Organization of Classes for Training in Operation of Agricultural Machinery

Class organization and conditions:

- a) One class will be organized for training of each type of machinery.
- b) For each unit of combine harvester and tractor, 1 instructor and 4 trainees are assigned.
- c) For the “Basic Training in Operation and Traction” trainees will make use of the machinery not occupied by other classes on sharing basis.
- d) Training classes are offered in 3 different regions in parallel. Planned number of bedding equipment and transplanter is 2 respectively in consideration of less frequent use in northern region, and these will be used on sharing basis among the regions.
- e) Harvesting practice will be conducted by using 3 combine harvesters with 3 instructors and 12 trainees in the same region in parallel so that it can train the planned number of trainees in a short harvesting season.
- f) Maximum training period for a student trainee on compulsory course for all types of machinery will be 30 days in a year. He can select the time of a class in accordance with the actual timing of agricultural works that he wishes to participate in.
- g) A student of optional training course will be able to select time of a class.
- h) Basic training classes in operation and traction of a tractor and optional courses for training of different types of machinery will be offered to farmers, operators and mechanics.
- i) A certificate will be issued by the Center to a trainee who completed a training class.
- j) Only the tractors of 80HP type will be used for training because these can give principal technical skills equivalent to those of 100HP and more.
- k) Planned number of combinator, drill and planter could be minimized since these items are used in the neighboring small farm plots and could be operated without significant time loss.
- l) Optional training for farmers, operators/mechanics will be conducted by using tractors not occupied in training courses for students, thus making maximum use of tractors.

Basis for organizing a class:

Because it is desired that the students, after graduating, will immediately become key persons at the farms where they work, and are expected to possess a high level of skill, their training should be concentrated and done in small groups. Farm accidents are not uncommon, and often are caused by lack of technical capability; for this reason it is necessary to inculcate a high level of skills by relatively long training under the direct supervision of an instructor. Further, it is desired that practice in fields be done by making use of plots on private farms and in this case even though “training” is involved it is important that results be consistent and up to a certain standard. For this reason too it is desirable to do the training in small size groups.

Field training requires a certain duration of time devoted to start-up and end-of-day

procedures, returning the equipment to the proper place on the machine yard, detaching attachments to the machines, and adjusting and perhaps repairing the machines; for this reason use of small groups is necessary to ensure that each trainee has the required time to attend to the assigned tasks. Machinery is to be used in accordance with Moldovan labor regulation, corresponding to an 8-hour work day. Each trainee is therefore to have 2 hours a day of machinery operation time in a class. To raise the level of skills in operating these machines, concentrated and continuous use of them is necessary, and time is needed for detaching and attaching attachments between uses as well as for checks and adjustments; in view of this the minimum training time per day for a trainee is 2 hours.

In the case of agricultural machinery that is classified as “large, special machinery,” in Japan, training for a driver’s license is offered in several agricultural universities as well as in private driving schools. In the case of training at a university for this license to be given to students about 30 hours of practice in tractor operation and another 30 hours in traction of implements are required. In view of the special features of the various type of machinery and safety considerations, and in consideration of the need to train a larger number of persons within the limited time for farm work and the limited budget leads to the judgment that a class will be properly made up of one trainer (instructor) and four trainees.

Because the nature of farm work differs from season to season, training would be divided according to the requirements of the season as shown below (Fig. 2-3 shows the relationship between major works performed on the farm and the use of agricultural machinery). It seems that there exists no significant time lag among the works to be done in the summer and autumn seasons. It is possible for trainees to select the individual class that they are trained, and obtain comprehensive training throughout the seasons.

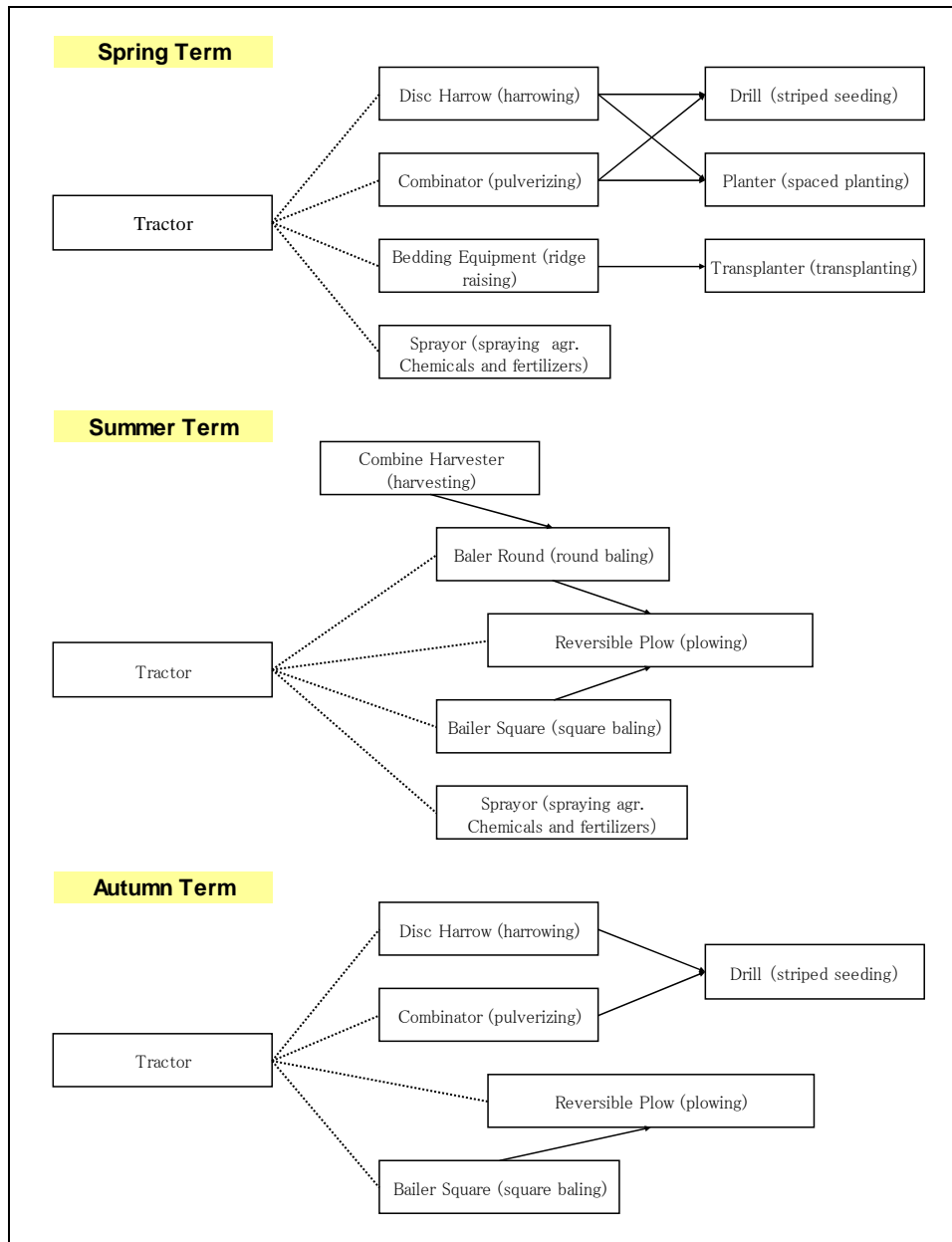


Fig. 2-3 Flow of Training on Farm Plots

Spring Term Training

The training is performed in 3 different regions by using tractors and other machinery. Most of the time the fields used will be those that had been plowed in the previous autumn and are to be seeded in spring.

Disc harrows and combinators are used with the tractors, to level clods at the earliest possible, suitable time so that drills or planters can be used, depending on the crop, and grain drilling and group seeding are performed. Disk harrows and combinators are used in classes individually so that each of them is used in different soil conditions. After the clods are broken up, striped seeding is done with a no-till drill or spaced seeding is done with a no-till planter. Inasmuch as whether a no-till drill is used to plant grains or a no-till planter is used to plant maize or legumes will depend on the location, the same line of thought as for the disc harrow is used.

Tractors are used with bedding equipment for ridge planting and with transplanters, both for vegetable plots. The tractors are planned to be used primarily with sprayers as well for use of chemicals in orchards. Because the timing of agricultural works differ total of 18 tractors will be used for different machinery on sharing basis.

Summer Term Training

Training will be done in 3 regions and use combine harvesters and tractors. Combine harvesters are used to complete the harvest of wheat, maize and/or sunflower. In the case of wheat harvesting tractors will be used to pull a baler (making rounds) after harvesting. Plowing will follow after bales are removed from the fields. All this is to be done consecutively on the same farm.

Tractors will be used also with balers (square) attached. Note that on farms where harvesting is done with combines large balers (rounds) will be used in most cases for the sake of the greater efficiency they provide, so the square balers will be used for training of baling pastures on other farms than where the round balers are used. The sprayers will be used with tractors for spraying chemicals. Total 9 combine harvesters and 21 machines with 18 tractors on sharing basis will be used.

Autumn Term Training

Training will be done in 3 regions, as in the spring and summer. The tractors will be used and will prepare the soil by use of attached disc harrows and combinators for fields where winter wheat is to be cultivated. Following this soil preparation drills will be used for winter wheat preparation with tractors, and the tractors will also be used for practice in tilling for spring-planting crops. Tractors will be used with reversible plows to break up clods and do tillage in addition to which balers (square) will be attached to them for clearing fields after spring wheat harvest and forage cutting. Total 24 machines will be operated for training by using 18 tractors on sharing basis.

Thus it is planned that training in fields will be done with training content appropriate to the season, using the appropriate machinery that is provided in the right number. In order to maximize the results of training students, moreover, their waiting time at the fields is to be minimized, and it is planned that in the future the training will not be concerned only with equipment operation technique but will also include matters such as measurement of harvest loss when combine harvesters are used, and measurement of the work efficiency of tractors.

Service Car

A service car is planned to be included in the planned equipment so that the appropriate persons can move from place to place in order to check on and service machinery, or perform repairs on machines used for training. At the present time in Moldova all domestic dealers in agricultural machinery (about ten companies) and agricultural machinery service providers (about 100) have several service cars (mobile repair cars) respectively that are used to check on and

provide repair services on the spot to agricultural machinery.² These service cars are usually pickup trucks or vans in which tool shelves and boxes for repair equipment have been installed, and they also carry repair tools, replacement parts, supplies and when required for a specific job welding equipment and power generators. Mechanics and repairmen of these companies are dispatched in the service cars in response to requests from users of agricultural machinery, and perform the required work on the spot. Further, in order to handle requirements for emergency repairs of agricultural machinery at the location where there was a breakdown while in use, farms that are managed under some sort of joint or collective arrangement (as companies, producers' associations, kolkhoz, etc., about 2,000 in all) or relatively large-scale independent farms (about 45,000³), repairmen employed by the farm itself are sent out by truck with tools and equipment from the farm workshop, to perform repairs or make adjustments in the fields. A breakdown of agricultural machinery during the relatively short farming season can be devastating to the farm, making it extremely important to provide mobility so that repairmen can deal with emergency situations quickly. The agricultural machinery to be provided by this project for training in farm fields consists of 27 self-powered vehicles (combine harvesters and tractors) and 40 attachments that are pulled by tractors, and service car support for these when they are in use is indispensable.

At the stage of the preliminary study for this project the Moldovan side indicated that it wished to have six service cars for use as equipment for training in maintenance and repair work at farms, but this request was assigned Priority B because the necessity for training in situ maintenance and repair service was not recognized. Subsequently, at the time of the present basic design study, as a result of examining the appropriateness of this with consideration given to training requirements, it was found that it will be possible when the Center implements its Module 3 for trainees to acquire the training in agricultural machinery maintenance and repair that would be available through use of service cars, and from the viewpoint of the cost-benefit relationship, real need to plan on use of a large number of vehicles as training equipment was not found to exist.

The north-south dimension of Moldova is great, and it is thought that farms where training would be provided will be in the reachable range of 100-150 km from Chisinau where the Center is located. The preliminary survey report estimates that the rate of breakdown of agricultural machinery (tractors particularly) in Moldova is somewhat less than 10%, but when in addition to the occurrence of breakdowns consideration is given to emergency calls and support service at the points of training (adjustment of machines, replenishment of battery fluid and engine oil, changing tires, adjusting attachment connections, replacing parts, etc.), it is evident that there is very high need for providing at least one service car at the Center, for support of training at farms in various parts of the country. In view of this, the project would include as the minimum necessary one service car, as it is highly important to provide a support function for training

² In the case of Agrofermotech, an agent for after service of machinery procured under 2KR, the company has four service cars fitted out according to specifications from agricultural machinery makers.

³ According to the Training Needs Survey, about 9% of target agricultural producers had their own workshops. This corresponds to 45,000 out of the total 503,000 farms.

equipment used at farms, and this would help sustain the effective use of other equipment provided for training purpose.

3) Repair and Maintenance (Module 3)

Three courses have been planned for training in the techniques of maintaining and repairing agricultural machinery in Module 3, and are to be given in Center workshops. The course for students enrolled at the Agrarian University, the Technical University (particularly for mechanical engineering field), and agricultural colleges, conforms to the curriculum for Module 3-1, and lasts 20 days. The training for mechanics, operators and repair personnel working at farms and agricultural-related companies will last 5 days, and the course for educators at agrarian university and agricultural colleges also is 5 days long. The flow of training in techniques of maintaining and repairing agricultural machinery is shown in Fig. 2-4.

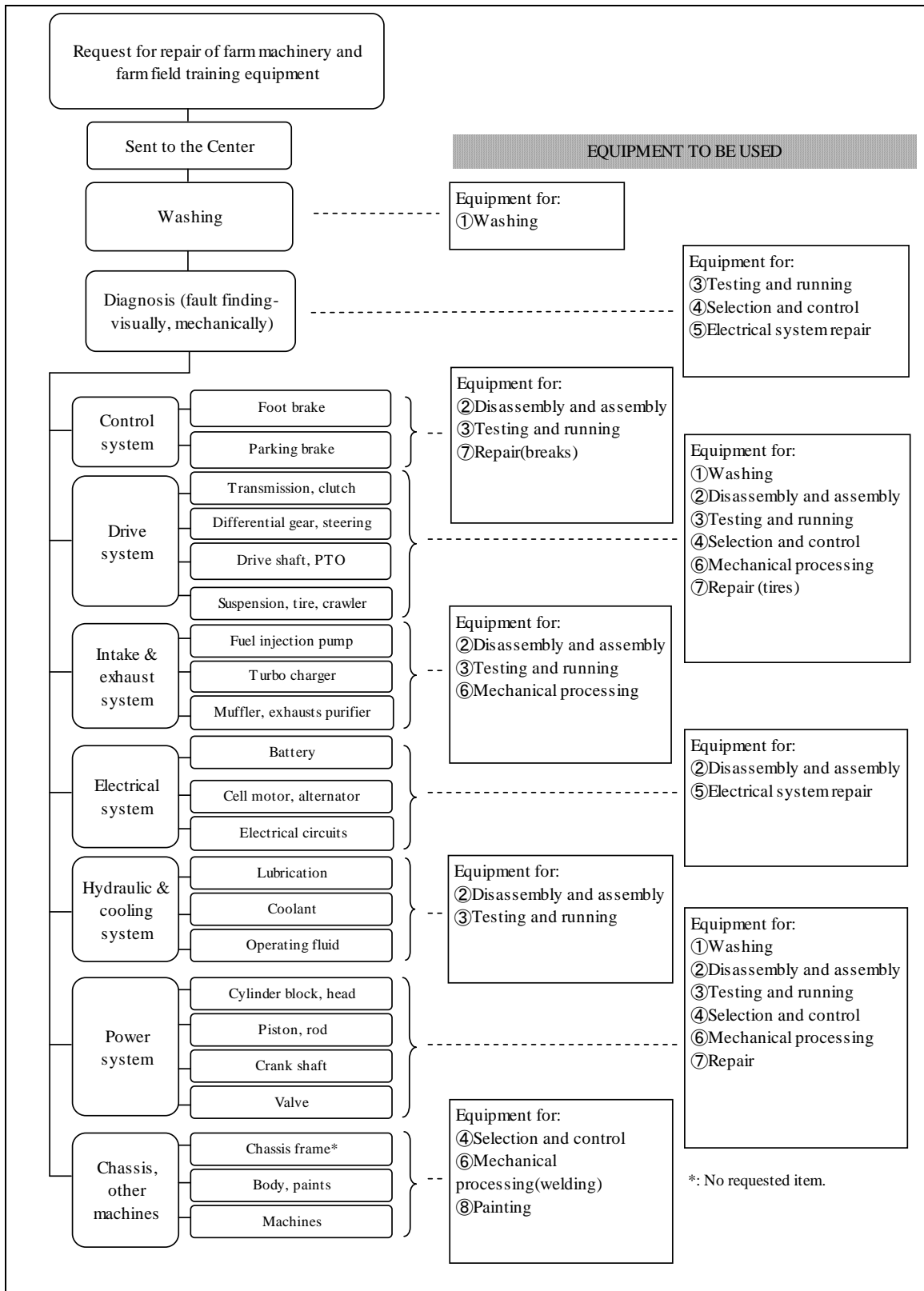


Fig. 2-4 Flow of Training in Techniques of Maintaining and Repairing Agricultural Machinery

Strong requests were made in connection with training in “the new techniques” by respondents to the Training Needs Survey. When one observes how agricultural machinery has developed in recent years, it is found that ease of operation and improved efficiency have resulted from the use of hydraulic components and electronic components. Great advances can be seen in hydraulic systems and electric/electronic system use, relative to the situation during the Soviet era. Desire to acquire knowledge about and learn the new techniques was particularly strong among machinists and repairmen who work on agricultural machinery in situ, and anticipations are high with regard to this being emphasized in the training course. The electronic systems now in general use in equipment are simply replaced in the event of a breakdown or malfunction and there is only low importance in giving this attention in training, but it is suitable to take up the maintenance and repair of hydraulic systems.

As a result of collecting information at dealers in agricultural machinery, it was found that there were inventories of oversize piston rings and undersize crankshafts that are needed when old engines are reground, and it is judged that there is a considerable volume of annual sales of these. And when visits were paid to places where repair work was being done, machine tools for rebuilding engines were on hand and it was confirmed that they were in current use. At small repair shops the working environment was not particularly good, as engine parts were left lying on the ground in the shops, and under such conditions it would be difficult to rebuild or process old parts with a high degree of precision. By way of contrast, in the Moldovan automobile repair industry there are all types of advanced machines needed for rebuilding engines, providing additional assurance that the provision of a venue for up-to-date training of repairmen who work on agricultural machinery at farms and agriculture-related companies so that they can acquire the new technology through training in techniques of rebuilding engines would contribute to a higher level of technology among users of the equipment and the equipment repair industry, with the result that the agricultural machinery would have longer lives and thus contribute to an improved balance of foreign exchange, among other effects.

At present there are many pieces of used equipment being bought and sold in the construction machinery industry. Because construction equipment carries high unit prices, even used equipment is in demand, as long as it functions properly. Similarly, a domestic maker of sprayers is selling imported rebuilt parts and domestic rebuilt parts at reasonable prices and these goods find a ready market. Farms and companies that are relatively weak financially in many cases import used tractors and combines. Because the breakdown rate for such used equipment is higher than that of new machines, the demand for repair services is high, and because the manufacturer’s warranty on the used equipment has expired, repair shops on farms, and repair service vendors, have to do all sorts of repair work.

In view of these conditions, training in maintenance and repair will be done by means of the following three courses.

Repair and Maintenance Course for Students (Module 3-1)

In the Agrarian University, the Technical University and agricultural colleges of Moldova

there is a shortage of equipment for hands-on practice and learning, and this course will supplement the education provided at those institutions. Therefore, each class will be made up of 12 students (two classes to be given instruction concurrently) over the period of 20 days, featuring hands-on, practical training in repair processes in accordance with the curriculum for Module 3-1. Training will be conducted in a group of students from the same institution. It is intended to deepen the students' understanding of agricultural machinery through their practice and learning of new maintenance and repair techniques so that in the future when they are hired to work at agricultural companies, tillage service companies and the like they will be of immediate value to their employers.

Repair and Maintenance Course for Mechanics (Module 3-2)

This course will be given for mechanics and repairmen whose present job is to provide maintenance and repair services for agricultural machinery at farms and agriculture-related companies. Because it is difficult to carry out long training programs for this kind of person, it is important to plan and give courses that are effective within a short period of time. Accordingly, as the trainees are already familiar with repair work, emphasis is to be placed on new and advanced techniques which otherwise would be difficult for these persons to master. Therefore, a class will be limited to six persons and two classes will be given concurrently, following the curriculum for Module 3-2. Emphasis will be on using machine tools for rebuilding engines, and on methods of analyzing problems in hydraulic systems. The course will have the effect of improving the repair capability of trainees and, moreover, as the mechanics will acquire familiarity with both the basics of using machine tools and working with hydraulic systems, they will be able to utilize their newly acquired skills not only for working with agricultural machinery but with other types of machinery as well.

Repair and Maintenance Course for Educators (Module 3-3)

This course is particularly for educators who work under the constraint of insufficient teaching tools in the form of agricultural machinery, and face a challenge in carrying out their teaching assignments with good effects. For these instructors, who are familiar with using old equipment for educating students, the training will be in general aspects of preventive maintenance but using new techniques, and repair techniques, in both cases for the new equipment and with the objective of enabling the instructors to improve their own teaching, bringing it up to date. For this reason there are to be two persons per class and training will follow the curriculum of Module 3-3. By their acquiring hands-on experience and understanding of the underlying principles of maintaining and repairing the new agricultural machinery, it will be possible for them to improve their classroom lectures at their schools. This course is to be given only during the Center's initial year.

(3) Policy for Identifying the Equipment for the Project

Study for identification of the machinery and equipment to be covered by this project was

made according to the following basic policy.

- Equipment deemed indispensable for training in the operating techniques, maintenance and repair of agricultural machinery presently in use in Moldova.
- Equipment judged to be necessary on the basis of the training curricula.
- Equipment for which replacement parts and supplies can be easily obtained.
- Equipment that would not present any problem with regard to storage, structure or related facilities.
- Equipment for which personnel and funds for management and operation will be available.

Also, equipment conforming to the following conditions was excluded from the project.

- Items which would not be frequently used relative to their cost.
- Items for which it would be difficult to ensure availability of the persons needed for proper operation and maintenance.
- Items requiring high outlays of funds for proper operation and maintenance.
- Items for which replacement parts and consumables cannot be easily obtained.
- Items that can be easily procured in Moldova by PIU-2KR.
- Items that PIU-2KR can make by themselves.
- Consumables.

(4) Policy for Determining Equipment Quantities

The assumption made was that basically there should be piece of equipment for each team of 2 trainees (4 trainees only in the case of farm field training), in addition to which the annual number of hours that each piece of equipment will be used was calculated using the number of training hours in the curricula and the projected number of trainees; this enabled the quantities to be determined.

- ① Workshop practice will be indoors and can be accomplished throughout the year, so the days of the coldest part of winter (December – January), Sundays and holidays were deducted and thus yielding the number of days per year of 200.⁴ With one day taken as equal to 8 hours the annual base number of hours becomes 1,600. This total of 1,600 hours was compared with the annual hours of use of the machines and equipment and this enabled determination of quantities of equipment for workshop

⁴ In Training Course No. 1, Farm Management and Preventive Maintenance (Module 1) there will be 5 days x 27 times = 135 days; for Courses 3 and 4 (Repair and Maintenance, Modules 3-1 and 3-2) each is 20 days x 3 times = 60 days and 5 days x 29 times = 145 days for a total of 205 days and grand total of 340 days, but as there would be some combination of courses the annual number of days was adjusted to 200.

training.

- ② In the workshops, each team of two trainees each will have one piece of equipment to work with, but in the case of relatively small materials (for example, metal parts for use in practice metalworking exercises) it was considered that it would be most effective if one set of these materials were to be provided to each trainee to use, and quantities of these materials were determined on that basis.
- ③ Concerning equipment for use in field training the period during which hands-on training can be done is limited to the period when work is being done in the fields, as the practice calls for working with actual fields and crops. Therefore, the quantities of these pieces of equipment were determined on the basis of the timing of the training.

(5) Policy for Implementing the Project

Among the staff at PIU-2KR, the implementing agency for this project, there are many persons with degrees in agricultural machinery, agronomy, accounting, and law, and not a few are teaching part-time at educational institutions such as the Agrarian University. Inquiry is being made into mobilizing faculty members of the Agrarian University or the Technical University, research institutes, the Ministry of Agriculture and Food Industry, or experts in manufacturing or other parts of the private sector as trainers and lecturers at the Center, and it is conceived that there would be no problem with regard to the technical abilities of instruction personnel. Individual items of equipment that would be provided by this project did not include highly sophisticated items, but in view of the need to provide training on equipment that embody new technology, it would be important to make use of the cooperation of specialists at private companies where progress has already been made in the acquisition and use of new equipment.

Further, in order to contribute to improving the ability of instructors at the Center who are directly responsible for management and maintenance of the training equipment to execute these responsibilities it is desirable at the outset for there to be provision of an adequate length of time for the equipment supplier to provide instruction and guidance in operation and use of the equipment, and the determination of the number of persons and duration of this assistance is to be planned to reflect the experience and ability of the Center staff.

2-2-2 Basic Plan (Equipment Plan)

A detailed study was made of the requested equipment, making reference therein to the results of the discussions in Moldova. The results of this study are shown below.

The requested equipment can be broadly separated into (1) items for use in workshop practice and training sessions, (2) items for use in farm field practice and training sessions, and (3) equipment for instruction use in classrooms.

2-2-2-1 Overall Plan

The equipment intended specifically for workshop training is to be used on the first floor of the Center building. The workshop floor area is about 990 square meters and it is equipped with primary electric power supply, water supply and drainage facilities. Many pieces of the workshop equipment are heavy but the workshop floor, made of reinforced concrete 20cm thick, has enough bearing strength for installation of that equipment. The Repair Shop, that has the largest space requirement at the workshop, mainly for training in maintenance and repair, has the ample floor area of about 540 square meters and a ceiling height of about 6m. Plans call for equipping the facility with equipment, devices and tools that match the Farm Management and Preventive Maintenance training (Module 1) and Repair and Maintenance training (Module 3) curricula.

The equipment for use in field training is planned to be used on farm plots that PIU-2KR is given permission to use by agricultural producers who do not own agricultural machinery. It is planned that the equipment will be for use in connection with the curriculum for Machinery Operation (Module 2).

Among the requested equipment there are items that are planned to be used in the second-floor classrooms (training rooms) for instructional purposes but as these can be obtained by the Moldovan side through purchase or by having them made these are excluded from the equipment covered by this project.

2-2-2-2 Equipment Plan (Workshop Training Equipment)

The Equipment Plan is based on the above-mentioned "Policy for Identifying the Equipment for the Project" and "Policy for Determining Equipment Quantities." Study of the workshop training equipment, followed the arrangements shown in Fig. 4, Flow of Training in Techniques of Maintaining and Repairing Agricultural Machinery, namely washing, testing, control system, drive system, exhaust system, electrical system, hydraulic system, cooling system, power system, chassis and tools. The results are given below. It must be mentioned that at almost all phases of training, hand tools and various meters are required, but these are not shown below as almost all of them can be readily obtained by the Moldovan side, and in the following explanation here no reference is made to their use for the equipment and processes where they are required. As for some common items that are needed at all phases, these would be used on sharing basis throughout.

(1) Washing

As agricultural machinery brought to the Center for practice at maintenance and repair will have soil and old grease adhering to its part, not only does this condition interfere with the work of maintenance and repair but if soil and grease were to enter internal parts of equipment at the time of disassembly and reassembly, this would cause new breakdowns. It is therefore necessary to wash the equipment. It has been planned to provide equipment that supplies cold water to

remove soil, and that sprays hot water and steam to remove the old grease. There are two Machine Washing Rooms, one larger than the other, but a single washing device is planned for the both rooms. A drainage channel and pit for the washing equipment have already been provided as part of the building (on the north side). A pump, filters etc. for recycling use of water from the wastewater will be provided by the Moldovan side.

Planned Equipment (Washing)

Category	Equipment (quantity)
Washing equipment	Hot & cold water and steam combination washer (1)

(2) Diagnosis

Once washed, the equipment is brought to the Agricultural Machinery Testing Corner in the Repair Shop, and used as educational materials for practice in studying what is broken or malfunctioning. The investigation is done primarily by visual inspection and analysis of the status of the breakdown or failure, but equipment is needed for certain analyses, such as of electrical systems. The plan is to supply a diesel compression gauge set for measuring compression in cylinders of diesel engines, and a diesel timing and tacho tester to measure combustion timing. Also planned is a computerized engine analyzer that performs functions including measuring temperature inside the engine, combustion conditions, combustion timing, fuel consumption and more. Analysis of exhaust gas requires equipment that measures CO, CO₂ and HC in exhaust gas; this too is to be provided. A diesel smoke meter is to be provided for analysis of black smoke. White smoke is a sign of worn valves or piston rings but visual examination and use of the sense of smell are sufficient, so no equipment is provided for this. Provision of a scope to listen for abnormal engine sounds is planned, as is a battery tester and a digital multimeter.

The equipment to be provided is as shown in the table below. Among the analytic equipment for engines as noted above, equipment is needed for maintenance and repair of the drive system (mentioned later), is considered separately as “Testing and Running Equipment.”

Planned Equipment (Testing)

Category	Equipment
Testing and running equipment	Diesel compression gauge set (1); Diesel timing and tacho tester (1); Computerized engine analyzer (1); CO-HC exhaust emission analyzer (1).
Selection and control equipment	Scope (1); Diesel smoke meter (1).
Electrical equipment repair equipment	Battery tester (1); Digital multimeter (1).

(3) Maintenance and repair of control systems

The equipment to be used for training activities in the maintenance and repair of control systems consists of combine harvesters and agricultural tractors. Because agricultural tractors are

driven on public roads as well as in fields, from a safety viewpoint the maintenance and repair of the control system is of great importance. The parking brake can be maintained and repaired by use of ordinary hand tools but special devices are needed for the foot brake. The part in the control system that wears out faster or more than any other is the brake shoe, so inclusion of a brake shoe adjusting tool set is planned. In addition there is to be a brake pipe flaring tool set, for removal and installation of the brake pipe, brake spring and brake anchor pin, brake spring pliers, and brake anchor pin remover. Vacuum boosters or compressors are often installed on large agricultural machines in order to increase the power of braking, so a multi purpose vacuum tester and a portable brake compression tester set are to be supplied. Plans include a micro-hone set for brake cylinder for repair of scratches on the inside of the master cylinder which controls braking by hydraulic means and cylinders that convey pressure to brake pads. A drum brake gauge will be provided for fixing and adjusting drum brakes.

Necessary in addition to the equipment directly used for brake parts are a hydraulic jack for separation of the tire and brake, an air impact wrench, an air hose reel; a hydraulic hose crimping machine for attaching the brake line hose; and a mobile work bench with vise for disassembly of brake parts. The hydraulic jack is a relatively simple piece of equipment, but if not used properly injury and even death can result; both a manual and pneumatic jack are planned and it will be necessary to provide training in the safe, proper use of them.

The equipment planned is as follows.

Planned Equipment (Control systems)	
Category	Equipment
Disassembling and assembling equipment	Hydraulic jack (one each of manual and compressed air operation); Air impact wrench (large and small; 4 types, 1 set); Air hose reel (4); Hydraulic hose crimping machine (1); Work bench for use in the large tractor corner (1); Mobile work bench with vise (1).
Testing and running equipment	Multi purpose vacuum tester (1).
Repair equipment	Brake shoe adjusting tool set (1); Brake pipe flaring tool set (1); Portable brake compression tester set (1); Brake spring pliers (1); Brake anchor pin remover (1); Micro-hone set for brake cylinder (1); Brake drum gauge (1).

(4) Maintenance and repair of drive systems

Basically, the training in maintenance and repair of drive systems will be confined to work on agricultural tractors and combine harvesters. Drive provided by the engine, after the flywheel, is transmitted to the clutch, gearbox (transmission), drive shaft, differential, axle, and tire or crawler in that order. Because this section is devoted to the components and parts from the clutch to the tire, in terms of the number of parts what is involved is, essentially, gears and shafts. Prolonged use will cause wear of gears and bearings, and warping and accumulation of metal fatigue of shafts, which will require maintenance and repair.

Separate from the system for running the vehicle, agricultural tractors are provided with power take-off (PTO) devices. The power take-off system, consisting of a clutch, gears and shaft,

is classified within the drive system. PTOs can also provide hydraulic force and power, and in such cases these are classified separately in hydraulic system and power system.

Also, steering systems, from the steering wheel to the front wheels via the differential, consist of gears and shafts and hence for convenience are included in the drive system category. Hydraulic systems for power steering are included in hydraulic systems.

Equipment used in agriculture other than combine harvesters and agricultural tractors also has shafts, gears and tires, and skill in maintenance and repair of agricultural tractors and combine harvesters obtained through training at the Center will also be applicable for these other pieces of equipment.

Equipment needed for maintenance and repair consists of a transmission jack, differential gear jack, scissors lift, air impact wrench, air hose reel, and master pin remover. Disassembled components are raised from the vehicles by an overhead crane and moved by a manual forklift (pallet truck) to the transmission repair corner, where they are further disassembled into their parts. A hydraulic press is needed to remove ball bearings from the shaft. One each of a 100t and a 25t press is planned, for work with different size bearings.

After disassembly the parts are washed in the Washing Room. A jet parts washer and a parts cleaner are needed there. If there is an accumulation of rust on the part, the rust is removed by a cleaning equipment with abrasive. Shafts, such as the drive shaft and axles, are subjected to powerful forces, making it necessary to inspect them for surface and interior defects by use of magnetic crack detectors for crankshafts (that can also be used for examining for damage to long shafts, and not just crankshafts) and an ultrasonic flaw detector. The former is used to examine the surface and near-surface metal for defects and the latter is for examination for defects relatively deep in the parts.

The next step is mechanical processing by use of mechanical processing equipment. A lathe and a bench drill press are needed for repair of shafts. A radial drilling machine is needed for repair of the box of the gearbox. A universal milling machine is needed for repair of gears.

After the parts are inspected and repaired, they are returned to the point of disassembly by the same means as they were conveyed from that point for reassembly and mounting in the vehicle chassis. Grease is applied where needed. A portable lubricator for grease and grease gun are used as needed.

Repair and replacement of tires is one of the most common requests concerning agricultural tractors. In the past, relatively strong pulling-power tractors of the crawler type were most common but recently the number of wheeled tractors that can also be operated on roads has increased and skills in tire repair and tire changing are increasing in importance. Because the tires on medium to large tractors are as tall as a person and heavy, the repair equipment required is different from that used for passenger vehicles. The equipment that is necessary is a tire changer, hydraulic tire removing tool, and a set of tools for tire vulcanization and repair (including an air compressor). It is planned that the same compressor as used for filling tires, and the air impact wrench used for other purposes will be used for tractor tires as well. In the case of passenger cars and trucks, there would be need for a wheel balancer but as agricultural equipment is not operated at high speeds, no provision is made for this. Further, a wheel alignment tester is needed for

adjustment of vehicle suspensions, as the angle that a tire makes with the pavement, if not proper, interferes with straight driving and turning.

In addition to the equipment directly needed for drive system parts, work benches with vise are needed for disassembly work, testing and inspection.

The equipment planned is as follows.

Planned Equipment (Drive systems)	
Category	Equipment
Washing equipment	Jet parts washer (1); Cleaning equipment with abrasive (1); Parts cleaner (1); Manual forklift (1).
Disassembling and assembling equipment	Transmission jack (1); Hydraulic shop press (25t) (1); Air impact wrench (large and small, 4 types, 4); Air hose reel (4); Portable lubricator for grease (2); grease gun (1); Scissors lift (1); Differential gear jack (1); Master pin remover (1 set); Hydraulic shop press (100t) (1); Overhead crane (1); Work bench for the gear and transmission repair corner (2); Work bench for the wheel repair and balancing corner (1); Work bench for the axle repair corner (1); Mobile work bench with vise (1)
Testing and running equipment	Wheel alignment tester set (1).
Selection and control equipment	Magnetic crack detectors for crankshafts (1); Ultrasonic flaw detector (1).
Mechanical processing equipment	Lathe (1); Radial drilling machine (1); Bench drill press (1); Universal milling machine (1).
Repair equipment	Tire changer (1); Hydraulic tire removing tool (1); Set of tools for tire vulcanization and repair (1).

(5) Maintenance and repair of intake and exhaust systems

Basically, the training in maintenance and repair of fuel injection and exhaust systems will be confined to work on agricultural tractors and combine harvesters. Function failure of the exhaust system will cause the engine to stop, or increase fuel consumption or increase pollutants in exhaust gas, singly or in combination. Because fuel prices have risen in recent years and there is greater demand to take environmental considerations into account, so the importance of maintenance and repair of exhaust systems have increased in importance.

The most important part in the intake system of diesels is the diesel injection pump; the functioning of this pump and its timing are of great importance in determining how well diesel engines perform. A diesel injection pump tester is planned in consideration of its importance for working on these pumps. In recent years there has been a rapid increase in the use of common-rail injection for fuel supply in diesel engines for passenger cars but the diesel engines used in agricultural machines for the most part are still the conventional (jerk) type of fuel injection pump, and among the machines that have been imported there are relatively old machines so for the time being it is expected that service requirements will be concentrated on the old type of pump. The pump tester to be provided, therefore, will be for the old type of pumps. Also planned for training in pump servicing is a fuel injection pump tool. The nozzle through which fuel is introduced into

the cylinders is an engine part and is included in the power system as discussed below.

A part in the intake system that relatively often requires maintenance or repair is the turbocharger. Because a higher compression ratio will improve engine performance, diesel engines, which are not subject to knocking as in the case of conventional internal combustion engines, and in particular those used for agricultural machinery where fuel consumption is of high importance, tend to be provided with turbochargers. Because of the high level of rotation of the turbine, wear or seizing of the bearing part can easily occur. Adjustment of the center of gravity is necessary in order that an excessive load is not placed on the bearings during high-speed operation after servicing. Because of this, provision of a balancing test bench for turbo charger is planned.

Machinery parts in the exhaust system include manifold, muffler, and exhaust purification system. A hole is often made due to corrosion from high temperature and acidic water of exhaust gas, but those are changed with new parts instead of repair, so equipment for repair for the system is not planned. For testing of exhaust purification system, CO-HC exhaust emission analyzer is used, that are used for diagnosis too.

The equipment planned is as follows.

Planned Equipment (Fuel injection and exhaust systems)

Category	Equipment
Disassembling and assembling equipment	Work bench for the injection pump repair room (1); Work bench for the injector and turbocharger repair room (2).
Testing and running equipment	Balancing test bench for turbo charger (1); Diesel injection pump tester (1); CO-HC exhaust emission analyzer (1).
Mechanical processing equipment	Fuel injection pumps service tool kit (1).

(6) Maintenance and repair of electrical systems

Training in maintenance and repair of electrical systems will be primarily those of agricultural tractors and combine harvesters, but balers and other equipment that have electrical systems are also to be covered. Combines, apart from driving them, have diverse functions related to harvest work, and hence the electrical control systems in them are complicated. In the case of agricultural tractors, whereas in the past electrical systems were rather simple, but in recent models, starting, running, hydraulic operation, speed change and more are controlled by electrical signals, and the electrical systems are complicated. The tractor being of great importance to farmers, requirements regarding technical servicing of tractors are similarly of great importance.

The most common problem of electrical systems is the battery becoming discharged. Batteries are recharged by chargers and the battery tester used for servicing batteries also can recharge batteries. The instant-charge type of charger now dominates in terms of chargers being used commercially in repair shops, and plans are for this type of charger to be provided. It will be necessary to provide training so that excessive voltage is not used when charging as this can damage batteries.

Relatively large parts in the electrical system are the starter (starter motors) and the

alternator.

Provision of a starter generator test bench for both analysis of functions and checking on performance after servicing is planned.

Large agricultural machinery is equipped either with units for starting diesel engines or for starting gasoline engines. It is planned to provide a plug cleaner and tester to wash plugs and test their resistance.

Other servicing of electrical systems will require a multimeter for vehicles, for investigating performance and problems.

Other than the equipment directly used for servicing electrical systems, a work bench with a vise, for disassembly and reassembly of parts, and inspection and testing, is required.

The equipment planned is as follows.

Planned Equipment (Electrical systems)

Category	Equipment
Disassembling and assembling equipment	Work bench for the electric parts repair room (2); Mobile work bench with vise (1).
Electrical system repair equipment	Silicon quick charger (1); Battery tester (1); Digital Multimeter for automotive (1); Starter generator test bench (1); Plug cleaner and tester (1).

(7) Maintenance and repair of hydraulic and cooling systems

Agricultural tractors and combine harvesters are the equipment of major interest with respect to hydraulic and cooling systems. In particular, hydraulic systems are needed to raise and lower tractor attachments, and hence are vital for tractor performance. Some tractor hydraulic systems are provided with PTO. In order to test and inspect these hydraulic mechanisms, a portable hydraulic tester and hydraulic pressure gauge set are necessary. When hydraulic hoses are to be connected, the hose crimping device otherwise used for brake hose connections can be used.

Almost all parts in the lubricating and cooling systems can be repaired with ordinary hand tools, and no provision is made for equipment for these.

Other than the equipment directly used for servicing hydraulic equipment, a work bench with a vise, for disassembly and assembly of parts, and inspection and testing, is required.

The equipment planned is as follows.

Planned Equipment (Hydraulic and cooling systems)

Category	Equipment
Disassembling and assembling equipment	Hydraulic hose crimping machine (1); Work bench for the hydraulic parts repair room (1); Mobile work bench with vise (1).
Testing and running equipment	Portable hydraulic tester (1); Hydraulic pressure gauge set (1).

(8) Maintenance and repair of power systems

Combine harvesters and agricultural tractors are of concern in connection with servicing of power systems, and it is the engines that are relevant. Almost all combine harvesters and agricultural tractors used in Japan are small in size, and because it is more economical in terms of labor and other costs to buy new equipment than to have old equipment repaired, there is little demand for rebuilding engines. Due to historical factors, in Moldova relatively large equipment is used, and at present the models that are being purchased are much larger than those used in Japan. Because labor costs are lower in Moldova, there is relatively strong demand for rebuild engines. Therefore, it is thought that the need for training human resources in working on drive systems.

To rebuild an engine, a hoist to remove (and later replace) the engine from the chassis is indispensable. The equipment that is generally used for this is called an engine lifter (i.e., it is a movable crane used only for engines), but an overhead crane can also be used. Once removed, the engine is lowered for conveyance to the engine repair and testing room by means of a manual forklift; in this room it is disassembled and serviced. The equipment necessary to disassemble an engine is comprised of a giraffe-type crane, set of tools for disassembling engines, hydraulic press, engine positioner, puller set, air impact wrench and air hose reel. The major parts that make up the engine are the cylinder block, cylinder head, crankshaft, crankcase, pistons (and piston rings and connecting rods), valves (and valve springs), camshaft, and flywheel. After the engine is broken down into these component parts the parts are brought to the Washing Room to be cleaned of dirt, grease and rust. The equipment used there for this purpose is the same jet parts washer, parts cleaner, and cleaning equipment with abrasive as are used for the drive system.

After prolonged use, cylinders become worn and the air, gaseous fuel, and oil in the cylinders will tend to leak, lowering the power of the engine and perhaps causing it to stall, as well as increasing pollutants in exhaust emissions. When cylinders have become worn, they are re-bored and then polished with a cylinder honing machine. A cylinder gauge is used during this process.

To work on cylinder heads or other parts with complicated surfaces, a milling machine with versatile capability is required. This type of machine is generally either a machining center or a milling machine, but the most suitable machine for training is universal milling machine. To remove carbon deposits from the valve seat on the cylinder head and re-polish the surface, a valve seat grinder and valve seat cutter are needed.

A gasket is positioned between the cylinder head and the cylinder block, but corrosion and other factors can cause openings to develop at that interface. In that case, a flat-surface grinding machine is needed to re-polish the surfaces, but as it is not expected that there would be many occasions requiring this work, no provision is made for this type of equipment. Nevertheless, because it is still necessary to determine whether there is any leakage from the interface, a cylinder head and cylinder block pressure tester is planned.

Repeated application of force to a crankshaft will result in metal fatigue and increase the likelihood of formation of a defect. To investigate the condition of a crankshaft, the same magnetic flaw detector and ultrasound detector as are used to work on drive systems are used, to

find out the conditions inside the part. Wear at the point that a connecting rod is attached to the crankshaft can cause unevenness, which is a source of lower engine performance. A crankshaft grinder is used to restore roundness at the point where the wear has caused unevenness. A counterbalance is achieved by modest steps of drilling on the side opposite where grinding has been done, and a crankshaft balance tester is used to verify when both parts have the same center of rotation.

The same radial drilling machine that is used for work on drive systems for punching and processing when repairing crankcases and other cast parts, or the coupling part of connecting rods.

The connecting rod connects pistons to the crankshaft and a connecting rod aligner is used to remedy any curvature that has developed in the rods.

For work on valves and valve springs, a valve true gauge, a valve refacer, an air valve lapper, and a valve spring tester are needed.

Also, for washing, inspecting and servicing the nozzles of fuel injection units, a nozzle cleaning kit, a nozzle tester, and an injector reconditioning machine are needed.

Other than the equipment directly used for servicing power systems, a work bench with a vise, for disassembly and reassembly of parts is required.

After individual parts are serviced, they are returned to the starting point by the same method as with they were brought to the repair point, in reverse sequence, for reassembly, and greasing where needed. The portable lubricator for grease and the grease gun are used where appropriate to provide the proper amounts of oil and grease.

After the engine is reassembled, its functions are checked before it is mounted on the chassis. The equipment used for this is the engine dynamometer and equipment used for working on the drive system, namely the diesel compression gauge set, the diesel timing tacho tester, the computerized engine analyzer, and the CO-HC exhaust emission analyzer.

The equipment planned is as follows.

Planned Equipment (Power systems)

Category	Equipment
Washing equipment	Jet parts washer (1); Cleaning equipment with abrasive (1); Parts cleaner (1); Nozzle cleaning kit (1); Giraffe-type crane (1); Manual forklift (1).
Disassembling and assembling equipment	Hydraulic shop press (25t) (1); Hydraulic shop press (100t) (1); Air impact wrench (large and small, 4 types, 1 set); Air hose reel (4); Portable lubricator for grease (2); Grease gun (1); Set of tools for disassembling engines (1 set); Overhead crane (1); Work bench for the cylinder head and valve repair room (2).
Testing and running equipment	Nozzle tester (1); Cylinder gauge (1); Valve spring tester (1); Engine dynamometer (1); Diesel compression gauge set (1); Diesel timing tacho tester (1); Computerized engine analyzer (1); CO-HC exhaust emission analyzer (1); Cylinder head and cylinder block pressure tester (1).
Selection and control equipment	Magnetic crack detectors for crankshafts (1); Ultrasonic flaw detector (1); Connecting rod aligner (1).
Mechanical processing	Work bench for the machine processing room (2); Crankshaft

equipment	grinder (1); Radial drilling machine (1); Cylinder boring & milling machine (1); Universal milling machine (1); Valve true gauge (1); Injector reconditioning machine (1); Valve refacer (1); Air valve lapper (1); Valve seat grinder (1); Valve seat cutter (1).
Repair equipment	Engine positioner (1); Dynamic balancing machine for crankshaft (1).

(9) Maintenance and repair of the chassis and attachments

Agricultural machines are not operated on public roads at high speeds, and because they have relatively solid chassis, it is thought that there is relatively little demand for repair of the chassis and frame of this type of equipment. Therefore, no plans have been made for provision of repair equipment for the chassis or frame.

Because of the working environment in which agricultural machinery is used, it is not infrequent that the bodies become damaged or dented. It is not thought that this means there is great need for repair work, but if the damage is such that it interferes with the motion of the machine or its moving parts, immediate attention is required. Repair consists of body work (metalwork) and painting, for which conventional tools and equipment will generally suffice, so no plans have been made for provision of such equipment; they are to be provided by Moldovan side.

The frames, discs and other parts of plows, disc harrows, combiners and other attachments that are pulled by agricultural tractors occasionally are damaged, and if large force is applied to them breakage can occur. Welding equipment is needed for training in making such repairs. There are three types of welding equipment: gas welder set (CO₂, Argon), DC arc welder, and TIG arc welder. To check on the existence of welding flaws after work has been done, the ultrasonic flaw detector used for power system repair is employed.

The equipment planned is as follows.

Planned Equipment (Chassis and frame)

Category	Equipment
Selection and control equipment	Ultrasonic flaw detector (1).
Mechanical processing equipment	Gas welder set (CO ₂ , Argon) (1); DC arc welder (1); TIG arc welder (1).

2-2-2-3 Equipment Plan (Farm Field Training)

Preparation of the equipment plan for training in farm fields was done on the basis of the above-mentioned "Policy for Identifying the Equipment for the Project," "Policy for Determining Equipment Quantities," Fig. 2-3, "Flow of Training on Farm Plots," and the contents of the spring, summer and autumn programs. Equipment used in the farm field training is confined to that which can be used at the actual times training will take place and for the specific crops on the farms. Therefore for the relevant period the field training equipment will be used for Module 2, and for

other periods, it will be used for Modules 1 and 3. Quantities for Module 2 in the following are rounded up to the nearest decimal place, and are to be used for Modules 1 and 3.

(1) Harvesting Practice

Training is to be provided in operation of the combine harvester, which is used to harvest the main crops of Moldova, wheat, maize and sunflower. Combine harvesters can be used for training of these harvests for 4 months from July to October. During that period, allowing for movement of machinery from plot to plot, maintenance and repair time, the number of days that actual practice can be had is 22 days in a month, for a total of 88 days in 4 months. In Module 2 harvesting practice on combine harvesters is to take place for 8 days, meaning 11 times (classes) during the 88-day period. PIU-2KR plans to have 92 classes of harvesting practice for 371 trainees a year, so 92 classes divided by 11 classes/unit means that about 9 units of combine harvesters are needed.

The equipment planned is as follows.

Planned Equipment (Harvesting practice)	
Category	Equipment
Field training equipment	Combine harvester (9).

(2) Basic Operation and Traction Practice

Training is to be provided in basic operation and traction of agricultural tractors prior to training of farm work with the tractors and attachments. Agricultural tractors are used not only for actual farm work but also transportation on the road with pulling attachments, so driving practice assuming on the road is to be provided too.

The basic operation and traction practice can be arranged about 9 months from March to November such as no-snow seasons. The number of days in a month that can be used for actual practice, after deducting maintenance and repair time, is 22 days, meaning that 198 days are available during the 9-month period. Practice in operation in Module 2 is to be for 2 days for the basic operation and traction practice, so during the 198-day period there can be 99 sessions (classes). PIU-2KR plans to have 139 classes of the basic operation and traction practice for 557 trainees a year, so 139 classes divided by 99 classes/unit means that about 2 agricultural tractors are needed.

The equipment planned is as follows.

Planned Equipment (Basic operation and traction practice)	
Category	Equipment
Field training equipment	Agricultural tractor 80HP (2).

(3) Straw Harvest Practice

Wheat straw is used as cattle feed during winter. Training will be provided in operating a baler, used to collect the straw, pulled by an agricultural tractor. Balers produce either round or square bales depending on the nature of the equipment, and as these two types of balers differ in manner of operation, training is to be given using both types. Because the round bales can be moved by rolling, relatively large balers are used to make such bales. Square balers are common with small tractors. The baler size to be used for training is to be the most common sizes in Moldova, making approx. 300kg round bales or approx. 30kg square bales.

The timing when balers are actually used to harvest the straw is about two months after the wheat harvest. During that period the number of days in a month that can be used for actual practice, after deducting for moving the equipment from plot to plot, maintenance and repair time, is 22 days, meaning that 44 days are available during the two-month period. Straw harvest practice in Module 2 is to be for 3 days each for round and square balers, so during the 44-day period there can be 14 sessions. Because four trainees will practice using a baler at the same time, 14 sessions will enable 56 trainees to have the experience of operating a baler. PIU-2KR plans to have 77 classes of the straw harvest practice for 309 trainees a year, so 77 classes divided by 14 classes/unit means that about 6 round and square balers are needed.

The equipment planned is as follows.

Planned Equipment (Wheat straw harvest practice)

Category	Equipment
Field training equipment	Baler round (6); Baler square (6); Agricultural tractor 80HP (12).

(4) Plowing Practice

Reversible plows are the type most commonly used in Moldova. Training is to be provided in agricultural tractor operation pulling a reversible plow. Reversible plows are to be used for practice after harvesting of sunflower, maize, sugar beet, and vegetables, and about 2.5 months after the wheat straw harvest. During that period the number of days in a month that can be used for actual practice, after deducting for moving the equipment from plot to plot, maintenance and repair time, is 22 days, meaning that 55 days are available during the 2.5-month period. Plowing practice in Module 2 is to be for 3 days, so during the 55-day period there can be 18 sessions. PIU-2KR plans to have 97 classes of the plowing practice for 389 trainees a year, so 97 classes divided by 18 classes/unit means that about 6 reversible plows are needed.

The equipment planned is as follows.

Planned Equipment (Plowing practice)

Category	Equipment
Field training equipment	Reversible plow (6); Agricultural tractor 80HP (6).

(5) Clod-breaking and Leveling Practice

Disc harrows and combinator are the implements most commonly used in Moldova to break up clods and level soil after plowing. Training is to be provided in operating an agricultural tractor pulling a disc harrow or combinator. These implements are used in Moldova after the last frost, to prepare the ground for planting sunflower, corn, sugar beet and vegetables, and for about 2.5 months after summer and autumn harvests. During that period the number of days in a month that can be used for actual practice, after deducting for moving the equipment from plot to plot, maintenance and repair time, is 22 days, meaning that 55 days are available during the 2.5-month period.

Practice in operation in Module 2 is to be for 3 days for training with a disc harrow, so during the 55-day period there can be 18 sessions. PIU-2KR plans to have 97 classes of the clod-breaking and leveling practice with disc harrows for 389 trainees a year, so 97 classes divided by 18 classes/unit means that about 6 disc harrows are needed.

Practice in operation in Module 2 is to be for 2 days for training with a combinator, so during the 55-day period there can be 27 sessions. PIU-2KR plans to have 89 classes of the clod-breaking and leveling practice with combinator for 359 trainees a year, so 89 classes divided by 27 classes/unit means that about 3 combinator are needed.

The equipment planned is as follows.

Planned Equipment (Clod-breaking and leveling practice)

Category	Equipment
Field training equipment	Disc harrow (6); Combinator (3); Agricultural tractor 80HP (9).

(6) Seeding and Planting Practice

No-till precision planters and no-till drills are the major attachments used for sowing and row planting in Moldova. Training is to be provided in operating an agricultural tractor pulling these. Minimum- or zero-tillage farming has become more widespread in recent years, and no-till drills and no-till planters are requested. However, for that purpose, required power of agricultural tractors is comparatively higher (110 - 130Hp or more), and the power of agricultural tractors with 80Hp to be used generally for field training is not sufficient. Therefore, precision planters and drills for training of conventional way of agriculture are planned instead of no-tillage type. Training using these can be done in or about February after the last frost, during the period of about 2.5 months for the sowing or planting vegetables. During that period the number of days in a month that can be used for actual practice, after deducting for moving the equipment from plot to plot, maintenance and repair time, is 22 days, meaning that 55 days are available. Seeding and planting practice in Module 2 is to be for 2 days each for a precision planter and a drill, so during the 55-day period there can be 27 sessions. PIU-2KR plans to have 89 classes of the seeding and planting practice for 359 trainees a year, so 89 classes divided by 27 classes/unit means that about 3 drills and 3 precision planters are needed.

The equipment planned is as follows.

Planned Equipment (Sowing and planting practice)

Category	Equipment
Field training equipment	Precision planter (3); Drill (3); Agricultural tractor 80HP (6).

(7) Spraying Practice

Fan sprayers are used to spread liquid fertilizer, pesticides and other agricultural chemicals in Moldova. Training is to be provided in operating an agricultural tractor pulling a fan sprayer. Training in the use of a fan sprayer can be performed for about 3 months from late February or March, to spread fertilizer and pesticide in vineyards and apple orchards, about in April for wheat, and for about a month from May to June for sugar beet; because of overlapping the available time on the calendar is about 3.5 months. During that period the number of days in a month that can be used for actual practice, after deducting for moving the equipment from plot to plot, maintenance and repair time, is 22 days in a month, meaning that 77 days are available in 3.5 months. Spraying practice in Module 2 is to be for 2 days, so during the 77-day period there can be 38 sessions. PIU-2KR plans to have 89 classes of the spraying practice for 359 trainees a year, so 89 classes divided by 38 classes/unit means that about 3 fan sprayers are needed.

The equipment planned is as follows.

Planned Equipment (Spraying practice)

Category	Equipment
Field training equipment	Fan sprayer (3); Agricultural tractor 80HP (3).

(8) Ridge Raising Practice and Transplanting Practice

Bedding equipment for ridge raising and seeds bedding, and transplanters are used in Moldova for cultivation of vegetables. Training is to be provided in operating an agricultural tractor pulling bedding equipment and transplanters. Training in the use of bedding equipment and transplanters can be performed for about 2 months between March and about June. During that period the number of days in a month that can be used for actual practice, after deducting for moving the equipment from plot to plot, maintenance and repair time, is 22 days in a month, meaning that 44 days are available in 2 months, for 44 sessions. Ridge raising practice and transplanting practice in Module 2 are to be for 1 day each for bedding equipment and a transplanter, so during the 44-day period there can be 44 sessions respectively. PIU-2KR plans to have 89 classes of the ridge raising practice and transplanting practice for 359 trainees a year, so 89 classes divided by 44 classes/unit means that about 2 of each implement are needed.

The equipment planned is as follows.

Planned Equipment (Ridge planting Practice; transplanting practice)

Category	Equipment
Field training equipment	Bedding equipment (2); Transplanter (2); Agricultural tractor 80HP (4).

Concerning the Number of Tractors

In sections (2) through (8) above, there is duplication of counting of agricultural tractors to be used for training; in principle the use of agricultural tractors is to be shared among the different activities. The below-mentioned table "Field Training and Necessary Equipment" is a summary of the above (1) through (8). As the table mentions, agricultural tractors are the most frequently used in 2.5 months (55 days) from September to the first half of November due to the timing of farm work, and used on total 987.5 days for the training during the period (Straw harvest practice, Plowing practice, and Clod-breaking and leveling practice), and a tractor is necessary for all the days of the training, then, necessary quantity of the agricultural tractors is 987.5 days-units divided by 55 days = 18 units. Spring term training is carried out for 4 months from March to June, and the training during the period (Clod-breaking and leveling practice, Seeding and planting practice, Spraying practice, Ridge raising practice and Transplanting practice) is total 946.5 days, then, the above-mentioned 18 units of agricultural tractors are sufficient. In addition, when the agricultural tractors are not used for the above training, those are also used for the basic operation and traction practice which can be arranged the terms not related to seasons of farm work.

Field Training and Necessary Equipment

Training	Power-driven machinery	Attachments	Training days/class	Trainees	Class (/4 persons)	Total training days	Available training days	Times of training	Necessary quantity	Planned quantity	Terms of training	Farmwork training with tractors	
												Mar. - Jun.	Sept. - Nov.
Basic operation and traction practice	Tractor	-	(2)	557	139	278	198	99	1.40	2	Mar. - Nov.	-	-
Harvesting practice	Combine Harvester	(Header, 3 kinds)	8	371	92	736	88	11	8.36	9	July - Oct.	-	-
Straw harvest practice	Tractor	Baler round	3	309	77	231	44	14	5.50	6	Sept. - Oct.	-	231
	Tractor	Baler square	3	309	77	231	44	14	5.50	6	Sept. - Oct.	-	231
Plowing practice	Tractor	Reversible plow	3	389	97	291	55	18	5.39	6	Sept. - Oct.	-	291
Clod-breaking and leveling practice	Tractor	Disc harrow	3	389	97	291	55	18	5.39	6	Mar. - Apr., Nov.	145.5	145.5
	Tractor	Combinator	2	359	89	178	55	27	3.30	3	Mar. - Apr., Nov.	89	89
Seeding and Planting Practice	Tractor	No-till drill	2	359	89	178	55	27	3.30	3	Mar. - May	178	-
	Tractor	No-till precision planter	2	359	89	178	55	27	3.30	3	Mar. - May	178	-
Spraying practice	Tractor	Fan sprayer	2	359	89	178	77	38	2.34	3	Mar. - Jun.	178	-
Ridge raising practice and transplanting practice	Tractor	Bedding equipment	1	359	89	89	44	44	2.02	2	Mar. - Jun.	89	-
	Tractor	Transplanter	1	359	89	89	44	44	2.02	2	Mar. - Jun.	89	-
Total			30									946.5	987.5

(9) Support for Field Training

In the training to be provided on farms support work is needed for mounting and

dismounting attachments needed for specific harvesting tasks, procurement and delivery of replacement parts when needed for maintenance and repair, replenishment of fuel, routine checks, repair work, and more. Because the time that can actually be used for practice in operating the agricultural machines is limited, it is necessary to keep the machines in good condition at all times so that the training is not hampered, and in the event that there is a breakdown and need for repair, appropriate measures must be swiftly taken. The purpose of operating the machinery is not to harvest crops, but a breakdown of the machinery not only would curtail the time available for training but also could impart damage to the owner of the farm who has provided use of it for the program, and discourage farmers from making their fields available for practical training. For these reasons it is necessary to furnish a service car equipped with repair equipment and tools, to ensure the smooth implementation of field training. The support services using this vehicle would be provided by a technical staff of PIU-2KR.

It would be possible to request an outside party to provide maintenance and repair services, but the number of such businesses is limited and it is indispensable to complete the necessary work speedily so as not to delay the progress of the training program. Moreover, even during the one-year initial product warranty, if there is a breakdown or damage of a part due to reasons related to the manner of operation, the warranty does not cover repairs or replacement of parts, and from the second year, such costs must be borne by the owner of the equipment. Inasmuch as the machinery is to operate by students with little or no prior experience the likelihood is that the need for technical support will be higher than under other conditions. Also, it would be useful for PIU-2KR to undertake maintenance and repair itself, on simple economic grounds.

Field trainings are to be conducted in 3 regions, i.e. northern, central and southern part of the country simultaneously, and engineers of the PIU-2KR visit the fields at least once a week in each region to take care of the field training equipment on farm. This service will be provided by a set of tools and equipment carried on the service car and through the daily maintenance service the life of farm machinery on farm is expected to be prolonged. In the case of breakdown of the field training equipment, the service car and engineers of PIU-2KR will be dispatched to the site and they will tested and repair the field training equipment immediately if it is possible. In case that a replacement part is required, the engineers will service the equipment for temporary repair for limited use to minimize influence on the schedule of the field training. And when replacement part is supplied, they will visit the field again and fully fix the breakdown.

Field trainings on farm are conducted during March and the first half of November for about 8 months (about 35 weeks) period, and the service car is principally used for the same period. Excluding official holidays the working days of a month are 22 days, and the servicing period of the service car is 176 days (22 days x 8 months) a year. Assuming that the service car makes 3 visits each week for servicing the training equipment it needs 105 days (3 x 35 weeks) during the 8 months period.

The frequency of breakdowns may be forecast using data from Moldova for 2005. The ratio of the annual number of instance when repair was needed to the number of agricultural machines

in the country was 9.4% in the case of recent-model tractors and 91% in the case of combine harvesters (source: Preliminary Study Report). No data is available for repair frequency of attachments, but the ratio for balers, drills, precision planters, and fan sprayers is taken as the same as for tractors, at 9.4%, and the ratio for reversible plows, disc harrows, combinators, transplanter and bedding equipment is taken as half that, at 4.7%. Also, the rate of breakdowns or problems with field equipment is taken as one and a half times those rates in view of the lack of experience on the part of trainees. On the basis of these assumptions, the rate of breakdowns is calculated as follows.

Calculation of Breakdown Rate

Item No.	Equipment	Qty	Breakdown rate (%)		No. of annual breakdowns
			Ordinarily	Training	
9.1.1	Combine harvester	9	91.0	136.50	12.29
9.4.1	Agricultural tractor 80HP	18	9.4	14.10	2.54
9.7.1	Baler round	6	9.4	14.10	0.85
9.19.1	Baler square	6	9.4	14.10	0.85
9.8.1	Reversible plow	6	4.7	7.05	0.42
9.10.1	Disc harrow	6	4.7	7.05	0.42
9.17.1	Combinator	3	4.7	7.05	0.21
9.11.1	Precision planter	3	9.4	14.10	0.42
9.12.1	Drill	3	9.4	14.10	0.42
9.15.1	Fan sprayer	3	9.4	14.10	0.42
9.16.1	Transplanter	2	4.7	7.05	0.14
9.20.1	Bedding equipment	2	4.7	7.05	0.14
Total					19.13

Assuming that one service call requires 1 day in case of immediate repair or 3 days including the traveling time in case of necessity of ordering machine parts, the number of days that the service car would be needed for the repair work would be 2 days on average, and the working time of a service car for servicing the training equipment on farm would be 19.13 times x 2 days – approx. 38 days.

In addition to this, support would be needed on a day to day basis other than for breakdowns. Adding these gives a total of 143 days of services by a service car during about 8 months (176 working days) between March and the first half of November when the field trainings are conducted. This makes a servicing ration of 81.3% (143 divided by 176), and necessary quantity of the service car for the service is one unit. The rest 18.7% (33 days) is meant for the use of the service car for additional maintenance and inspection of the training farm machinery and for servicing the service car itself.

The equipment planned is as follows.

Planned Equipment (Field training support)

Category	Equipment
Mobile technical service equipment	Service car (1).

It is planned that the foregoing workshop training equipment will be used in the workshop

only, and moving them to the service car for off-site (on-farm) use would be a cause of delay or trouble of the workshop training. Therefore, the equipment for the service car is planned separately as follows.

Service Car Equipment

Equipment	Qty	Intended use; notes
Generator	1 unit	Power for electric tools, garage lamp, battery charger, etc.
Battery charger	1 unit	Servicing a discharged battery
Air compressor and air blowgun	1 set	Adjusting tire pressure; washing by use of the air blowgun
Gas welder set	1 unit	Welding and cutting of damaged metal
Electric tool set	1set	Investigation and repair of electrical systems
Lubrication equipment	1set	Lubrication
Garage lamp	1 piece	Lighting during maintenance and repair work
Portable hydraulic jack	2 pieces	Changing tires, repairing brakes, etc.
Mechanical tool set	1 set	General maintenance work
Tool cabinet	1 set	Orderly storage of tools

The results of the study of the request are summarized in Table 2-4.

Table 2-4 Results of Study of the Request for Equipment

Notes:
 Priority A: Highly necessary and appropriate, suitable for the main objectives of the training at the Training Center, and appropriate as the equipment to be supplied through Japan's grant aid.
 Priority B: Subject to consideration of necessity and appropriateness because it is less suitable for the main objectives of the training at the Training Center, or because it is not appropriate as the equipment to be supplied through Japan's grant aid.
 Priority C: Less necessary or inappropriate.

*1: In consideration of importance of the items, the Moldovan side requested to change the priority from "B" to "A".
 *2: PIU prepared supporting data, information etc. to explain necessity and importance of the item. Priority and quantity of the item will be decided by the Japanese side based on the further examination of the said data.

Study of validity (In case of the following categories 1 - 9 and no solution of the problem, the item shall not be included in the plan.)
 1. Expensive equipment that is planned to be used not so frequently.
 2. No suitable places for operation and keeping of the equipment are provided.
 3. It is difficult to find engineers necessary for appropriate operation and maintenance of the equipment.
 4. Costs necessary for appropriate operation and maintenance is too expensive.
 5. It is difficult to obtain spare parts or consumables of the equipment.
 6. It is easy to buy the equipment in Moldova.
 7. PIU can make the equipment.
 8. Consumables
 9. There is a possibility to be used for another purpose.

Group: Number of group per one class

No.	Equipment	Quantity	Priority	Note	Study of Necessity					Frequency of Use																Study of Validity			Study of Quantity				
					Curriculum				Purpose of Use	Judge-ment	Module 1				Module 2				Module 3-1				Module 3-2				Operation Hour/year	Category	Study of Problems	Judge-ment	Study	Necessary Quantity	Planned Quantity
					1	2	3-1	3-2			Hour	Group	Class	Times	Hour	Group	Class	Times	Hour	Group	Class	Times	Hour	Group	Class	Times							
Component I – Workshop Training Equipment																																	
I. Washing Equipment																																	
1.1.1	Hot & cold water and steam combination washer	1	A		A5		3	1	Cleaning of body, engine, suspension etc. of agriculture machines (in large and small machine washing rooms)	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O	common use of 1 unit	1	1
1.1.2	Hot water high pressure washer	1	A		A5		3	1	Removal of mud from agriculture machines (outside, field)	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O	using 1.1.1 in the center, washing by hand in field		
1.1.3	Cold water high pressure washer	1	A		A5		3	1	Parts cleaning (by hand, in machine washing room)	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O	using 1.6.1		
1.2.1	Washing tank for special parts	1	A		A5		3	1	Oil supply	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O		1	
1.2.2	Oil service cabinet	1	A		A5		3	1	Cleaning of parts (oil etc.)	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O		1	1
1.3.1	Jet parts washer	1	A		A5		3	1	Cleaning of parts (rust, paint)	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O		1	1
1.4.1	Cleaning equipment with abrasive	1	A		A5		3	1	Keeping of parts	O	-	6	2	27					-	6	2	3	-	3	2	29	continuous	6, 7		X			
1.5.1	Parts rack	4	C		A5		3	1	Cleaning of parts (by hand, in parts washing room)	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O		1	1
1.6.1	Parts cleaner	1	A		A5		3	1	Separation of oil from waste water	O	0.8	6	2	27					1.6	6	2	3	1.6	3	2	29	595.2	2	procured by PIU	X			
1.6.2	Water recycling cleaner unit	1	C		A5		3	1	Nozzle cleaning	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O		1	1
1.6.4	Nozzle cleaning kit	1 set	A		A5		3	1	Cleaning of parts (rust, paint etc.)	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O		1	
1.6.6	Jet multiple chisel	1	C		A5		3	1	Cleaning with air	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O	3 kinds 1 each	3	
1.6.7	Air blow gun	3	A		A5		3	1	Handling of heavy machine parts	O	0.6	6	2	27					1.2	6	2	3	1.2	3	2	29	446.4			O		1	1
1.8.1	Giraffe type crane	1	A		A5		3	1	Transport of heavy parts	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6			O		1	1
1.9.1	Manual forklift	2	1B 1C	*1, *2	A5		3	1	Container of parts for washing	O	0.4	6	2	27					0.8	6	2	3	0.8	3	2	29	297.6	7	1 set to be included in 1.3.1	X			
1.10.1	Washing container for parts washer	8	C		A5		3	1																									
2. Disassembling and Assembling Equipment																																	
2.1.1	Sling chain kit with wire rope	1 set	C		A6		4,6,8,9	2	Suspension of parts	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	
2.1.2	Mobile work bench with vise	1	A		A6		4,6,8,9	2	Work bench to be used beside agriculture machines	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0			O		1	1
2.1.3	Mechanic tool set, inch	4 sets	B		A6		4,6,8,9	2	Tightening etc. of inch bolt/nut	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0	6		X			
	Mechanic tool set, mm	6 sets	B		A6		4,6,8,9	2	Tightening etc. of ISO bolt/nut	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0	6		X			
2.1.4	Hydraulic garage jack	2	A		A6		4,6,8,9	2	Jack-up of agriculture machines (manual)	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0			O	to be used long time	2	2
2.1.5	Transmission jack	1	A		A6		4,6,8,9	2	Positioning, disassembling and assembling of transmissions	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	1
2.1.7	Hydraulic shop press (25t)	1	A		A6		4,6,8,9	2	Disassembling and assembling of parts	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	1
2.1.8	Set of tools for disassembling / assembling Double-face sledge hammers Torque multipliers Wrenches Tinner scissors Adjustable reamers Grip pliers	1 set	B		A6		4,6,8,9	2	General tools for disassembling and assembling	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0	6		X			
2.1.9	Service creeper	2	B		A6		4,6,8,9	2	Repair and maintenance of bottom of agriculture machines	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0	7		X			
2.1.10	Blocking tool, 10, 12 ton	1 set	C		A6		4,6,8,9	2	Support of lifted machines	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0	7		X			
	Blocking tool, 35, 25 ton	1 set	C		A6		4,6,8,9	2		O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0	7		X			
2.1.11	Air hose reel	4	A		A6		4,6,8,9	2	Hose for air tools etc.	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O	same quantities of 2.1.12	4	4
2.1.12	Air impact wrench	4	A		A6		4,6,8,9	2	Tightening etc. of bolt/nut	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O	4 sizes 1 each	4	4
2.1.13	Portable lubricator for grease	4	2A 2B		A6		4,6,8,9	2	Lubrication (grease)	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O	for 2 kinds of grease	2	2
2.1.14	Portable lubricator for oil	4	A		A6		4,6,8,9	2	Lubrication (oil)	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O	for 4 kinds of oil	4	4
2.1.15	Grease gun with micro hose	2	1A 1B		A6		4,6,8,9	2	Lubrication (grease, by hand)	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	1
2.1.16	Oil drain	5	B		A6		4,6,8,9	2	Removal of engine oil	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	
2.1.17	Body puller set, standard	1 set	B		A6		4,6,8,9	2	Disassembling of body (small and medium size agriculture machines)	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	
2.1.18	Body puller set, large	1 set	B		A6		4,6,8,9	2	Disassembling of body (large size agriculture machines)	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	
2.1.19	Body & fender tool set	1 set	B		A6		4,6,8,9	2	Seat metal work of body and fender	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	
2.1.20	Scissors lift	2	B		A6		4,6,8,9	2	Lifting of agriculture machines	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0			O		1	1
2.1.21	Air hydraulic jack	1	A		A6		4,6,8,9	2	Jack-up of agriculture machines (air)	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0			O		1	1
2.1.22	Differential gear jack	1	A		A6		4,6,8,9	2	Positioning, disassembling and assembling of differential gear	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	1
2.1.23	Master pin remover	1	A		A6		4,6,8,9	2	Disassembling of crawler	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	1
2.1.24	Hydraulic hose crimping machine	1	A		A6		4,6,8,9	2	Connection of hydraulic hoses	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	1

No.	Equipment	Quantity	Priority	Note	Study of Necessity						Frequency of Use														Study of Validity			Study of Quantity						
					Curriculum				Purpose of Use	Judgement	Module 1				Module 2				Module 3-1				Module 3-2				Operation Hour/year	Category	Study of Problems	Judgement	Study	Necessary Quantity	Planned Quantity	
					1	2	3-1	3-2			Hour	Group	Class	Times	Hour	Group	Class	Times	Hour	Group	Class	Times	Hour	Group	Class	Times								
2.1.25	Forklift	1	B		A6		4,6,8,9	2	Transportation, loading and unloading of heavy parts	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1		
2.3.1	Set of tools for disassembling engines	2 sets	A		A6		4,6,8,9	2	Tools for disassembling and assembling of engines	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		2		
	Spring pusher								Compression of valve spring	O																						1		
	Piston ring tool								Disassembling and assembling of pistons	O																					1			
	Torque multiplier								Tightening with high torque	O																					2			
	Torque wrenches								Tightening with required torque	O																					2			
	Piston holder set								Tightening of piston rings	O																					1			
	Piston heater								Heating of piston for connecting rod	O																					1			
	Air blow gun								Cleaning with air	O																					1			
	Nozzle and injector puller								Dismantle of injection nozzles	O																					1			
2.4.1	Hydraulic shop press (100t)	1	A		A6		4,6,8,9	2	Disassembling and assembling of large parts	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		1	1	
2.5.1	Overhead crane	1	A		A6		4,6,8,9	2	Transportation of heavy parts	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0			O		1	1	
2.10.1	Puller / hydraulic puller / hydraulic gear puller set	2 sets	A		A6		4,6,8,9	2	Dismantle of parts	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			O		2	2	
2.12.1	Portable hydraulic jack	4	B		A6		4,6,8,9	2	Jack-up of agriculture machines in field	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0			X				
2.13.1	Parts rack	4	C		A6		4,6,8,9	2	Keeping of parts	O	-	6	2	27					-	6	2	3	-	3	2	29	continuous	6, 7		X				
2.13.2	Tool storage cabinet	5	C		A6		4,6,8,9	2	Keeping of tools etc.	O	-	6	2	27					-	6	2	3	-	3	2	29	continuous	6, 7		X				
2.16.1	Parts wagon, 1000 kg	3	B		A6		4,6,8,9	2	Temporary keeping of parts beside agriculture machines	O	0.5	6	2	27					1.6	6	2	3	0.4	3	2	29	300.0	6, 7		X				
2.16.2	Parts rack for small parts	2	C		A6		4,6,8,9	2	Keeping of small parts	O	-	6	2	27					-	6	2	3	-	3	2	29	continuous	6, 7		X				
2.17.1	Work bench with vise	15	A		A6		4,6,8,9	2	Work bench for disassembling and assembling work	O	0.8	6	2	27					2.4	6	2	3	0.6	3	2	29	450.0			O		15	15	
3. Testing and Running Equipment																																		
3.1.1	Hydraulic test stand	1	A		A5		10	3	Pressure test of hydraulic equipment	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1		
3.1.2	Portable hydraulic tester with accessories	1	A		A5		10	3	Measurement of flow rate, pressure, temperature etc. of hydraulic system	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
3.1.3	Hydraulic pressure gauge set	1 set	A		A5		10	3	Measurement of hydraulic pressure	O	0.4	6	2	27					1.5	6	2	3	1.0	3	2	29	357.6			O		1	1	
3.1.4	Flowmeter set	1	C		A5		10	3	Measurement of flow rate of hydraulic system	O	0.4	6	2	27					1.5	6	2	3	1.0	3	2	29	357.6			O		1		
3.3.1	Balancing test bench for turbo charger	1	A		A5		10	3	Testing of turbine balance of turbo charger	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
3.5.1	Multi purpose vacuum tester	1	A		A5		10	3	Testing of vacuum equipment	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
3.5.2	Diesel injection pump tester	1	A		A5		10	3	Testing of injection pumps	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
3.6.1	Nozzle tester	1	A		A5		10	3	Testing of injection nozzles	O	0.4	6	2	27					1.5	6	2	3	1.0	3	2	29	357.6			O		1	1	
3.10.1	Cylinder gauge	1 set	A		A5		10	3	Measurement of inner diameter of cylinders	O	0.4	6	2	27					1.5	6	2	3	1.0	3	2	29	357.6			O		1	1	
3.10.2	Valve spring tester	1	A		A5		10	3	Measurement of force of valve spring	O	0.4	6	2	27					1.5	6	2	3	1.0	3	2	29	357.6			O		1	1	
3.10.3	Engine dynamometer with accessories	1	A		A5		10	3	Measurement of engine power	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
3.10.4	Diesel compression gauge set	1 set	A		A5		10	3	Measurement of pressure in cylinders	O	0.4	6	2	27					1.5	6	2	3	1.0	3	2	29	357.6			O		1	1	
3.10.6	Stop watch	1	C		A5		10	3	Measurement of time for testing	O	0.4	6	2	27					1.5	6	2	3	1.0	3	2	29	357.6	6		X				
3.10.7	Diesel timing and tachometer	1	A		A5		10	3	Measurement of injection timing	O	0.4	6	2	27					1.5	6	2	3	1.0	3	2	29	357.6			O		1	1	
3.10.8	Computerized engine analyzer	1	B	*1, *2	A5		10	3	Testing of exhaust, temperature, pressure, etc.	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
3.10.9	CO-HC exhaust emission analyzer	1	A		A5		10	3	Measuring of CO, HC etc. in exhausted gas	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
3.10.10	Cylinder head and cylinder block pressure tester	1	A		A5		10	3	Pressure test of cylinder head and cylinder block	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
3.12.1	Wheel alignment tester set	1	A		A5		10	3	Measurement of tire angle	O	0.4	6	2	27					1.2	6	2	3	0.8	3	2	29	312.0			O		1	1	
4. Selection and Control Equipment																																		
4.1.1	Scope	1	A		A5		2		Checking engine sound etc.	O	0.8	6	2	27					0.8	6	2	3					288.0			O		1	1	
4.1.2	Battery and coolant tester	1	B		A5		2		Measurement of specific gravity and freezing point of battery solution and coolant	O	0.8	6	2	27					0.8	6	2	3					288.0			O		1		
4.1.3	Diesel smoke meter	1	A		A5		2		Measuring smoke in exhausted gas	O	0.8	6	2	27					1.6	6	2	3					316.8			O		1	1	
4.3.1	Set of measuring tools Square, Steel compass, Surface gauge, Thickness Gauge, Screw pitch gauge, etc.	1	C		A5		5		Measurement of length, surface etc.	O	0.8	6	2	27					0.8	6	2	3					288.0	6		X				
4.4.1	Set of measuring instruments Dial indicator Hand spring balance Cylinder gauge Hand tachometer	1 set	B	*1, *2	A5		5		Measurement of the following: Roughness of surface Weight Inner diameter of cylinders Rotation of shafts	O	0.8	6	2	27					0.8	6	2	3					288.0			O		1		
4.5.1	Inside, outside micrometer and caliper set	5	C		A5		5		Measurement of parts	O	0.8	6	2	27					0.8	6	2	3					288.0	6		X			Frequently used. Necessary quantities are about half of trainees of 1 group.	
4.12.1	Magnetic flaw detector	1	A		A5		5		Flaw detection of parts	O	0.8	6	2	27					1.6	6	2	3					316.8			O		1		
4.12.2	Magnetic crack detectors for crankshafts	1	A		A5		5		Crack detection of crankshaft	O	0.8	6	2	27					1.6	6	2	3					316.8			O		1	1	
4.13.1	Ultrasonic flaw detector with accessories	1	A		A5		5		Flaw detection of parts and welding points	O	0.8	6	2	27					1.6	6	2	3					316.8			O		1	1	
4.14.1	Connecting rod aligner	1	A		A5		5		Alignment of connecting rods	O	0.8	6	2	27					1.6	6	2	3					316.8			O		1	1	
4.17.1	Parts rack	4	C		A5		5		Keeping of parts	O	-	6	2	27					-	6	2	3				continuous	6, 7		X					
4.17.2	Parts rack with drawer	2	C		A5		5		Keeping of small parts	O	-	6	2	27					-	6	2	3				continuous	6, 7		X					
5. Electrical Equipment Repair Equipment																																		
5.1.2	Parts rack	2	C		A5		16		Keeping of parts	O	-	6	2	27					-	6	2	3				continuous	6, 7		X					
5.1.3	Tool storage cabinet	2	C		A5		16		Keeping of tools etc.	O	-	6	2	27					-	6	2	3				continuous	6, 7		X					
5.1.4	Silicon quick charger	1	A		A5		16		Battery charging	O	0.8	6	2	27					1.6	6	2	3					316.8			O		1	1	

No.	Equipment	Quantity	Priority	Note	Study of Necessity					Frequency of Use													Study of Validity			Study of Quantity							
					Curriculum				Purpose of Use	Judge-ment	Module 1			Module 2			Module 3-1			Module 3-2			Operator Hour/year	Category	Study of Problems	Judge-ment	Study	Necessary Quantity	Planned Quantity				
					1	2	3-1	3-2			Hour	Group	Class	Times	Hour	Group	Class	Times	Hour	Group	Class	Times								Hour	Group	Class	Times
7. Repair Equipment																																	
7.1.1	Tire changer, heavy duty	1	A		A6		14	2	Changing of large tires	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O			1	1
7.1.2	Hydraulic tire removing tool	1	A		A6		14	2	Disassembling of tires	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O			1	1
7.1.3	Tire bead remover, length 1.6m	2	B		A6		14	2	Disassembling of tubeless tires from rim	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	
7.1.4	Tire lever different 5 size	1	B		A6		14	2	Disassembling of tires (hand tool)	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	
7.1.5	Universal wheel hub puller	1	C		A6		14	2	Removal of wheel hubs	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	
7.2.1	Engine positioner	1	A		A6		4	2	Positioning of engines	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O			1	1
7.3.1	Set of tools for tire vulcanization and repair	1 set	A		A6		14	2	Repair of tires	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O				
	Air compressor								For tires, and air tools	O																							
	Tube vulcanizer set								Repair of tire tubes	O																							
	Thermopress								Reconditioning of tires	O																							
	Tire pressure gauge								Measurement of air pressure of tires	O																							
7.7.1	Disc assembling unit	1	C		A6		14	2	Assembling of brake discs	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	
7.8.1	Disc leveling stand	1	C		A6		14	2	Ditto (stand)	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	
7.9.1	Wheel balancer	1	A		A6		7,14	2	Balancing of wheels	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O			1	
7.10.1	Dynamic balancing machine for crankshaft	1	A		A6		7	2	Balancing of crankshafts	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O			1	1
7.11.1	Brake shoe adjusting tool set	1 set	A		A6		15	2	Adjustment of brake shoe	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O			1	1
7.11.2	Brake pipe flaring tool set	1 set	A		A6		15	2	Flaring of brake pipes	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	1
7.11.3	Portable brake compression tester set	1 set	A		A6		15	2	Pressure test of brake boosters	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O			1	1
7.11.4	Brake spring plier	1 set	A		A6		15	2	Disassembling and assembling of brake springs	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	1
7.11.5	Brake anchor pin remover	1	A		A6		15	2	Removal of brake anchor pins	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	1
7.11.6	Micro-hone set for brake cylinder	1	A		A6		15	2	Polishing of inner surface of cylinders	O	0.5	6	2	27				0.8	6	2	3	0.8	3	2	29	340.8			O			1	1
7.11.7	Brake drum gauge	1	A		A6		15	2	Measurement of brake drums	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	1
7.11.8	Wheel dolly, 7.50-11.00 tire	1	B		A6		15	2	Transportation of tires	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	
7.11.9	Brake shoe grinder	1	B		A6		15	2	Grinding of brake shoe	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	
7.11.10	Brake disc lathe	1	B		A6		15	2	Reconditioning of brake discs	O	0.5	6	2	27				0.3	6	2	3	0.3	3	2	29	242.8			O			1	
8. Painting Equipment																																	
8.1.1	Painting booth	1	B				11		Painting of agriculture machines after repair	O								1.5	6	2	3				54.0		1		X				
8.2.1	Airless spray unit	1	B				11		Ditto	O								1.5	6	2	3				54.0		1		X				
8.3.1	Air compressor, 2.2kw, 7kg/cm2	1	B				11		Ditto	O								1.5	6	2	3				54.0		-	using 7.3.1	X				
8.5.1	Set of tools for painting Air hose, Spray gun, Container, Air hose socket & plug, etc.	1 set	B				11		Ditto	O								1.5	6	2	3				54.0		1		X				
Component II – Field Training Equipment																																	
9. Field Training Equipment																																	
9.1.1	Combine harvester	12	A	*2	A1.2.B1	2			Training of combine harvester operation	O	4.1	6	2	27	64.0	1	92	1								7,216.4			O			9	9
9.3.1	Agricultural tractors 130 HP and more	12	A	*2	A1.2.B2	1,3-9			Training of tractor operation (traction of heavy machines)	O	2	6	2	27	192.0	1	139	1								21,584.0			O			-	
9.4.1	Agricultural tractors 80HP and more, narrow type	12	A	*2	A1.2.B2	1,3-9			Training of tractor operation (traction of light machines)	O	2	6	2	27	192.0	1	139	1								21,584.0			O			18	18
9.7.1	Balers round, 300 kg bales	12	A	*2	A1.2.B2	3			Training of baler (round) operation	O	1	6	2	27	24.0	1	77	1								2,172.0			O			6	6
9.8.1	Reversible plows 130HP	12	A	*2	A1.2.B2	4			Training of reversible operation	O	1	6	2	27	24.0	1	97	1								2,652.0			O			6	6
9.10.1	Disc harrow	6	A	*2	A1.2.B2	5			Training of disc harrow operation	O	1	6	2	27	24.0	1	97	1								2,652.0			O			6	6
9.11.1	No-till precision planter	6	A	*2	A1.2.B2	7			Training of precision planter operation	O	1	6	2	27	16.0	1	89	1								1,748.0			O			3	3
9.12.1	No-till drill	6	A	*2	A1.2.B2	6			Training of drill operation	O	1	6	2	27	16.0	1	89	1								1,748.0			O			3	3
9.15.1	Fan sprayer	6	A	*2	A1.2.B2	8			Training of fan sprayer operation	O	1	6	2	27	16.0	1	89	1								1,748.0			O			3	3
9.16.1	Transplanter	2	A	*2	A1.2.B2	9			Training of transplanter operation	O	1	6	2	27	8.0	1	89	1								1,036.0			O			2	2
9.17.1	Combinator	6	A	*2	A1.2.B2	5			Training of combinator operation	O	1	6	2	27	16.0	1	89	1								1,748.0			O			3	3
9.19.1	Baler square, 30 kg bales	6	A	*2	A1.2.B2	3			Training of baler (square) operation	O	1	6	2	27	24.0	1	77	1								2,172.0			O			6	6
9.20.1	Bedding equipment	2	A	*2	A1.2.B2	9			Training of bedding equipment operation	O	1	6	2	27	8.0	1	89	1								1,036.0			O			2	2
10. Equipment for Mobile Technical Service																																	
10.1.1	Service car	3	B	*1, *2				1	Supporting for field training	O	-							-							1,280.0		4, 9	Ditto	O	Ditto	1	1	
Component III – Class Training Equipment																																	
11. Equipment for training classes																																	
11.1	Tractor chassis instruction model	1	C		A1				Instruction of structure of tractors	O	0.5	6	2	27											162.0			O			1		
11.2	4-stroke gasoline engine instruction model	1	B		A1				Instruction of gasoline engines	O	0.3	6	2	27											97.2		7		X				
11.3	4-stroke diesel engine instruction model	1	B		A1				Instructions of diesel engines	O	0.3	6	2	27											97.2		7		X				
11.4	Diesel distributor injection pump model	1	B		A1				Instructions of distributor injection pump	O	0.3	6	2	27											97.2		7		X				
11.5	Plunger barrel injection pump plastic model	1	B		A1				Instructions of plunger barrel injection pump	O	0.3	6	2	27											97.2		7		X				

On the basis of the study of the request, as summarized above, the Equipment Plan for the project was formulated and is shown in Table 2-5. In identifying the items to be included in the plan the following were taken into consideration.

- The equipment should be of such a level as to be compatible with the training curricula.
- The equipment should be of a level appropriate to the trainees.
- The equipment was studied to determine if its operation, storage and management would not have substantial requirements in terms of techniques, time required, and costs.
- Standards should be internationally recognized and the equipment design should conform to the national Moldovan Standards.
- Spare parts and supplies should be procurable on an as-needed basis.
- Priority is to be given to equipment for which there are sales agents in Moldova and swift acquisition of spare parts and consumables is possible.
- Russian- or Rumanian-language operation and service manuals should be included.
- After installation, there should be adequate time for representatives of the vendor to provide orientation and guidance on use of the equipment.

Also, because the equipment would be put to actual use for practical training in the operation of agricultural machinery, the following were taken into consideration in making the selections.

- The equipment should be suitable for training in major, representative farm operations.
- The equipment should be capable of performing farm work at the time required.
- The equipment should be compatible with equipment in general use on Moldovan farms.
- The equipment should be of the kind that persons who have been trained in the use of that equipment will be able to readily acquire in the domestic market.
- There should be an existing service arrangement for the equipment and its maintenance should not be difficult.

Table 2-5 Equipment Plan

No.	Equipment	Quantity	Main specifications or configurations	Location*1
Component I – Workshop Training Equipment				
1. Washing Equipment				
1.1.1	Hot & cold water and steam combination washer	1 unit	Water pressure 14MPa or more, Water volume 840L/h or more	①
1.3.1	Jet parts washer	1 unit	Water pressure 0.29MPa or more, Water volume 189L/h or more, Capacity 0.45m ³ or more	②
1.4.1	Cleaning equipment with abrasive	1 unit	Fan capacity 900L/min. or more, Door 600 x 575mm or more, Width 750mm or more	②
1.6.1	Parts cleaner	1 unit	Tank capacity 47–60L or more, 70L or more, Tap 2 or more	②
1.6.4	Nozzle cleaning kit	1 set	Applicable nozzle S, T and others, Accessories: a set of necessary tools	②
1.8.1	Giraffe type crane	1 unit	Capacity 1t or more, Span 3m, Height 3m	③
1.9.1	Manual forklift	1 unit	Capacity 2.5t or more, Min. height 80mm or lower	②
2. Disassembling and Assembling Equipment				
2.1.2	Mobile work bench with vise	1 unit	Size 1,200 x 750 x 700, Load 800kg or more (Even load. Moving and up/down 600kg or more)	⑪ – ⑰
2.1.4	Hydraulic garage jack	2 units	Capacity 10t or more, Lift 400mm or more	⑫ and ⑭
2.1.5	Transmission jack	1 unit	Capacity 800kg or more, Lift 580mm or more	⑫ and ⑭
2.1.7	Hydraulic shop press (25t)	1 unit	Capacity 25t or more, Stroke 336mm or more	⑥
2.1.11	Air hose reel	4 units	Size 12mm dia. or more x 10m length or more, Pressure 0.98MPa or more	③
2.1.12	Air impact wrench	4 units (4 kinds 1each)	Shaft size 1/2, 3/4 x2 (long, short), 1 inch, with sets of socket	③
2.1.13	Portable lubricator for grease	2 units	Pressure 22.5MPa or more, Discharge volume 350g/min. or more	③
2.1.14	Portable lubricator for oil	4 units (2 kinds 2each)	With dolly, incl. hose 1/2"x5m or more x2 units, 1/2" x2m or more+extension hose x2 units	③
2.1.15	Grease gun with micro hose	1 unit	Capacity 400cc or more, Micro-hose 330mm or more	③
2.1.20	Scissors lift	1 unit	Capacity 10t or more, Lift 1,540mm or more, Length 5,800mm or more	⑬
2.1.21	Air hydraulic jack	1 unit	Capacity 5t or more, Lift 410mm or more	⑫ and ⑭
2.1.22	Differential gear jack	1 unit	Capacity 300kg or more, Lift 430mm or more	⑫ and ⑭
2.1.23	Master pin remover	1 set	Cylinder 100t or more, Pump: manual	⑫ and ⑭
2.1.24	Hydraulic hose crimping machine	1 unit	Applicable hose size 1 1/2 (6 spiral), – 2"(2, 4 spiral) or more, Pressure 68.6MPa or more or crimping force 2MN or more	⑩
2.3.1	Set of tools for disassembling engines	1 set	Spring pusher, Piston ring tool 1 set each, Torque multiplier, Torque wrenches 2 sets each, Piston holder set, Piston heater, Air blow gun, Nozzle and injector puller 1set each	③
2.4.1	Hydraulic shop press (100t)	1 unit	Capacity 100t or more, Stroke 330mm or more	⑯
2.5.1	Overhead crane	1 unit	Span 15m, Capacity 5t	⑪ – ⑰
2.10.1	Puller / hydraulic puller / hydraulic gear puller set	2 sets (2 kinds 1each)	Configuration: 10t or 13t set, 17.5t set or more	③
2.17.1	Work bench with vise	15 units	Size 1,500 x 700 x 740mm, Load 1.2t or more	*2
3. Testing and Running Equipment				
3.1.2	Portable hydraulic tester with accessories	1 unit	Flow 283.9L/min. or more, with adapters and hoses	⑩
3.1.3	Hydraulic pressure gauge set	1 set	Configuration: 2.5, 6 or 7, 40, 60 MPa	⑩
3.3.1	Balancing test bench for turbo charger	1 unit	Diameter 10–40mm or more, Rotation 600–1,800rpm or more, Length 500mm or more	⑧
3.5.1	Multi purpose vacuum tester	1 unit	Air pressure 635mmHg or lower	⑩

No.	Equipment	Quantity	Main specifications or configurations	Location*1
3.5.2	Diesel injection pump tester	1 unit	Test tube 8 or more, Motor 5.5kW or more, Rotation 80-4,000rpm or more	⑦
3.6.1	Nozzle tester	1 unit	Pressure meter 500bar or more, Fuel tank 3L or more	⑦
3.10.1	Cylinder gauge	1 set	Range 35-60, 50-100, 100-160mm, graduation 1/100mm	⑤
3.10.2	Valve spring tester	1 unit	Capacity 1,176N or more, Spring size 80 dia. x 210 length mm	⑥
3.10.3	Engine dynamometer with accessories	1 unit	Brake capacity 312ps or more, Configuration: Engine stand, Bed, Fuel tank, Cooling water tank, Water supply pump, Silencer	③
3.10.4	Diesel compression gauge set	1 set	Gauge 6.8MPa or more, with hoses, packing, adapters	⑰
3.10.7	Diesel timing and taco tester	1 unit	Rotation 120-9,990rpm or more	⑰
3.10.8	Computerized engine analyzer	1 unit	Measuring items: Temperature, Ignition timing, Pressure etc., Application: Diesel engine	⑰
3.10.9	CO-HC exhaust emission analyzer	1 unit	Measuring items CO, CO ₂ , HC, Range CO 0.00-10.00% or wider, HC 0-10,000ppm or wider	⑰
3.10.10	Cylinder head and cylinder block pressure tester	1 unit	Cylinder block size 1,000 length x 310 width x 210 height mm or more, Temperature 70 deg. C or more	⑩
3.12.1	Wheel alignment tester set	1 unit	Indication: LCD monitor or print, Accuracy $\pm 3'$ or 0.5mm/m (toe)	⑬
4. Selection and Control Equipment				
4.1.1	Scope	1 unit	Effective length 500mm or more	⑰
4.1.3	Diesel smoke meter	1 unit	Indication LED 0-100.0%, Accuracy $\pm 3\%$	⑰
4.12.2	Magnetic crack detectors for crankshafts	1 unit	Applicable length 1,250mm or more, Coil dia. 350mm or more	③
4.13.1	Ultrasonic flaw detector with accessories	1 unit	Frequency 1-15MHz or more, with probe 4 kinds, standard block 1piece	③
4.14.1	Connecting rod aligner	1 unit	Rod bearing 50-105mm or more, Rod length 150-420mm or more	③
5. Electrical Equipment Repair Equipment				
5.1.4	Silicon quick charger	1 unit	Voltage 12-24V, Output 80A or more	⑫ and ⑭
5.2.1	Battery tester	1 unit	Voltage 12V or more, Test capacity 27-160AH or more	⑰
5.2.2	Digital Multimeter for automotive with accessories	1 unit	Type: digital, for automobile	⑰
5.6.1	Starter generator test bench with accessories	1 unit	Configuration: Motor, Tachometer, Ampere meter, Voltage meter, Torque meter, Rotation 0-1,500rpm or more (starter), 0-5,400rpm or more (generator)	⑨
5.7.1	Plug cleaner and tester	1 unit	Pressure 0.88MPa or more	⑧
6. Mechanical Processing Equipment				
6.1.1	Work bench with vise	2 units	Size 1,500 x 800 x 740mm, Load 3t or more	⑤
6.2.1	Crankshaft grinder	1 unit	Center length 1,700mm or more, offset 140mm or more	⑤
6.8.1	Lathe with accessories	1 unit	Center length 2,000mm or more, Main motor 7.5kW or more, Rotation 25-1,500rpm or more	⑤
6.9.1	Radial drilling machine	1 unit	Length between spindle and column 1,250-360mm or more, Main motor 5.5kW or more	⑤
6.9.2	Cylinder boring & milling machine	1 unit	Boring dia. 32-320mm or more, Head moving 700mm or more	⑤
6.9.3	Cylinder honing machine	1 unit	Horning dia. 25-250mm or more, Spindle stroke 460mm or more	⑤
6.10.3	Bench drill press	1 unit	Applicable thickness (steel) 13mm or more, Power 200W or more	⑤
6.10.5	Universal milling machine with accessories	1 unit	Table movement 800 x 300 x 400mm or more, Main motor 3.7kW or more, Rotation 90-1,400rpm or more	⑤

No.	Equipment	Quantity	Main specifications or configurations	Location*1
6.14.1	Gas welder set (CO ₂ , Argon)	1 unit	Welding current 350A or more, Input 18kVA or more	⑫ – ⑭
6.15.1	DC arc welder	1 unit	Welding current 300A or more	⑫ – ⑭
6.16.1	TIG arc welder	1 unit	Welding current DC 5–300A or more, AC 20–300A or more	⑫ – ⑭
6.28.1	Valve true gauge (Device for measurement of valve)	1 unit	Valve face dia. 125 mm or more, Valve stem dia. 4–20mm or more, Valve stem length 45–300mm or more	⑥
6.29.1	Injector reconditioning machine	1 unit	Motor 93W or more	⑦
6.30.1	Fuel injection pump service tool kit	1 set	Tools 19 kinds or more, Application: Diesel injection pump	⑦
6.31.1	Valve refacer	1 unit	Valve stem dia. 4.5–14.3mm or more, Valve head dia. 101mm or more	⑥
6.31.3	Air valve lapper with suction cap	1 unit	Air pressure 0.6–0.78MPa or more, Rubber 20, 30, 35, 45mm dia.	⑥
6.31.5	Valve seat grinder (Round grinding machine)	1 unit	Valve seat dia. 28–60mm or more, Motor 120W or more	⑥
6.31.6	Valve seat cutter set	1 set	Valve seat dia. 18–65mm or more, Cutter 46 kinds or more	⑥
7. Repair Equipment				
7.1.1	Tire changer, heavy duty	1 unit	Wheel dia. 1,500mm or more, Wheel width 700mm or more	⑪
7.1.2	Hydraulic tire removing tool	1 unit	Rim size 25 inch or more	⑪
7.2.1	Engine positioner	1 unit	Engine weight 1,000kg or more, Rotation: manual	③
7.3.1	Set of tools for tire vulcanization and repair	1 set	Configuration: Air-compressor 1 unit, Tire vulcanization set 1 set, Tire pressure gauge 1 set. Air-compressor 15kW or more, 1,460L/min. or more	⑪ (④:air-compressor)
7.10.1	Dynamic balancing machine for crankshaft	1 unit	Testing weight 3–300kg or more, Testing length 3,100mm or more, Rotation 450–900–1,400rpm or more	⑤
7.11.1	Brake shoe adjusting tool set	1 set	Tools 9 kinds or more, Application: drum and disk brake	⑩
7.11.2	Brake pipe flaring tool set	1 set	Applicable dia. 4.76, 6.35mm	⑩
7.11.3	Portable brake compression tester set	1 set	Configuration 19.6, 9.8, 0.98MPa, Application: air-master, hydro-master	⑫ and ⑭
7.11.4	Brake spring plier	1 set	3 kinds (large, medium, small)	⑩
7.11.5	Brake anchor pin remover	1 unit	Capacity 31.75mm dia. Pin	⑩
7.11.6	Micro-hone set for brake cylinder	1 set	Cylinder dia. 37 – 60mm or more (3 sizes)	⑩
7.11.7	Brake drum gauge	1 set	Measuring dia. 350–600mm or wider, Gauge 0.1–5mm	⑩
Component II – Field Training Equipment				
9. Field Training Equipment				
9.1.1	Combine harvester	9 units	Engine power 185Hp or more, Attachment: Header (for wheat, corn, sun flower)	Field
9.4.1	Agricultural tractors 80HP or more	18 units	Engine power 80Hp or more	Field
9.7.1	Balers round	6 units	Bale 120 dia. x 120 width cm or more	Field
9.8.1	Reversible plows	6 units	Plow 3 x2 rows	Field
9.10.1	Disc harrow	6 units	Width approx. 3m, soil 12cm or more	Field
9.11.1	Precision planter	3 units	Width approx. 5.6m, Files 8	Field
9.12.1	Drill	3 units	Width approx. 3.6m, Files 29	Field
9.15.1	Fan sprayer	3 units	Tank capacity 2m ³ or more, Spray width 18m or more	Field
9.16.1	Transplanter	2 units	Width 400cm or more, Files 6	Field
9.17.1	Combinator	3 units	Width approx. 2.6m	Field
9.19.1	Baler square	6 units	Bale length approx. 40–110cm, Working width approx. 160cm or more	Field
9.20.1	Bedding equipment	2 units	Width 200cm or more, Required power approx. 50Hp	Field

No.	Equipment	Quantity	Main specifications or configurations	Location ^{*1}
10. Equipment for Mobile Technical Service				
10.1.1	Service car	1 unit	Type 4WD, Equipment: Generator 1 unit, Battery charger 1 unit, Air-compressor 1 unit, Gas welder 1 unit, , Jack 2 units, Tools 1 set	Field

- *1
- ① : Machine washing room
 - ② : Parts washing room
 - ③ : Engine repair and testing room
 - ④ : Compressor room
 - ⑤ : Mechanical work room
 - ⑥ : Cylinder head and valve repair room
 - ⑦ : Injection pump repair room
 - ⑧ : Injector and turbo-charger repair room
 - ⑨ : Electric equipment repair room
 - ⑩ : Hydraulic equipment repair room
 - ⑪ : Wheel repair and balancing corner
 - ⑫ : Small tractor repair corner
 - ⑬ : Axle repair corner
 - ⑭ : Big tractor repair corner
 - ⑮ : Combine harvester repair corner
 - ⑯ : Gear and transmission repair corner
 - ⑰ : Agricultural machinery testing corner

- *2
- ③ : Engine repair and testing room 2 units
 - ⑥ : Cylinder head and valve repair room 2 units
 - ⑦ : Injection pump repair room 1 unit
 - ⑧ : Injector and turbo-charger repair room 2 units
 - ⑨ : Electric equipment repair room 2 units
 - ⑩ : Hydraulic equipment repair room 1 unit
 - ⑪ : Wheel repair and balancing corner 1 unit
 - ⑬ : Axle repair corner 1 unit
 - ⑭ : Big tractor repair corner 1 unit
 - ⑯ : Gear and transmission repair corner 2 units

2-2-3 Basic Design Drawing

The project site for this grant-aid cooperation is the National Training Center for Agricultural Mechanization in Chisinau, the capital of the Republic of Moldova. A map showing the location of the project is provided at the beginning of this report. The Center compound is shown in Fig. 2-5. The layout plan of the ground floor of the Center is as shown in Fig. 2-6. Figures 2-7-1 through 2-7-7 show the locations of major pieces of equipment in the Center.

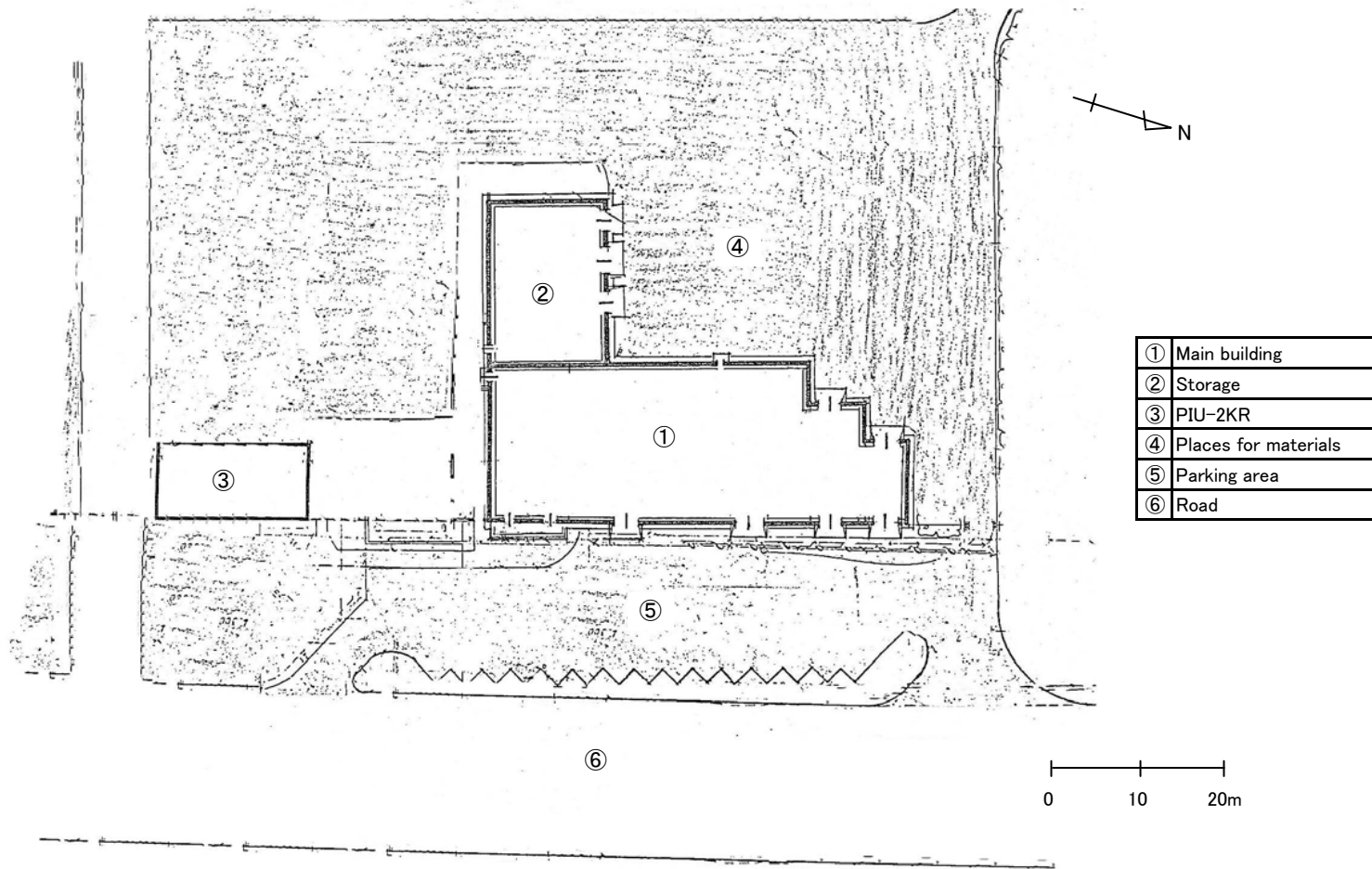
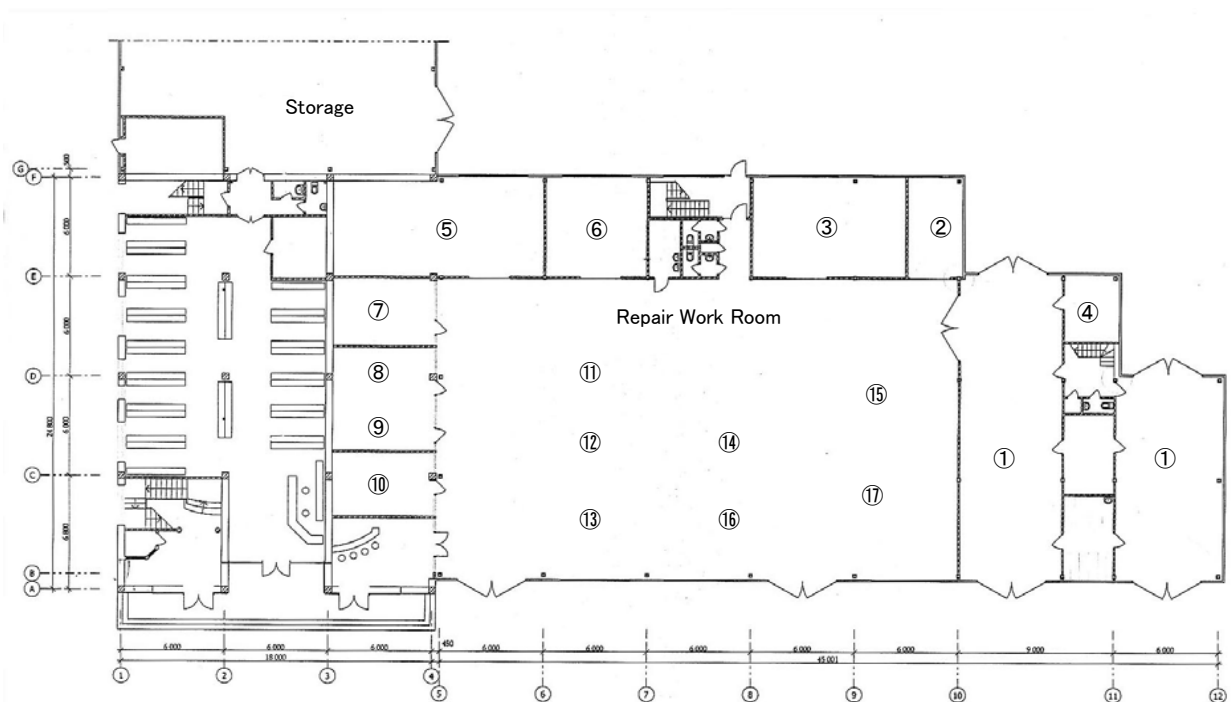


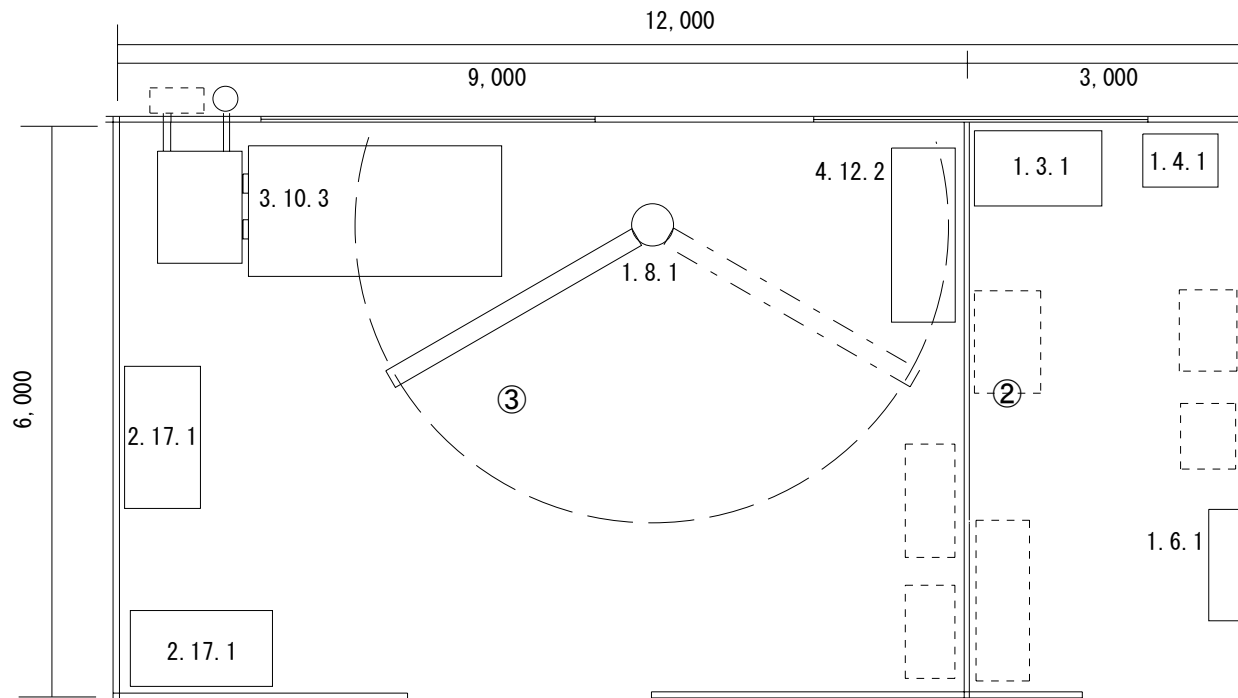
Fig.2-5 The Premises of the National Training Center for Agricultural Mechanization



①	Machine washing room
②	Parts washing room
③	Engine repair and testing room
④	Compressor room
⑤	Mechanical work room
⑥	Cylinder head and valve repair room
⑦	Injection pump repair room
⑧	Injector and turbo-charger repair room
⑨	Electrical equipment repair room
⑩	Hydraulic equipment repair room

Repair Shop	
⑪	Wheel repair and balancing corner
⑫	Small tractor repair corner
⑬	Axle repair corner
⑭	Big tractor repair corner
⑮	Combine harvester repair corner
⑯	Gear and transmission repair corner
⑰	Agricultural machinery testing corner

Fig. 2-6 The National Training Center for Agricultural Mechanization - Ground Floor (Workshop)



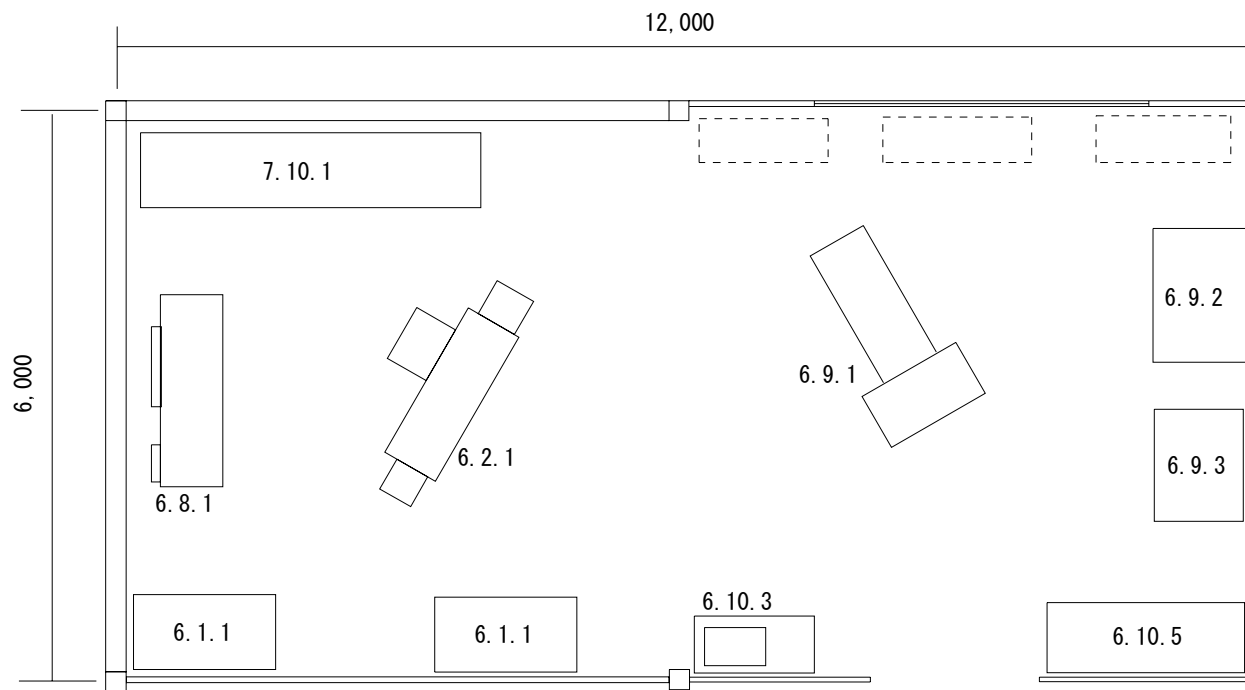
② Parts Washing Room

Item No.	Equipment
1.3.1	Jet parts washer
1.4.1	Cleaning equipment with abrasive
1.6.1	Parts cleaner
1.6.4	Nozzle cleaning kit
1.9.1	Manual forklift

③ Engine Repair and Testing Room

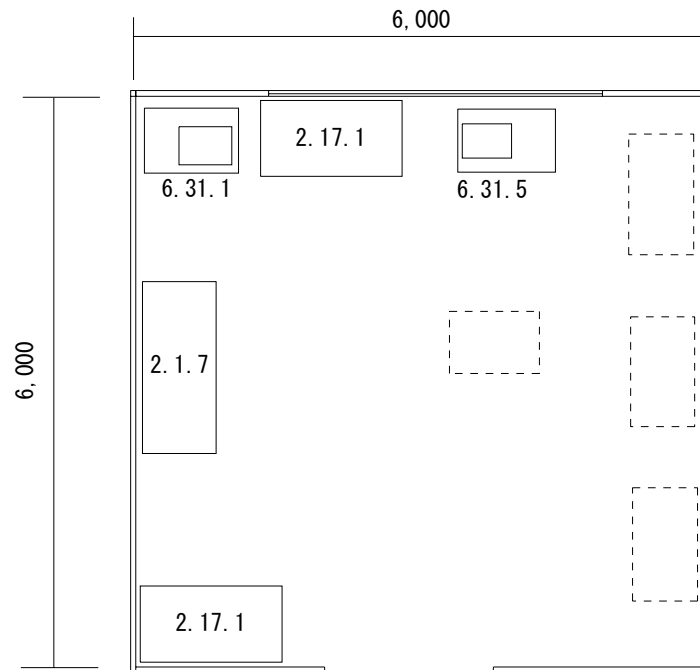
Item No.	Equipment
1.8.1	Giraffe type crane
2.1.11	Air hose reel
2.1.12	Air impact wrench
2.1.13	Portable lubricator for grease
2.1.14	Portable lubricator for oil
2.1.15	Grease gun with micro hose
2.17.1	Work bench with vise
2.3.1	Set of tools for disassembling engines
2.10.1	Puller / hydraulic puller / hydraulic gear puller set
3.10.3	Engine dynamometer with accessories
4.12.2	Magnetic crack detectors for crankshafts
4.13.1	Ultrasonic flaw detector with accessories
4.14.1	Connecting rod aligner
7.2.1	Engine positioner

Fig. 2-7-1 Equipment Plot Plan in Parts Washing Room and Engine Repair and Testing Room



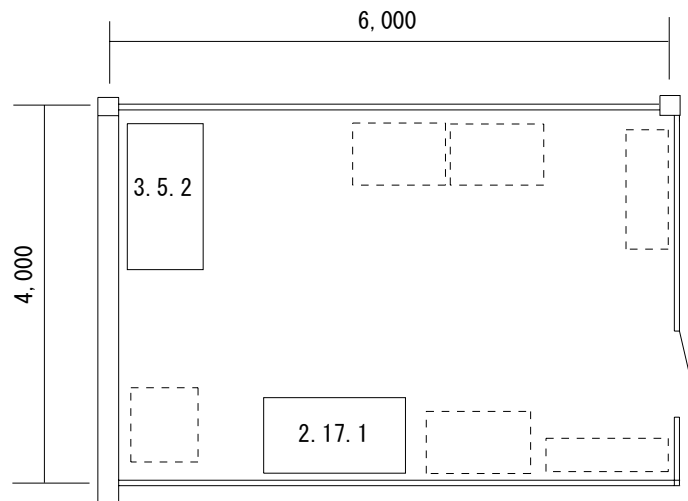
Item No.	Equipment
3.10.1	Cylinder gauge
6.1.1	Work bench with vise
6.2.1	Crankshaft grinder
6.8.1	Lathe with accessories
6.9.1	Radial drilling machine
6.9.2	Cylinder boring & milling machine
6.9.3	Cylinder honing machine
6.10.3	Bench drill press
6.10.5	Universal milling machine with accessories
7.10.1	Dynamic balancing machine for crankshaft

Fig. 2-7-2 Equipment Plot Plan in Mechanical Work Room



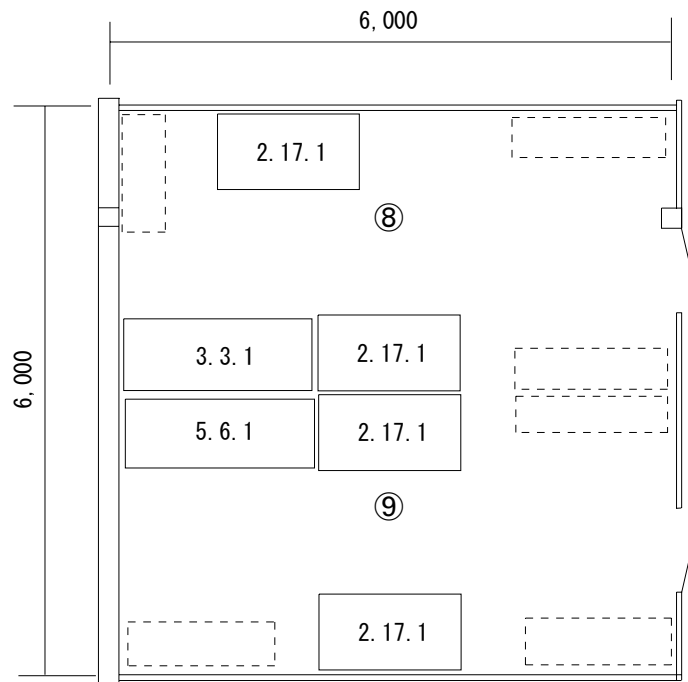
Item No.	Equipment
2.1.7	Hydraulic shop press (25t)
2.17.1	Work bench with vise
3.10.2	Valve spring tester
6.28.1	Valve true gauge (Device for measurement of valve)
6.31.1	Valve refacer
6.31.3	Air valve lapper with suction cap
6.31.5	Valve seat grinder (Round grinding machine)
6.31.6	Valve seat cutter set

Fig. 2-7-3 Equipment Plot Plan in Cylinder Head and Valve Repair Room



Item No.	Equipment
2.17.1	Work bench with vise
3.5.2	Diesel injection pump tester
3.6.1	Nozzle tester
6.29.1	Injector reconditioning machine
6.30.1	Fuel injection pump service tool kit

Fig. 2-7-4 Equipment Plot Plan in Injection Pump Repair Room



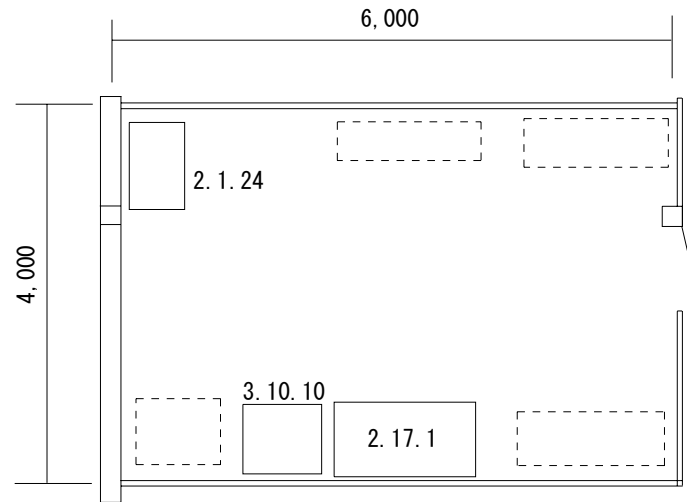
⑧ Injector and Turbo-charger Repair Room

Item No.	Equipment
2.17.1	Work bench with vise
3.3.1	Balancing test bench for turbo charger
5.7.1	Plug cleaner and tester

⑨ Electrical Equipment Repair Room

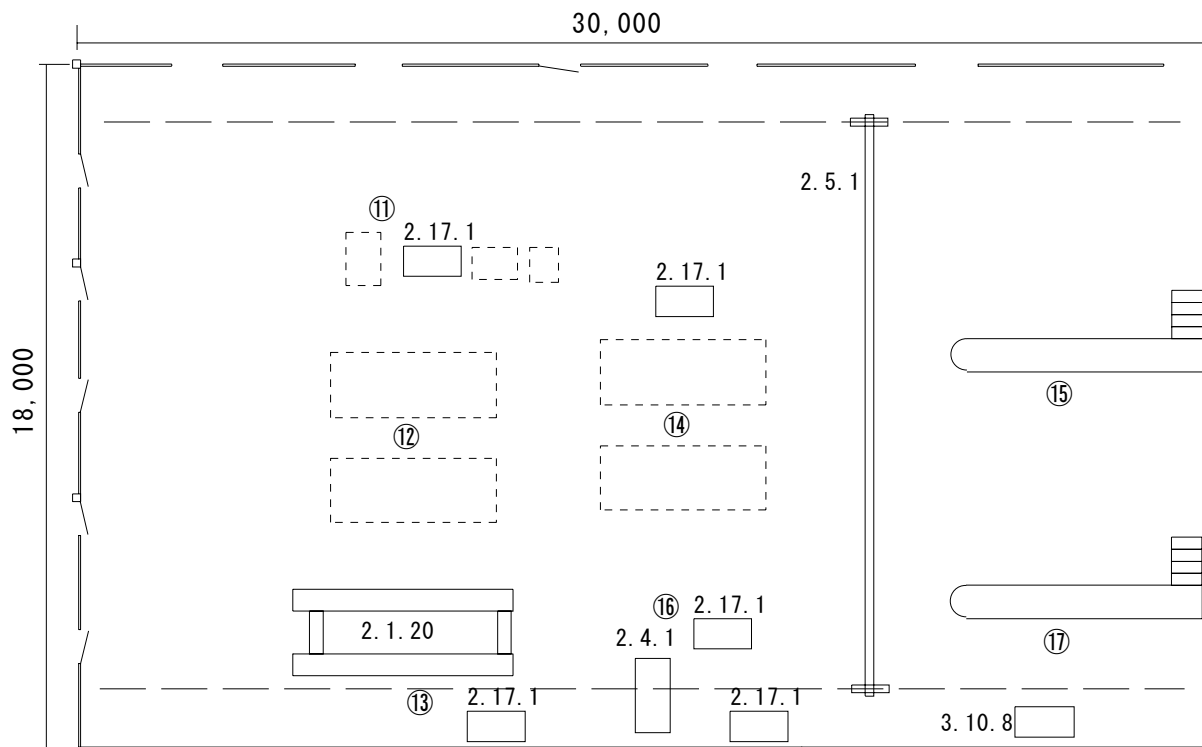
Item No.	Equipment
2.17.1	Work bench with vise
5.6.1	Starter generator test bench with accessories

Fig. 2-7-5 Equipment Plot Plan in Injector and Turbo-charger Repair Room and Electrical Equipment Repair Room



Item No.	Equipment
2.1.24	Hydraulic hose crimping machine
2.17.1	Work bench with vise
3.1.2	Portable hydraulic tester with accessories
3.1.3	Hydraulic pressure gauge set
3.5.1	Multi purpose vacuum tester
3.10.10	Cylinder head and cylinder block pressure tester
7.11.1	Brake shoe adjusting tool set
7.11.2	Brake pipe flaring tool set
7.11.4	Brake spring plier
7.11.5	Brake anchor pin remover
7.11.6	Micro-hone set for brake cylinder
7.11.7	Brake drum gauge

Fig. 2-7-6 Equipment Plot Plan in Hydraulic Equipment Repair Room



⑪ Wheel Repair and Balancing Corner

Item No.	Equipment
2.17.1	Work bench with vise
7.1.1	Tire changer, heavy duty
7.1.2	Hydraulic tire removing tool
7.3.1	Tire vulcanization set
7.3.1	Tire pressure gauge

⑫⑭ Tractor Repair Corners

Item No.	Equipment
2.1.4	Hydraulic garage jack
2.1.5	Transmission jack
2.17.1	Work bench with vise
2.1.21	Air hydraulic jack
2.1.22	Differential gear jack
2.1.23	Master pin remover
7.11.3	Portable brake compression tester set
5.1.4	Silicon quick charger

⑰ Agricultural Machinery Testing Corner

Item No.	Equipment
3.10.4	Diesel compression gauge set
3.10.7	Diesel timing and taco tester
3.10.8	Computerized engine analyzer
3.10.9	CO-HC exhaust emission analyzer
4.1.1	Scope
4.1.3	Diesel smoke meter
5.2.1	Battery tester
5.2.2	Digital Multimeter for automotive with accessories

⑬ Axle Repair Corner

Item No.	Equipment
2.1.20	Scissors lift
2.17.1	Work bench with vise
3.12.1	Wheel alignment tester set

⑯ Gear and Transmission Repair Corner

Item No.	Equipment
2.17.1	Work bench with vise
2.4.1	Hydraulic shop press (100t)

Repair Work Room (common use)

Item No.	Equipment
2.1.2	Mobile work bench with vise
2.5.1	Overhead crane

Fig. 2-7-7 Equipment Plot Plan in Repair Work Room

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

Considering that implementation of this project is to be implemented according to the framework of the Government of Japan regarding grant assistance, the following policies are deemed desirable.

- ① After an Exchange of Notes (E/N) between the two governments, details of the project will be confirmed within the period provided for in the E/N, the equipment supplier will be selected by means of a competitive tender, and the equipment will be delivered and installed swiftly and without complications.
- ② There should be a useful exchange of information among personnel at the responsible ministry and the Moldova implementing agency, the consultant, and the supplier; all should endeavor to have good communication and cooperate on behalf of smooth execution of the project.

On the basis of the foregoing, after the two governments have reached their agreement and exchanged notes, the Moldova executing agency is to sign an agreement with a Japanese consultant who will prepare the detailed design and supervise the procurement process of the project. Further, the Japanese supplier who has been selected by a competitive tender as provided for by the E/N will procure the equipment and install it at the site. The work of the implementing agency, the consultant, and the supplier are as follows.

(1) The implementing agency

The Ministry of Agriculture and Food Industry of the Government of Moldova is the entity responsible for the project, and the Project Implementation Unit for the 2KR projects (PIU-2KR) is the executing agency responsible for implementation of the project. It is PIU-2KR that will sign contracts with the consultant and the supplier as provided for by the E/N, and is to cooperate with both parties to ensure smooth implementation of the project.

(2) The consultant

Soon after the two governments have exchanged their notes PIU-2KR is to sign an agreement with a Japanese consultant for consulting services on supervision of the project. The consultant agreement will become effective after verification by the Government of Japan. The consultant will undertake the following on the basis of the agreement.

1) Detailed design; tender supervision

Final approval of the details of the project (identification of the specifications and quantity of the equipment), preparation of tender documents; holding of the tender; evaluation of bids; technical support for the implementing agency during tendering process.

2) Supervision of procurement

Provision of guidance, advice and coordination for the equipment supplier; inspection of equipment prior to shipment or loading aboard ship; advice and guidance as required concerning transport of the equipment, installation, test operation and adjustment, and start-up guidance in operation. The consultant is also to be present at the time of acceptance of delivered and installed equipment and supervise the performance of work according to the supply contract.

(3) The supplier

The Government of Moldova will sign a contract, on the basis of the E/N and in conformity with “Guidelines of the Japanese Grant Aid for General Projects and for Fisheries” issued by the Government of Japan, with the Japanese procurement agent selected by means of a general tender for the supply of the equipment. The contract for supply of the equipment will become effective after verification by the Government of Japan. Tasks to be performed by the supplier as required by the contract are as follows.

- ① Procurement of equipment; transportation and delivery to the project site
- ② Installation of equipment; operational guidance

2-2-4-2 Implementation Conditions

Close cooperation is required between the implementing agency, the consultant and the supplier, and dedication to the role of each, is required in implementing the project in order that the transport, delivery and installation of the equipment can be accomplished effectively and in a short period of time. The following points in particular require attention.

(1) Points Related to Transport and Import of the Equipment

When the equipment is imported, the Customs authorities should recognize that the equipment is being supplied as grant aid by the Government of Japan and as provided for by the E/N waive taxes and duties on the equipment. PIU-2KR, as the implementing agency, must contact these authorities in advance so that the necessary measures can be taken and no delay occurs in the delivery process.

(2) Points Related to Equipment Installation

In installing, test operation and adjustment and start-up guidance in operation work performed at the project site, the supplier must discuss work plans in advance with PIU-2KR and the responsible persons at the Center, and take precautions so as to not disturb the work of the Center. In conveying the equipment to the Center and installing it there, the supplier must ensure that no damage to entrances, pillars, ceilings, floors and other parts of the Center interior.

2-2-4-3 Scope of Works

The division of responsibility between the Japanese side and the Moldovan side in realizing this project is to be as follows.

Undertakings of the Japanese side

- Procurement of the equipment
- Transport, delivery and installation of the equipment
- Secondary wiring
- Test operation and adjustment of the equipment; guidance for operation and use
- Consulting service in connection with project detailed design, preparation of tender documents, management of the tender and supervision of procurement

Undertakings of the Moldovan side

(As necessary and appropriate the Moldovan side is to take care of the following)

- Works for preparation for installation of equipment (reinforcing the floor or foundation for equipment; installation of a water tank, ventilation piping)
- Supply of equipment needed for training but not provided by this project
- Supply of fixtures, furnishings, office items and supplies
- Agricultural machinery and service car registrations

2-2-4-4 Consultant Supervision

In conformity to Japanese government policy for grant assistance, the Japanese consultant is to provide fair and unbiased guidance, advice and coordination and work on behalf of smooth implementation of the project, following the basic design study report and through all stages from design through supervision of procurement. At the stage of detailed design, the consultant will review the detailed specifications of the equipment to be procured, draft the tender documents, hold the tender in the name of the implementing agency as the buyer; at the stage of supervision of procurement will confirm that the supplier's home-country work is properly accomplished and hold meetings with the

supplier, and when design drawings of the equipment are approved will provide technical advice to the implementing agency; when the equipment is inspected prior to shipment, technical personnel of the consultant will be present, and in general facilitate the smooth procurement of the equipment. On the occasion of installation of the equipment at the site, and acceptance of the equipment, the consultant supervise the work and after the completion of installation, upon confirming that the supplier has properly done the work contracted for will obtain approval of the implementing agency and will finish his work.

2-2-4-5 Quality Control Plan

To ensure quality control in implementation of this project, the consultant is to give due attention to the following points during the execution of procurement supervision.

- Confirmation that equipment meets specifications
- Pre-shipment examination at equipment manufacturing facilities
- Corroboration of marine surveyor inspection reports and shipping documents
- Examination of equipment installation instructions
- Overall safety control of installation work
- Acceptance inspection of installed equipment

To ensure proper implementation of the supplier, the submission of a performance security by the supplier is to be required.

2-2-4-6 Procurement Plan

(1) Procurement Method

As required by the E/N, in principle the equipment to be procured is to be either of Japanese or Moldovan origin. Because some of the equipment needed for workshop training is not produced in Moldova, such equipment would be obtained from Japanese or European sources. Some of those items are normally available for purchase in Moldova and can be obtained locally.

With regard to combine harvesters and tractors, because equipment obtained through 2KR are from Europe, Japan and CIS countries (Belarus, Russia, others), it is desirable that equipment to be procured by this project for use in farm fields be obtained from those countries. There is one company in Moldova manufacturing tractors; this company makes only crawler types on commercial basis, but is not qualified as a supplier because this project requires wheeled tractors.

Because good quality attachments to be pulled by the tractors are available from domestic sources, these sources are to be included with Japanese and European makers as candidate suppliers.

Imported equipment that can be procured in Moldova is to be limited to products from Japanese, European and CIS manufacturers, provided that specifications are met, out of quality considerations. It

is desirable, further, that equipment that requires scheduled inspection and servicing, and a reliable supply of replacement parts and supplies, be available from either domestic or neighboring-country agents that also provide after-service.

(2) Transport Method

In the event that equipment is purchased from Japan, European countries or CIS countries, it is to be brought to Moldova by either multimode (sea and land) or land transport. The circumstances of such transport would be as follows.

1) From Japan

When equipment is purchased in Japan it is to be carried by sea to Odessa, Ukraine; this requires approx. 40 days. From Odessa to Chisinau, either truck or rail transport is to be used. Truck transport requires two days and by rail about one week is needed. In general, trucks are used between these two points. In either case, passage through the Transnistria (known also as Trans-Dniester) region, is to be avoided, or in the case of truck transport the equipment would enter Moldova at its southern border while in the case of rail transport it would enter from the north, through Ukraine and passing to the east of the Transnistria region.

There also is a route in which the equipment would be landed at Constantza, Romania and transported to Moldova by rail, but Romania's accession to the EU has resulted in higher costs and use of this route has been declining.

2) From Europe

Equipment to be purchased in Europe is expected to be limited to some of the workshop training equipment and agricultural machinery for use in farm fields. When equipment has been purchased in Europe, generally transport to Moldova would be by truck. About one week is required.

3) From CIS countries (Belarus, Russia)

It is expected that purchases in Belarus and Russia would be confined to tractors and combines. In this case, the general practice would be to rely on rail transport (on flatbed cars). There have been instances of transport of small tractors from Belarus in covered railcars.

Whatever transport route is used, the supplier has responsibility for determining the optimum methods of crating and packing in keeping with the nature of the relevant equipment, the season and weather, and other conditions. If it is necessary to transport equipment on an urgent basis, depending on the volume, air transport may be used.

Imported equipment generally incurs an ad valorem Customs clearance charge of 0.4%.

(3) Installation Plan

Because installation of the equipment identified below requires specialized techniques and use of proprietary technology of a manufacturer, installation must be done under the supervision or by an engineer dispatched by the manufacturer of the equipment. Workers required for installation will be available in Moldova.

Table 2-6 Special-Installation Equipment

No.	Equipment	Q'ty
1.8.1	Giraffe type crane	1
2.5.1	Overhead crane	1
3.3.1	Balancing Test Bench for Turbo Charger	1
3.5.2	Diesel Injection Pump Tester	1
3.10.3	Engine Dynamometer with accessories	1
4.12.2	Magnetic Crack detectors for crankshafts	1
6.2.1	Crankshaft Grinder	1
6.9.1	Drilling Machine 40mm, radial	1
6.9.2	Cylinder Boring & Milling Machine	1
6.9.3	Cylinder Honing Machine	1
7.10.1	Dynamic Balancing Machine for Crankshaft	1

Installation of equipment other than that in the above table is to be performed by a Moldovan contractor under the supervision of engineers dispatched by the supplier.

Those pieces of equipment requiring test operation after installation are to be so operated by engineers dispatched by the supplier.

2-2-4-7 Operational Guidance Plan

Engineers dispatched by the manufacturer of the equipment, or by the supplier, will be required to provide initial guidance in the operation of some equipment. With particular reference to equipment embodying technology new to Moldova, training is to be provided at the Center in the principle, basic functions, methods of use, and so on of such equipment, by the supplier who is to ensure an adequate period of time for this is available, so that the Center personnel in charge of managing the equipment can improve their abilities. Start-up operational guidance is to be done during the period available for installation of the equipment.

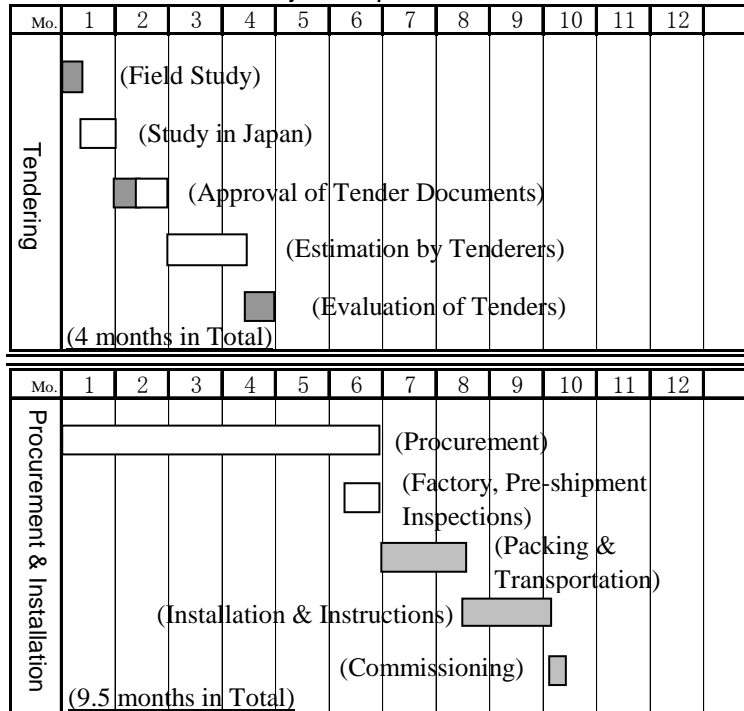
2-2-4-8 Soft Component Plan

Study was made of the possible need for soft components for the project, on the basis of the “Soft Component Guidelines” of JICA, and from the viewpoints of promoting a smooth start of the project and ensuring that the results of the project are sustained. Key personnel at the implementing agency, the PIU-2KR, hold higher degrees and some are presently engaged as part-time instructors at educational institutions such as the State Agrarian University. Project management by PIU-2KR to date is highly evaluated, and no problems are evident in terms of its capacity for management. The Center is, moreover, studying the possibilities of obtaining the cooperation, as lecturers and instructors, of faculty members at the Agrarian University and the Technical University who have an academic background, employees of research institutions or the Ministry of Agriculture and Food Industry, and technical personnel from the private sector, who have actual experience at agriculture-related companies, manufacturers, or dealers. If this is accomplished, the Center will have no difficulty as to technical capability. Considering also that from the time the Center begins its training the PIU-2KR will not have a problem as to its managerial ability, it is judged that there is no need for a soft component in this project and hence none is included.

2-2-4-9 Implementation Schedule

In the event that this project is realized as a grant aid project supported by the Government of Japan as has been discussed it would consist of detailed design of the project by the consultant, followed by his management of a tender, and then by supervision of procurement of the equipment by the supplier. The process of implementing the project is shown in Table 2-7. If there are no delays in each process, the total time required following the exchange of notes would be about 13.5 months.

Table 2-7 Project Implementation Schedule



2-3 Obligations of the Recipient Country

In the event that the project is implemented as a grant aid undertaking by the Government of Japan, the following would be the obligations that the recipient country would have to bear.

- 1) The supply of necessary data and information for realizing the project.
- 2) Completion of all necessary preparation work prior to the installation of equipment.
- 3) Furnishing the necessary electricity, water and drainage facilities.
- 4) Preparation of the budget and personnel required for the proper and effective management of the equipment supplied by the project, including maintenance of the equipment.
- 5) Pay required commissions to the Japanese bank under the Banking Arrangement.
- 6) Waive taxes and Customs duties on the equipment, and guarantee the unhindered passage of the equipment through Customs and its transport to the project site.
- 7) Exempt from Customs duties, domestic taxes and the like the Japanese corporations and Japanese individuals providing goods and services under the verified contracts.
- 8) Facilitate the entry to and stay in Moldova of Japanese individuals providing goods and services under verified contracts.
- 9) Secure the required licenses, authorizations etc. whenever needed to realize the project.
- 10) Facilities and equipment provided by the project are to be responsibly managed and stored, and properly used, by the Moldovan side.

- 11) Bear all costs necessary for the project that are not covered by grant assistance.

2-4 Project Operation Plan

After the Planned equipment has been installed the project implementing agency, PIU-2KR, will be required to adopt the following management practices.

- 1) Manuals (in summary form) for management and handling of the main pieces of equipment are to be prepared for the Center personnel. Special attention must be given to educating them so as to prevent breakage of the equipment, and ensure safety.
- 2) For each piece of equipment, one person will be appointed to be in charge of its management and to be responsible for it on a day-to-day basis and to perform periodic inspections of the equipment.
- 3) Twice a year a meeting will be held of all of the persons in charge of equipment management, and a check of inventory of attachments, parts etc. is to be made.
- 4) Records of the periodic inspections, including mention of all problems found, are to be prepared and archived. In the event that there is breakage of damage, prompt remedial steps are to be taken.
- 5) Small tools are to be stored in a single place and their removal and replacement requires approval of the person responsible for them.
- 6) An annual budget allocation will be needed for the costs of maintenance of the equipment.

Also, so that PIU-2KR can effectively carry out training at the Center, it will be necessary to increase the number of its staff in accordance with progress of the project and development of the training program.

Table 2-8 Staffing Plan for the Center

Job title	No. of persons	Job Description	Notes
Director of Center	1	Overall management of the Center	Concurrent position of a PIU-2KR person
Accounting Department Manager	1	Management of the Center's accounting	Concurrent position of a PIU-2KR person
Training Manager	3	Planning and supervision of training	New hire
Instructor	37	Practical instruction in use of agricultural machinery and workshop equipment	New hire: Workshop training (10 persons); farm training (27 persons)

The planned equipment does not include anything that is especially advanced, but in the case of equipment embodying new technology, engineers dispatched by the supplier will provide the necessary guidance on operation of the equipment to Center staff at the time of installation.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Among the costs of the project, the Moldovan side has already financed the cost of building construction and the necessary utilities, with its own funds. Construction work was commenced in December 2005, and completed in March 2007. The cost of construction work together with some facilities was MDL 15,400 thousand (equivalent to about 140 million yen) and this was provided by PIU-2KR from the 2KR revolving funds. The total expenditure made by the Moldovan side as of the end of July 2007 is as in the table below.

Government of Moldova Expense (Disbursements)

Description	Amount (MDL)
Building Construction*	15,400,881
Asphalt/external works	1,205,316
Furniture for the hotel, canteen, classrooms	705,617
Audio-Video Equipment for the classrooms except computers (to be procured)	87,706
The fire-prevention equipment	26,108
Technological equipment for the Kitchen	481,550
Building façade advertising	175,098
Total	18,082,275

* Including boiler and heater facilities.

In the event that the planned equipment is supplied on a grant aid basis it is thought that the following would be expenses to be borne by the Moldovan side.

Government of Moldova Expense (Additional Disbursements)

Description	Amount (MDL)
AC, PBX, PC	1,240,000
Miscellaneous works for receiving equipment	96,000
Registration fees for agricultural machinery, etc.	12,700
Banking charges	65,800
Total	1,414,500

If the amount of the completed disbursements including the construction cost is added to the amount estimated as additional disbursements the total expense borne by the Moldovan side comes to MDL 19,497 thousand (equivalent to about 178 million yen). Of the additional disbursements, the amount of MDL 1,414 thousand represents 1.1% of the 2006 operational expenditure of PIU-2KR (MDL 123 million), and it is judged that the cost can be readily taken on.

This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

All the costs were estimated based on the conditions mentioned below.

- 1) Time of estimation: March 2007
- 2) Exchange rates
 - 1 US\$ = 120.59 yen
 - 1 euro = 155.91 yen
 - 1 MDL = 9.1142 yen
- 3) Construction and procurement period: The time for approval of the design and procurement of equipment is as shown in Table 7, Project Implementation Schedule.
- 4) Others: Estimates conform to prevailing practices of the Japanese government regarding its grant aid projects.

2-5-2 Operation and Maintenance Costs

In the study done by the study team, it was found that including the incremental annual expense on the Moldovan side of utilities, sundry expenses and supplies in the event that the planned equipment is procured for use by the Center, as shown in the table below, would yield the total cost of 31,730 thousand yen (JPY), equivalent to about MDL 3.48 million. This would be the equivalent of about 23% of the fiscal 2009 estimated income of the Center, and it is planned that the operating expense is to be treated as a part of the facilities usage expense of the Center, and payment for training,

and it is expected that adequate funding will be available.

Operating Expenses

Item	Rate (MDL)	Workshop Training Equipment		Field Training Equipment		Total (MDL)
		Consumption	Amount (MDL)	Consumption	Amount (MDL)	
Electricity (kWh)	0.78	37,634	29,355	0	0	29,355
Water (m ³)	1.96	1,857	3,640	0	0	3,640
Diesel Fuel (L)	10.00	8,776	87,760	206,900	2,069,000	2,156,760
Spare Parts, Consumable	-	1 lot	355,796	1 lot	935,825	1,291,621
Total			476,550		3,004,825	3,481,375

Note 1) Consumption refers only to that of planned equipment to be provided by the Project.

Note 2) Spare parts and consumable are estimated only for those items of equipment that need such supplies.

Repair of the equipment provided for this project would be done within the Center using planned equipment (workshop training equipment), so no significant increase in repair cost is expected. Further, although there will be an increase in the use of utilities when the Center training courses are in operation, it is expected that income would be generated by the training courses and no difficulty is expected regarding the cost of utility usage.

2-6 Other Relevant Issue

All the works related to receive and install the procured equipment must be completed by the Moldovan side well before the new equipment arrives at the Center. The Moldovan side had made a plan to secure a budget for that particular purpose and it needs be executed in time, otherwise the installation works of the equipment supplier will be delayed. In this regard, the Moldovan side shall be required to assure that it will carry out all the works under its responsibility as outlined earlier pursuant to the stipulations of the Japanese grant aid scheme. The PIU-2KR shall be required to secure a budget sufficient enough to bear the expenses which may be generated during the operation and maintenance of the equipment.

Further, it is indispensable for PIU-2KR to employ additional staff as outlined in Table 2-8 for proper operation and maintenance of the equipment. In this connection, PIU-2KR will be required to employ the personnel well before the equipment supplier starts operational guidance after delivery and installation of the equipment.

CHAPTER 3 Project Evaluation and Recommendations

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3-1 Effects of the Project

It is expected that this Project, planned for supply of training equipment at the National Training Center for Agricultural Mechanization, would realize the following benefits in satisfying national needs towards human resource development in agricultural sector in line with the Economic Growth and Poverty Reduction Strategy Paper (2004-2006; EGPRSP) and the master program for the agricultural sector, Agro-Food Sector Development Strategy.

Table 3-1 Expected Effects of the Project

Present Status and Existing Problems	There has been an increase in acquisition in Moldova of agricultural machinery embodying new technology, but because of insufficient diffusion of proper techniques for operation and repair of such machinery the number of disabled or broken machines that have been idled because of inability to repair them has increased, and this has caused a decrease in the productivity and productive capacity of the agricultural sector. Thus there is urgent need for developing skilled technicians who can be of immediate value in remedying this situation.
Measures Proposed by this Project	Equipment used for training in workshops and on farms would be provided for use in the curriculum of the National Training Center for Agricultural Mechanization, construction of which has already been completed by the Moldovan side under jurisdiction of the Ministry of Agriculture and Food Industry.
Direct Effects; Extent of Improvements	<ul style="list-style-type: none"> • The number of persons to be trained per year would be increased (to a maximum of 1,655) by the sustained operation of training activities by the Center, thereby contributing to the advancement of mechanization in Moldova's agriculture. • It will become possible to spread knowledge about modern farm management and preventive maintenance of new agricultural machinery among agricultural producers (648 farmers/year). • It will become possible to disseminate professional skills of safe and effective operation and maintenance of agricultural machinery for the students at the agrarian university, the technical university, and agricultural colleges, will be able to take compulsory and elective subjects that call for on-farm practice (309-557 students/year). • It will become possible to transfer techniques in maintenance of the new agricultural machinery and repair of it among students, mechanics and repair personnel and teachers (per year: 72 students, 348 mechanics and repair persons, and 30 teachers).
Indirect Effects and Extent of Improvements	<ul style="list-style-type: none"> • Training in the techniques of operating, maintaining and repairing agricultural machinery will shorten time requirements for farm work, reduce the rate of mechanical breakdowns, and shorten the idle period caused by breakdowns; the usable life of the machinery will be prolonged, and the area farmed using mechanized methods will increase. As a result increase in farm output can be expected. • Application of methods of effective farm operation that have been learned through training in new methods of farm operation (leading to increase in the area of land under cultivation, increase in unit yields, and conversion to higher-value crops) by trainees has the potential to raise the level of productivity of land, and increase output. • By means of acquisition by youthful members of the population (from farms, who have moved to the cities to work) of new knowledge and techniques related to mechanized farming, it will be possible to anticipate an invigoration of agriculture based rural regions.

It is reasonable to use the number of persons trained as a measure of the direct effects mentioned above. Because at the present time the equipment available for workshop and on-farm practical courses given at the state agrarian university, the state technical university, and agricultural colleges is insufficient, students are prevented from receiving the practical training that they should be given and when they subsequently graduate, they have not been provided with all of the required capabilities. By enabling these educational institutions to provide the required practical training through use of the new equipment at the Center, it will be possible to equip the students with practical knowledge and experience. Further, by means of the continued implementation of training at the Center, a large number of technically-skilled persons will be produced, enabling the anticipation of an increase of driving force for mechanization of agriculture in Moldova.

At the same time, as a quantifiable measure of direct effects of the Project, use can be made of the number of non-student persons - agricultural producers, mechanics and repair persons, and educators - who are provided with training. As a consequence of training these persons in new methods of farm management, and providing them with knowledge about maintenance of agricultural machinery as well as practical training in the techniques of maintenance and repair of agricultural machinery, a large number of persons equipped with technical skills of value in providing leadership on farms, in agriculture-related companies, and educational institutions, and this significant increase in the number of Moldovans who can effectively and efficiently use agricultural machinery can be expected to contribute to achievement of improved agricultural productivity and through that to stabilization of the nation's market economy.

It will be necessary for PIU-2KR to routinely collect data related to the above means of measuring results and analyze it; this monitoring of the results of the Project must be reported on a regular basis to the authorities concerned.

3-2 Issues and Recommendations

3-2-1 Recommendations to the Moldovan Side

(1) Ensuring Budgetary Measures, and Monitoring

Plans call for operating expenses of the Center to be obtained from two sources. One is to be a special training fund equivalent to 2% of the price of agricultural machinery sold under the 2KR Project; users of agricultural machinery under the 2KR Project will be able to receive training in the care of agricultural machinery they have acquired, free of charge. The second source is to be payments made by machinery or farm owners for services provided by trainees when they are given opportunities for practical work in workshops or on farms, such payment to be of amounts that would not influence the market prices for private-sector suppliers of machinery repair or cultivation services. The latter would include payments received when other organizations (donor agencies, consultants, NGOs, NPOs, etc.) use the Center facilities including lodging facilities for seminars or training. The

plans thus position the Center as being financed by its own budget within the PIU-2KR program. It is expected that machinery acquired under this Project would be put to use for training starting in 2009, but until the time that the training at the Center becomes well established the Ministry of Agriculture and Food Industry, which has ultimate responsibility for PIU-2KR, would provide both financial and personnel support if so required. To ensure that the machinery acquired under the Project is properly maintained, and effectively utilized over a long period of time, it is essential that the financial basis of operation of the Center be assured, and it will also be necessary for there to be monitoring of budgeting and budget use, by means of periodic reports by the Government of Moldova to the Government of Japan.

(2) Improvement of the Organization for Management of Operations

Whereas responsibility for the arrangements for management of the equipment and machinery used at the Center is based on the PIU-2KR regulations, the responsibility for operating, inspecting, maintaining, and other tasks of the machinery in each workshop is to be assigned to the chief instructor of each of the workshops. The hiring of staff under PIU-2KR is to be done prior to the installation of the machinery, and plans call for emphasizing the engagement of outstanding persons who have studied agricultural engineering or mechanical engineering at universities. Despite this, as the techniques needed in connection with agricultural machinery, repair machinery and the like that have been manufactured in the developed countries is not well established in Moldova, need exists for updating and refresher training to improve the capabilities of instructors prior to the start of actual training.

Under PIU-2KR it is indispensable that full consideration is given to the past career of persons considered for hiring, and that thorough preparatory training be given to them, each according to his ability. Therefore, after the installation of machinery under this Project has been completed, when start-up training is provided by the suppliers of the machinery, the newly hired personnel must be present, so at the very least each person learns how to effectively and efficiently provide instruction in the use of the machinery that they will be working with.

Further, need exists to prepare manuals for day to day use in operating and maintaining for the machinery, assignment of proper persons for management of specific item of machinery, developing the system for scheduling, recording and taking action related to routine inspections and storage of the machinery, and drafting a budget proposal for annual maintenance and operating expenses. By thus improving the system for management of the machinery, effective use of the machinery is that much better assured and the Project can be expected to have substantial effects.

3-2-2 Technical Cooperation, and Coordination with Other Donors

(1) Coordination with Other Donors

High evaluations have been accorded by international organizations and donor agencies to the abilities of PIU-2KR in project implementation and management; these organizations and agencies are looking forward to an early and smooth start of the Center under PIU-2KR. Because at this time construction of the buildings has been completed, and it is possible to hold classroom sessions or seminars in four rooms, inquiries as to their possible use have already been received from private-sector consultants employed by donor agencies, NGOs, NPOs, and others. PIU-2KR is considering making training rooms, the cafeteria, and lodging facilities available for a certain organization to hold agriculture-related seminars starting in mid-September 2007. Plans call for use of OA equipment and so forth at the Center, for classroom education during the period until the completion of installation of machinery and equipment procured under the grant aid scheme of the Japanese Government, that is expected to take place in early 2009, and then to start full-scaled training activities in that year. It is expected that these donor agencies and related institutions will wish to hold training sessions here, using the agricultural machinery and workshop equipment once they are available, in addition to holding classroom seminars, so that it is desirable for PIU-2KR to maintain close contact with these entities as they would provide payment for use of the facilities, thereby ensuring even more effective use of the machinery and equipment that have been provided.

(2) Technical Assistance Related to Equipment Management

Possessing staff members who are highly skilled in terms of technology, PIU-2KR is capable of deploying these persons for support of training on an as-needed basis, so that it can be anticipated that training can be provided by relatively well-qualified instructors. Nevertheless, techniques for use of agricultural machinery and repair machinery that have been produced in developed countries in recent years has not become widespread in Moldova, and against this background the opinion has been expressed that technical cooperation from Japan would be welcome, in connection with the methods of use of these machines, and instruction in their use. Considering that the 2KR program in Moldova is highly evaluated by both agricultural producers and donors, it is to be expected that there will be 2KR support for the Center's training activities, and that there will be multiplier effects. From these viewpoints, it is thought that provision of support by Japan through technical cooperation schemes would have substantial significance. It is further considered that there is value to studying the possibilities of training of Moldovans in Japan, and the implementation of third-country training at the Center as a means of achieving effective operations under the 2KR program.

3-2-3 Conclusions

One of the strategic goals in the Economic Growth and Poverty Reduction Strategy Paper (2004-2006¹), as an aspect of promoting the transition to a market economy, is accomplishment of sustained growth of agricultural output through mobilization of the private sector and introduction of the principle of free competition. In particular, the development of human resources has been accorded high importance as a means of promoting social and economic development, and the rectification of imbalances, in the rural sector. Further, the master program for the agricultural sector, Agro-Food Sector Development Strategy, calls for building a new agricultural production system, modernization and mechanization of production technology coupled with diversification of agricultural services, and the improvement and expansion of development of human resources for agriculture. The Ministry of Agriculture and Food Industry, moreover, in its Vision for Development of Agricultural Mechanization, has indicated that it is a matter of some urgency to improve the system of supply of agricultural machinery, the system for repair of such machinery, and improvement of information systems, in order to achieve the objectives of stable and sustained farm production through the promotion of mechanization; development of highly skilled human resources is essential for this.

Within this context, this Project, for the improvement of machinery and equipment for training at the National Training Center for Agricultural Mechanization, constructed by the Moldovan side, would contribute to the economic development of the agricultural and rural sector where a large number of the Moldovans live, and to improvement of the livelihood of the residents there, in conformity with the above-stated objectives of the Government of Moldova. Effects to be gained through implementation of this project would accrue to the nation's farms, companies, and related organizations and the like, through the medium of the trainees from the Center. If improvement is achieved in productive activities on farms by equipping those trainees with the knowledge and skills needed to operate and maintain the agricultural machinery in question, machinery that promises achievement of high levels of productivity, Moldova could look forward to an improvement in the balance of payments, as a result of the greater international competitiveness of farm products and processed agricultural products for export; in turn this has potential for helping the recovery of the national economy, invigorating the rural economy, improving the welfare of the people, stabilizing society, and promoting democracy. The Project is not in the category of those directed at basic human needs, but it is thought that its implementation will work to make improvements in that regard. Because this Project would also contribute to the long-term utilization of agricultural machinery provided since 2000 as assistance to underprivileged farmers, it is expected that it would have a heightened multiplier effect in conjunction with the 2KR program.

Moreover, it is possible for the equipment to be procured under this Project can be operated and managed with the financial, human and technological resources available in Moldova. The Project would not create any burden on the environment or on society. For all these reasons it is judged that

¹ Extended to 2007.

there would not be any particular impediment to the implementation of this Project under Japan's grand aid scheme.

At the same time that the Project promises the significant effects described above, because it would also contribute to the elevation of the standard of living of residents of a wide area, it can be confirmed that it is appropriate to consider the Project as grant aid cooperation. Also, it is believed that no constraints from either the human resources or financial resources standpoint would be imposed on operation and management of the machinery procured for the Project. It is thought however that the improvements described above would enable the Project to be smoothly and effectively accomplished.