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REVIEW OF THE FEASIBILITY OF BULK WHEAT HANDLING AND STORAGE IN PAKISTAN

CONSULTANTS REPORT

KSU
KANSAS STATE UNIVERSITY

FOOD & FEED GRAIN INSTITUTE
MANHATTAN, KANSAS 66506

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REVIEW OF THE FEASIBILITY OF BULK WHEAT HANDLING AND STORAGE IN PAKISTAN

CONSULTANTS REPORT

by

Harlan Shuyler
Henry Lembeck
Ekramul Haque
Roe Borsdorf

FOOD AND FEED GRAIN INSTITUTE
Kansas State University
Manhattan, Kansas 66506

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report sets forth the findings, conclusions, and recommendations of the Kansas State University Food and Feed Grain Institute (FFGI) team relative to bulk handling and storage of wheat in Pakistan. The team made on-site reviews of current bulk storage conditions and conducted a review of studies to date on the feasibility of public-sector bulk storage facilities. These studies and reports suggest that financial benefits are possible by converting to bulk handling and storage. However, they fail to provide complete cost/benefit analyses of either a complete system or its major components. None of the reports provide a complete overall view of the eventual objective, nor do they define specific phased plans which could be reasonably implemented.

The team determined that there is no technical reason why Pakistan can not successfully convert to bulk handling and storage of wheat. The technical skill is available. The construction industry is highly developed. Considerable capability exists throughout the country for supply, manufacture, and maintenance of machinery.

However, available studies and reports give no guidance for achieving the objective of the introduction of commercial bulk systems. Some of the costs and technical factors associated with bulk systems are unknown. Therefore, it is concluded that before large-scale commercial introduction of bulk systems is undertaken in Pakistan, an adaptation stage should be completed. To achieve this, the FFGI team recommends that a series of activities including pilot projects, training, and comprehensive planning be undertaken. These activities are related and interdependent, and should be undertaken simultaneously.

The general and specific recommendations provided in this report should assure successful and beneficial conversion to bulk grain systems throughout Pakistan.

SECTION I

INTRODUCTION

The purpose of this report is to set forth the findings, conclusions, and recommendations of the Kansas State University Food and Feed Grain Institute (FFGI) team as related to the scope of work originally given to the team by the Government of Pakistan (GOP). The specific scope of work called for the FFGI team to collaborate with personnel from the Pakistan Agricultural Research Council (PARC) and the Ministry of Food, Agriculture and Cooperatives (MINFA) to "review the results of studies to date on the feasibility of public sector bulk storage facilities, (especially the World Bank's Food Grain Storage and Processing Study). If feasible and still desired by the GOP, develop an implementation plan for conducting a study to identify the most efficient bulk storage facility design for Pakistani conditions."

A review of numerous studies which address public-sector bulk storage facilities was carried out in collaboration with GOP personnel. An on-site review of current bulk storage conditions was also conducted by the FFGI team. The results of the collaborative undertaking are provided in the Review of the Feasibility of Bulk Wheat Handling and Storage prepared by the Working Group on Bulk Wheat Handling and Storage, which is attached as Appendix A. The present report is provided as an extension to the review report prepared by the Working Group.

The FFGI team found that the identification of the "most efficient bulk storage facility design for Pakistani conditions" was not the critical element in the feasibility of public-sector bulk storage facilities. This question should be taken up as part of a comprehensive plan. Types and designs of storage facilities are subject to a broad set of considerations including operational as well as construction requirements. Pakistan will likely find many different types of storage appropriate, dependent on location and operating requirements. This report, therefore, deals with the broader requirements involved in adapting bulk wheat handling and storage systems to the Pakistani wheat production, import, export, marketing, and processing system.

SECTION II

ON-SITE REVIEW FINDINGS

The FFGI team visited facilities and met with officials of most types of government and private-sector agencies which might be affected by conversion to bulk storage. The team concentrated on the activities of the Pakistan Agricultural Storage and Services Corporation (PASSCO). PASSCO has some bulk wheat handling and storage operating experience and has expressed interest in moving towards more complete systems. This section of the report provides a summary of the findings of the team on current storage conditions determined through site visits and meetings.

General Situation

Wheat production has varied widely in Pakistan. In some years, production has exceeded consumption and wheat has been exported, while in other years production has fallen short of consumption and imports are required. The GOP, through the Provincial Food Departments (PFDs) and PASSCO, procures one-third or more of the domestic production of wheat and handles all imports. Farming, milling, stevedoring, and most of the trucking are private-sector activities. In general, government wheat moves from production areas to urban mills. Major movements of domestic wheat take place from surplus production areas in Punjab and northern Sind to Baluchistan and Northwest Frontier Province (NWFP). Import movements take place from the ports to Baluchistan and NWFP. Export movements take place from Punjab to the ports.

Current Procurement Procedures

Using Punjab as a representative example, the postharvest wheat system begins with the harvesting of the grain in May-June by both manual and mechanized means. The moisture content of the wheat at harvest is usually below 10 percent and no further drying is necessary. The manual method consists of harvesting the grain by sickle and threshing the grain with mechanical threshers. The sellers of wheat place the grain in bags issued to them by the purchase center. Each bag is stenciled with a code, for example PASSCO, WHEAT - 1986, PTK-CN-1. The code identifies the zone, project, and purchase center. Each seller is issued a maximum of 240 bags, based on a surety notorized by members of National or Provincial Assemblies or Councilers or a Magistrate. In the absence of such notorization, a cash security of Rs 16 per bag is required. The sellers are allowed to retain the bags for up to one week. The bags must be filled within this period, or they are returned empty and the surety or security deposit is refunded. The sewing thread for the bag is provided by the seller.

The transportation from the farm to the purchase center is the responsibility of the seller. The use of tractors and one- or two-axle trailers to transport wheat in bags to the purchase center is widespread and well established in major wheat-producing areas in Punjab. The wheat is inspected at the purchase center to determine conformity to the "Fair Average Quality" specifications and it is weighed at this time. The purchase price and any handling charges - such as labor for unloading, stitching, and stacking - are paid to the seller in the form of a check which can be cashed at a commercial bank.

In recent years combine harvestors have been introduced into Pakistan. Bulk grain from the combine harvestors is loaded into the two- or four-wheel trailers pulled by tractors. The grain is then bagged and transported to the nearest purchase center. Most purchase centers are within 10 km of farm production units.

Bulk Handling and Storage

Bag handling and storage is the predominant method used for wheat in Pakistan. However, some bulk storage of wheat is being tried in godowns with and without the use of bag bulkheads. Furthermore, a number of locally-constructed hexagonal-shaped bin units have been in use in various locations since the 1940s. With the exception of the older steel silo facility at Multan, bulk storage in silos has become a recent practice as silo facilities are constructed.

NLC Silo Project, Karachi. The Sind Food Department undertook the construction of a silo project in 1984, with the construction being supervised by the National Logistics Cell (NLC). The facility is located on the northeast edge of the city of Karachi. Construction is not yet complete. The silos are planned for 50,000 MT of storage capacity in two rows of 8 stand-alone concrete bins which are 40 ft in diameter and 120 ft high. The facility has loading, unloading, and bagging equipment for bag and bulk handling trucks. No rail connection is available. The engineering and construction of the facility were undertaken by local enterprises. The equipment was procured from Denmark. On-site inspection indicated that construction work has been stopped for some time for an undetermined reason. Piles supporting the foundations of the bins were interfering with the planned underground conveyor tunnel. As a result, the conveyor tunnel size was being reduced to conform to the space available. The target completion date for the facility is March 1987. However, under the present circumstances it does not seem likely that this target will be met.

PASSCO Chichawatni Silo. This facility consists of 14 free-standing concrete bins totaling 50,000 MT of storage capacity. The construction was undertaken by the NLC with the assistance of local consulting engineers and contractors. The equipment is of Danish manufacture. The silo became operational in 1985. Seven bins were filled last year and this year 11 bins have been filled. The grain is received from an approximate radius of 40 miles. Seven purchase centers feed this silo complex. About 90 percent of the grain is received from traders. About 40,000 MT of grain have been shipped from this facility since the start of the 1986 procurement season.

A number of representative problems are apparent at this facility. There is water leakage through the silo roofs. The site is at a lower level than the surrounding area and drainage is inadequate. The silos have a flat bottom with one small discharge opening to a reclaiming screw conveyor, and thus a large amount of grain must be manually moved to the discharge, making bin unloading a slow and laborious process. Bin filling is difficult and slow because gates are operated from difficult-to-access places on the bin tops. The spout is lightweight with no liners, resulting in rapid wear. Rail transport can not be used because of the lack of suitable bulk rail cars. Quality preservation methods such as aeration and fumigation are difficult to execute. Operation is slow because the grain is received and shipped in bags.

The bin temperature monitoring equipment is inoperable. The portable aeration fans are difficult to handle. Support facilities such as a workshop and laboratory are inadequate.

NLC Faisalabad Silo Project. The storage capacity of this facility is 50,000 MT in the configuration of 15 free-standing concrete bins. This facility was designed by Pakistani engineering consultants. The civil, mechanical, and electrical construction was done by Pakistani contractors. The equipment was purchased from a Danish firm. NLC is the supervising agency for construction of the facility. It was reported that a foundation problem was encountered during construction. Construction is currently stopped, with 12 bins and headhouse structures partially completed.

NLC Silo Project, Quetta. The storage capacity of this facility is 60,000 MT in 15 free-standing flat-bottom concrete bins. Loading and unloading operations are to be accomplished by both rail and road. Stand-by power arrangements have been provided. Some consideration was given to grain quality determination and preservation in the construction of the facility. The team understands that some test runs have been done, but that PASSCO has not accepted this facility as yet due to concern with deficiencies.

PASSCO Khairpur Silo. The team was unable to visit this facility. It is reported to be operational under PASSCO management. The team was told that this facility has features similar to the Chichawatni complex.

Punjab Food Department Silo, Multan. This facility consists of both bulk and bag storage. The storage capacity is 42,220 MT in 12 bolted steel tanks of three different sizes. The facility is operational but inefficient because of bagged grain receiving and shipping. The storage tanks are in excellent condition, but many other problems exist.

The bins are large in diameter and have flat bottoms with single center inlets to discharge screws. No sweep auger or other discharge mechanization is provided, thus bin unloading is labor-intensive and slow. The dust collection system is disconnected or nonexistent. There is no provision for aeration, and quality preservation is inadequate.

PASSCO Bulk Storage Experiments

PASSCO has experimented with bulk storage methods including open bulkheads, conversion of house-type godowns, silos, and hexagonal bins. PASSCO is somewhat handicapped by a lack of experience and training in a comprehensive bulk handling and storage system. Even with this handicap, PASSCO has embarked on fragmented efforts to convert to a bulk handling system with some success. An overview of these experimental methods is summarized below.

PASSCO Okara Project. PASSCO has built one 2,700-MT bulkhead of the type employed in the U.S. and Australia for temporary storage. The Okara bulkhead is 200 ft long, 60 ft wide, and 4 ft in sidewall height. The floor of the bulkhead is asphalt paving sloped to the outside. The walls are galvanized corrugated steel supported in light-gauge galvanized steel channel frames. The bulkhead was filled with wheat during the harvest in May and then covered with carefully laid and anchored plastic. This bulkhead was also used in two previous years. Wheat with 8 to 9 percent moisture was stored in the bulkhead

for a period of up to 8 months, from May to December. No facilities for aeration are provided. Five pieces of imported plastic cover at a cost of Rs 4.50 per square foot are used to cover the bulkhead. The same cover material has been used for three consecutive years and the material is now showing signs of degradation. PASSCO has asked a local manufacturer to produce covers locally.

The filling of the bulkhead is accomplished by opening the bags into an electric motor-driven portable inclined transport auger or a diesel engine-powered portable bucket elevator. The augers were imported and the auger support system was designed and manufactured locally. The two portable bucket elevators were gifts of the Australian Government. PASSCO is planning to enlarge the auger intake hopper to receive bulk grain from the truck directly into the transport auger intake. The unloading sequence is reported to be the reverse of the filling. To date, all grain has been manually bagged inside the bulkhead.

Since the grain moisture content is very low, and the storage surface area is very large, spoilage problems due to moisture migration and condensation are likely to be minimal. This system could be highly cost-effective if managed properly. The only disadvantages of this system are the possible rodent attack on the plastic cover and grain, and damage due to high winds. Lack of security for the grain could also be a problem.

In another experiment, PASSCO has installed overhead screw conveyors to fill a godown with bulk grain. One godown is equipped for bulk filling within bags stacked inside the walls. One section of the godown makes use of two inclined screw conveyors which discharge to two augers hung just under the roof bins. The opposite end of the godown is equipped with two bucket elevators, which in turn feed the roof conveyors. Exact plans for unloading systems are not apparent.

Precautions should be taken while filling and emptying the warehouse. Inside the warehouse there is a lengthwise row of reinforced concrete columns. With the bulk grain filling and emptying process, the individual columns may be subjected to a lateral grain pressure which may cause column failure. The strength of the columns should be checked for lateral grain pressure, if not already done. If the columns are not sufficiently strong, a suitable fender should be built around the columns. Furthermore, routine operation of front-end loaders in the building should be discouraged.

PASSCO Dipalpur and Mianchannu Project. PASSCO also has built two bulkheads each at Dipalpur and Mianchannu. These bulkheads are similar to the Okara bulkhead in construction except for minor dimensional differences. To date they have not been used for bulk storage.

PASSCO Hexagonal Bins, Khanewal. PASSCO's experiments in the mechanization of loading and unloading bulk grain in the hexagonal bin facilities is appropriate. However, there are some specific technical problems which should be addressed. The pipe thickness in the pneumatic system is inadequate. Deflection due to inadequate support in the silo top screw conveyor shaft results in difficulty keeping the screw conveyor straight. The light A-frame supports rest on an uneven surface. The equipment is generally of light construction and will become a maintenance problem.

Port Facilities

Port of Qasim. Grain is handled at the Port of Qasim by stevedoring contractors under contract with the Port of Qasim Authority. A current contractor has two rubber tire mounted pneumatic unloaders. Each unloader is equipped to load trucks in bulk, or bag the grain and load the bags onto trucks with the aid of bag belt conveyors. Each machine has a ship offloading capacity of 2,500 MT per 24 hr. It was reported that by rearranging the piping, the machines could also be used for vessel loading. To date, however, all grain exported has been in bags. Normal import operations include loading of trucks and rail cars. The loading of bagged grain onto rail cars is accomplished by loading double-axle wagons for movement to a rail siding some distance away from the berth.

Conventional mobile pneumatic units are also on hand for unloading to special multi-spout bagging bins. The pneumatic units are normally placed on the deck of the vessel and the bagging bins are stationed on the quay next to the vessel.

The harbor approach channel is 30 km long and the maximum draft under normal conditions is 31 ft. Transit sheds are available for temporary storage, but their use for grain is held to a minimum.

Port of Karachi. Import grain handling in the Port of Karachi is done at quayside. Grain is offloaded from the vessel by means of portable pneumatic unloaders placed on the deck. These units blow the grain into a bulk pile on the quay. The grain is then bagged by hand or with the aid of multi-spout bagging bins. The bagged grain is then either loaded onto trucks or rail cars, or stacked in the open. All grain exported to date has been in bags. Some prebagged grain cargos have also been received.

SECTION III

FINDINGS OF THE REVIEW OF REPORTS

The findings of the review of reports as concerns the feasibility of their recommendations are divided into three categories: (1) technical analysis (2) economic analysis, and (3) systems analysis.

Technical Analysis

The reports under review all address bulk handling and storage to some extent. All have recommendations in this regard. The recommendations vary from major silo construction programs to cautious pilot programs and additional studies. Management, training, administrative methods, and grain quality standards also are subjects of some recommendations. While the reports as a whole convey many important points, there are major considerations which are not fully addressed. In addition, many recommendations are not supported by facts. The following provides an outline of important considerations which are either not addressed or inadequately supported in the reports.

Hexagonal Bin and Godown Mechanization. The light-duty, portable equipment recommended will fail due to rough treatment and difficulty of handling. In addition, the recommended types of systems will not permit centralized control of receiving and shipping activities which is necessary for efficient bulk operations.

Reclaiming from Storage. Little or no consideration has been given to unloading or discharge systems for silos, hexagonal bins, flat storage, steel bins, bulkheads, or converted godowns. Each type of operation and configuration of container has a special set of problems. Dependence on front-end loaders to move grain within small round bins or buildings with interior columns is ill-advised as a general solution.

Godown Conversion. The conversion of existing godowns to bulk storage may not, in the long term, be cost efficient. Furthermore, designing all new godowns for bulk use as well as bag use is not practical. The structural and operational requirements for bulk versus bag are too diverse to be efficiently combined into one structure. Efficiency demands that bag storage units be relatively low in profile, while bulk units will make the most efficient use of costly equipment if they are high. Bulk units should be clear-span with special wall structures, while bag units can have interior columns and light wall structures. Conversion of existing godowns to bulk should be considered as only an interim step.

Procurement. None of the reports provide clear plans for procurement of grain in bulk. Many questions remain unanswered relative to critical details in this area.

Plant Layout. No complete plant layouts have been developed as a guide to designing specific types of facilities. Truck and railcar handling details dictate well-planned road and track layouts. A mixture of silos, flat buildings, and bulkheads is not shown and normal facility expansion requirements are not mentioned. Proper plans require consideration of many factors associated with overall plant layouts.

Pilot Programs. The various pilot programs proposed are not completely defined and do not have clearly-stated detailed objectives. A plan for management of any pilot program must be developed and a system of reporting data must be implemented.

Storage Options. A clear and complete description of options available for storage has not been presented. The wide range of storage requirements and conditions in Pakistan will demand a number of different types of configurations and building techniques.

Planning. The studies do not stress the need for ongoing planning and allowance for growth and change of the system. Furthermore, planning for effective phased improvement is necessary.

Management. Management and staffing systems are not defined. The studies do not define the skills and structure necessary for successful operation of a bulk system.

Maintenance. Mechanization and bulk handling increase the maintenance problem. The studies do not provide clear plans for proper maintenance.

Mill Storage. No consideration has been given to the requirement for storage at flour mills. It may be found beneficial to increase the storage at the mills, especially if the system moves toward free market conditions.

Successful bulk handling and storage systems are dependent on technical details. The technical details involve hardware and systems associated with the movement, storage, quality control, and transfer of ownership of the commodity. None of the reports provide a clear and concise plan for addressing the technical detail problems as they arise.

Economic Analysis

For the most part, cost/benefit analyses for the recommendations set forth in the reports are either missing or extremely weak. Only three reports were judged marginally adequate in addressing the benefits of the recommendations set forth. In all reports, the data quality is suspect since many of the cost/benefit factors presented are gross numbers without sufficient detail to justify conclusions.

Using the reports as guides to begin the development of a bulk wheat handling and storage system in Pakistan can not be justified because of the lack of definitive cost/benefit analyses for the recommendations. There is no way to determine if any of the recommendations would be cost-effective. Neither can it be determined if any recommendation would generate specific benefits of such magnitude so as to result in an adequate rate of return.

Systems Analysis

When considering an operational conversion from one type of handling and storage to another type, the total system - including such components as procurement, handling, storage, transport, and distribution - must be taken into account. The studies reviewed do not deal with the system as a whole, but rather with individual segments of a system. Predominantly lacking in all of the studies is a comprehensive plan by which wheat storage in Pakistan would be converted to bulk as a total system. Without a comprehensive plan for a total system, there is no way to correctly determine the location and size of bulk storage facilities, nor the particular facilities or groups of facilities which would generate the greatest rate of return on investment.

The handling of wheat in bulk form is an integral factor to be considered in a comprehensive plan in the conversion of a system to bulk storage. All reports have addressed this in one fashion or another by certain specific segments, but not as a total system.

SECTION IV

CONCLUSIONS

Recognizing a need to adopt modern methods, various agencies have made moves toward bulk storage and handling. The final outcome of these efforts has yet to be determined. Early signs point to possible failure. The Multan silo, originally constructed by a private group, suffers from poor maintenance under government management. The Chichawatni and Khairpur silos are under-utilized due to detail problems. A new silo at Quetta awaits start-up. Construction of silos at Faisalabad and Karachi is stopped. Bulk mechanization experiments under way by PASSCO at Khanewal, Okara, and Dipalpur are suffering from lack of funds and technical assistance. The full advantage of modern ship unloading equipment imported by a private stevedoring firm in the Port of Qasim has not been fully utilized due to the reluctance or inability of flour millers and government godowns to receive in bulk. Clearly, Pakistan is moving toward bulk handling. Fairly complete conversion will take place in due time. However, many costly missteps can be avoided with some technical assistance, exposure to the experience of others, and proper planning.

There is no technical reason why Pakistan can not successfully convert to bulk handling and storage. The technical skill is available through trained engineers and technicians. The construction industry is highly developed. Considerable capability exists throughout the country for the supply, manufacture, and maintenance of machinery. Good maintenance, which is so often lacking throughout the world, is exhibited in Pakistan. The desire and ability to design and manufacture equipment locally is demonstrated by PASSCO's experiments. PASSCO has employed a small local manufacturer to produce basic bulk handling equipment.

Numerous studies and reports, prepared in recent years, have addressed the question of conversion to bulk handling. All suggest financial benefits, but fail to provide complete cost/benefit analyses of either a complete system or its major components. None of the reports provide a complete overall view of the eventual objective nor do they define specific phased plans which can be reasonably implemented.

Although accurate facts and figures are not available for bulk handling and storage systems in Pakistan, it seems likely that substantial benefits could accrue. Possible benefits can be outlined as follows:

- -Farmers will benefit through more complete use of bulk methods currently being introduced through combine harvestors. Preliminary figures indicate that the prices charged by private "custom" combine harvesting service companies plus bulk movement to a procurement center will reduce the farmer's costs and increase the quality of his product.

- -Flour millers will benefit through reduced handling costs and improvement of quality and control. Furthermore, a free market system will provide an incentive for millers to purchase wheat at beneficial prices and store it. Bulk storage will be more appropriate for mill storage on restricted and confined sites.

-Truckers will benefit through more efficient truck utilization resulting from reduced waiting and loading and unloading time.

-Food security will be improved through the ability to import and transport grain more quickly and efficiently.

-Fabricators, suppliers, and manufacturers will benefit through the introduction of new equipment.

-Labor will benefit by allowing more labor-intensive bagging to be moved to areas of labor surplus and wheat deficit.

-Food quality and quantity will be increased.

In Pakistan, some constraints exist which affect conversion to bulk handling and storage. These can be summarized as follows:

-Availability of investment capital. There is no clear financial incentive for any private interests to invest because the system infrastructure is not available. Only government can bear the long-range financial burden necessary to get the system started.

-The ration system reduces the potential for benefits.

-The failure of government agencies to officially recognize losses in handling and storage removes a major benefit and interferes with the ability to use accurate weighing systems as a basis for transfer of ownership or control of bulk grain.

As with any development project, potential dangers to success in converting to bulk handling and storage are present. Some of the dangers which can be identified at this time include poor planning, improper use of scales, and lack of cooperation between railroad, port authorities, millers, and farmers.

In summary, previous reports give no guidance for achieving the objective of the introduction of commercial bulk systems. Operating costs and transport costs associated with bulk handling and storage are unknown. A large number of technical factors remain unsolved. In view of the nature of these requirements, it is concluded that pilot projects, training, and planning should be the next stage in adaptation of bulk handling and storage for grain in Pakistan.

SECTION V

RECOMMENDATIONS

The FFGI team has developed certain recommendations relative to the development of bulk grain systems in Pakistan. This section provides an overall outline of the recommendations. Appendices B to D provide a more detailed scope for many of the individual activities recommended. These recommendations are structured to lead to a technically-feasible and cost-effective bulk wheat handling and storage system in Pakistan.

The recommendations of the team can be divided into three areas: (1) pilot projects, (2) training, and (3) comprehensive planning. These three areas are related and interdependent, and should be undertaken simultaneously.

Pilot Projects

Since the findings to date are inconclusive as to the benefits of bulk grain systems in Pakistan, a pilot project approach is recommended. These pilot projects should be small-capacity but full-scale farm to market operations. They should make use of existing facilities as much as possible and be operated for a period sufficient to provide adequate experience. They should be such that they could be incorporated into permanent systems if found to be successful. An illustrative diagram of possible pilot programs is shown on the following page.

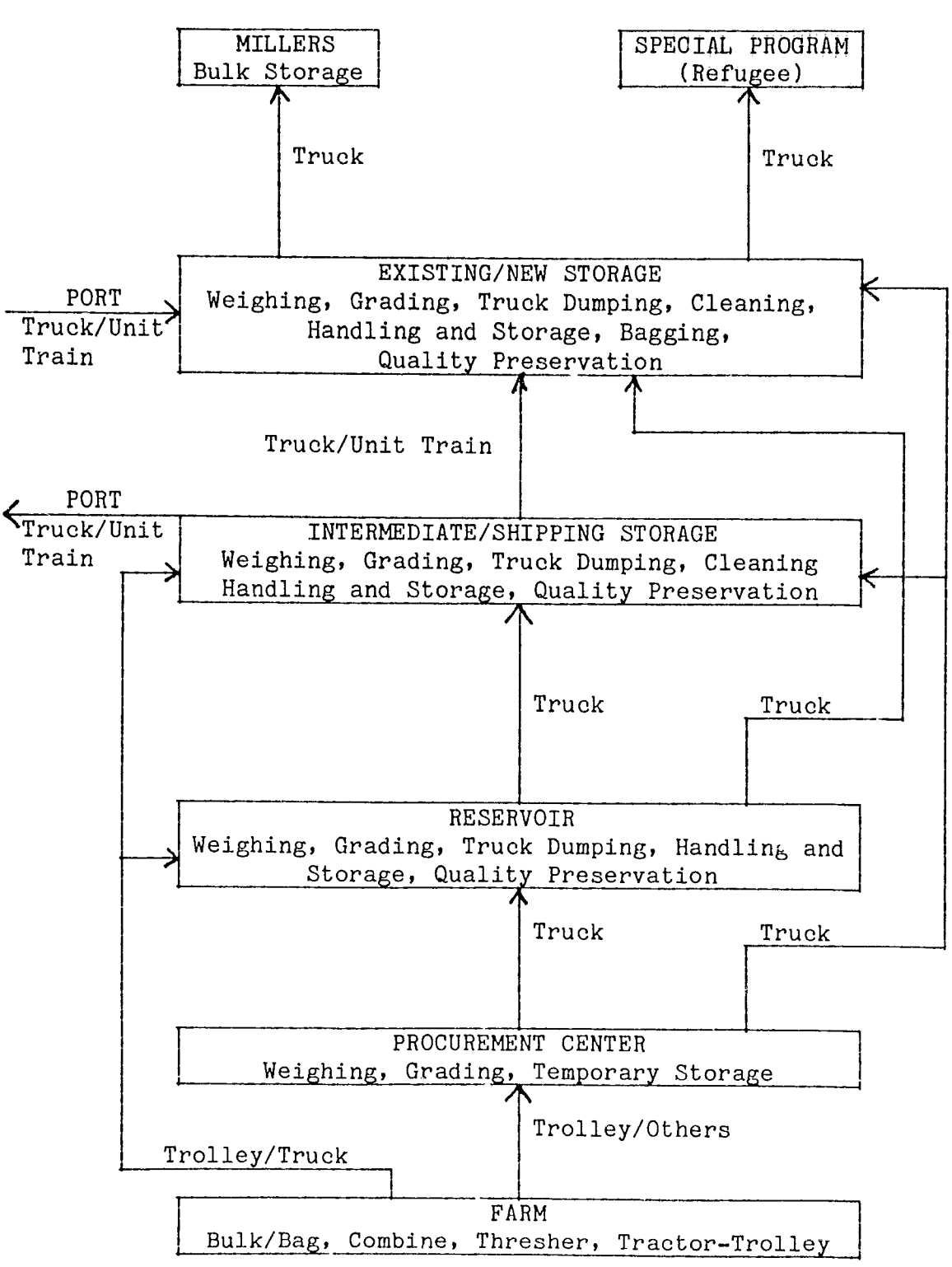
The objectives of the pilot projects should be: (1) to develop cost information on operations which can be used in financial and economic analysis of more complete systems, (2) to provide a test for technical features of systems, and (3) to provide facilities for orientation, training, and demonstrations.

To be successful, pilot projects must be planned, managed, and operated by a single agency which has in-depth experience in procurement, storage, handling, and distribution of wheat. The pilot projects should be implemented by PASSCO under the direction of a designated bulk handling project manager within PASSCO. PASSCO is recommended because (1) it satisfies the requirement of an agency experienced in procurement, storage, handling, and distribution of wheat, (2) it is the only agency which has any extensive experience in operating current bulk storage facilities, and (3) it has the required basic management structure of departmentalization, such as engineering, field operations, quality preservation, and finance and accounts.

Pilot projects should be thoroughly planned in advance of implementation to provide maximum assurance of technical success, efficient operation, and effective data collection. Specific suggested pilot projects and technical assistance packages are defined in Appendix B.

Training

Although excellent basic technical talent is available through the various Pakistani organizations, exposure to bulk grain handling technology is limited. Some officials have had contact with a few systems overseas. Local



ILLUSTRATIVE DIAGRAM OF BULK PILOT PROJECT

experiments and silo construction projects have provided some experience. However, there is no depth of understanding of the range of problems and solutions experienced in other countries. Furthermore, there is no means for understanding the state of the art nor for keeping up with ongoing developments.

A comprehensive ongoing training program should be developed and implemented to reach all levels of administrative, engineering, and operations personnel. These training programs should be administered by MINFA. The programs could be designed and implemented with the assistance of a consultant specializing in training of this type. The programs should involve some formal instruction, observation of operating facilities, and attendance at international grain handling technical conferences. Appendix C provides more detailed descriptions of suggested programs.

Systems Analysis and Planning

In general, the team recommends that no further studies be pursued, but instead a systems analysis be conducted which will lead to a comprehensive plan for the introduction of commercial systems, if warranted. The systems analysis and planning function should be carried out by a multi-disciplined planning team appointed by MINFA. The team could be assisted by a consultant experienced in this type of work.

Constructing a comprehensive plan requires the analysis of a proposed system. Accurate and detailed cost estimates are required in order for trade-offs to be analyzed. To correctly size, locate, and design (flat versus upright) storage facilities, the following trade-offs need to be considered so as to optimize the system.

Factor	Trade-off
Size of facility	Construction costs versus transport costs
	Operating costs versus transport costs
	Construction costs versus operating costs
Location of facility	Construction cost versus transport costs
	Operating costs versus transport costs
	Construction costs versus operating costs
Design of facility	Construction costs flat versus upright
	Operating costs flat versus upright
	Differences in transport delay costs

The initial constraint in conducting such an analysis is that the truck transport system is not currently handling bulk grain. It may even be questioned whether the rail transport system could carry out bulk transport in an efficient and effective manner without substantial changes. Since this constraint exists, the true costs of bulk transport are unknown. Such costs would have to be developed based upon data collected on transport operations in pilot projects. Other lacking cost data, such as operating costs of bulk facilities, will have to be acquired through a data collection process of a pilot project. Costs of transport from procurement center to storage or from farm to storage will need to be measured by pilot projects. Because of the existing data constraints, an analysis must depend on information generated by full-scale pilot projects.

Optimizing a new system and comparing the results to an existing system requires that costs of the existing system be known. These costs seem to be known on a provincial level, but whether they can be calculated on a district level is unknown. Another data constraint is the lack of documented flows of wheat within and between provinces.

Optimizing a new system so as to determine correct size, proper location, and efficient design of facilities requires analysis by linear programming based on the flow of wheat from production to processing. This analysis must take into consideration internal as well as external provincial flows of wheat.

Facility configurations within a province can then be segmented so as to measure the economic feasibility of a single facility or selected groups of facilities. The group of facilities having the greatest return on investment would be the target for the beginning of a commercial storage construction phase.

APPENDIX A

REVIEW OF THE FEASIBILITY OF BULK WHEAT HANDLING AND STORAGE IN PAKISTAN

REVIEW OF THE FEASIBILITY OF BULK WHEAT HANDLING AND STORAGE IN PAKISTAN

by the

Working Group on
Bulk Wheat Handling and Storage

Ministry of Food, Agriculture and Cooperatives
Government of Pakistan

8 September - 2 October
1986

TABLE OF CONTENTS

SECTION I

INTRODUCTION

This report provides a description of the work and findings of the Working Group on Bulk Wheat Handling and Storage. The Working Group was composed of representatives of the Ministry of Food, Agriculture and Cooperatives (MINFA), The Pakistan Agricultural Storage and Services Corporation (PASSCO), and Provincial Food Departments (PFDs) in consultation with representatives of the National Transport Research Center (NTRC) and the Kansas State University Food and Feed Grain Institute (FFGI), as described in Annex 1.

The goal of the Working Group was to review the question of bulk handling and storage of wheat procured and distributed by the public sector throughout Pakistan. Specific objectives were to: (1) determine if bulk handling and storage of wheat would be feasible and cost effective, and, if so, (2) define the initial steps appropriate for the introduction of a bulk wheat handling and storage system.

The objectives were to be accomplished through a review of published reports and data (Annex 2), on-site review of present conditions, and application of personal experience of the members of the Working Group.

The review began with a meeting of the Working Group on 8 September, 1986. Recommendations were formulated during a meeting of the Group on 2 October, 1986. Both meetings were held in MINFA offices in Islamabad.

SECTION II

METHODOLOGY

The reports to be considered for review were segregated into two categories: (a) recommendation/study reports, and (2) database reports. This list of reports is presented in Annex 2. The database reports are ones with background information and data; they contain either no recommendations or minor ones on bulk wheat handling and storage. The decision of the Working Group was to review the recommendation/study reports only.

A matrix style evaluation sheet was provided for the Working Group, listing the recommendations by report. Also included in the evaluation sheet was a set of possible measurement factors to be used in the evaluation of recommendations. The basic purpose of the evaluation sheets was to enable members of the Working Group to draw conclusions as to the validity of the recommendations set forth in the various reports.

On-site review and contact with other Working Group members were carried out by the FFGI team from 8 September through 2 October.

SECTION III

ANALYSIS

The Working Group, in its meeting of 2 October, discussed the report recommendations as to their applicability to the question of whether bulk handling and storage of wheat in Pakistan would be feasible and cost-effective. The purpose of this discussion was to arrive at definitive answers to three questions.

The first question was, "Is it likely that bulk wheat handling and storage may be beneficial?" The discussion and response were based on the data and recommendations of the reports under review, as well as observations and personal experience of the members of the Working Group.

The second question was, "Do the reports provide a plan of action?" Discussion and response revolved around whether a sound, systematic plan had been provided in the reports which would lead to a gradual conversion to bulk handling and storage of wheat on a national basis.

The third question was, "Are additional steps necessary?" The discussion included three major areas: pilot projects, training, and planning. In the area of pilot projects, the discussion centered on the justification for such projects and important factors such as bulk truck and rail transport, and the need to gain cooperation of other agencies and private-sector entities in conducting a pilot project. A general outline of possible pilot projects was reviewed. Further discussion addressed the need for pilot projects as related to training and planning activities.

Finally, the group held discussions on how to proceed from this stage of activities. The type of group which would be effective and accomplishments for which the group should aim were discussed.

SECTION IV

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The conclusions of the Working Group as related to the questions discussed were:

1. There is no specific set of facts that indicates whether bulk wheat handling and storage would be beneficial in either the short- or long-term. However, the Working Group concluded that bulk storage and handling of wheat would occur in time due to specific technical factors now in existence in the wheat production and marketing system, such as the use of combine harvesters and the need for additional storage capacity for wheat. It was concluded by the Working Group that, based upon the technical factors, bulk wheat storage was likely to be beneficial.

2. The reports reviewed do not present a sound general plan of action. There are many variables about which little is known and the reports do not give a composite set of directions by which to move towards bulk handling and storage of wheat.

3. Therefore, additional steps are necessary before a widespread implementation of bulk handling and storage should occur.

Recommendations

As a result of these conclusions, the Working Group recommended the following actions:

1. The pilot projects in bulk handling and storage should be undertaken to determine such factors as existing constraints, operating costs, how bulk transport would function, and how the operations of a bulk system could be adopted within the current system. The question of utilizing one of the existing silos for a bulk handling pilot project also was discussed by the Working Group. It was recommended that the implementing agency for the pilot projects be PASSCO, based on its experience and level of manpower resources.

2. Short-term training in specific areas such as design, operations, and inventory control would be required to assist in the design and implementation of sound pilot projects.

3. The planning for the introduction of a commercial bulk system based on a systems analysis approach is essential, and the output and results of pilot projects should become one of the major inputs to the planning process so as to develop a practical comprehensive plan of action for the introduction of a commercial bulk system, if warranted by the economic findings of the plan.

4. The most practical way to proceed from this stage of activities would be to develop an advisory committee on the introduction of bulk wheat handling and storage in Pakistan. This advisory committee could be composed of the current membership of the Working Group plus additional members from the

planning division, the finance division, and the NLC. Further, the results of the Working Group's work should be presented in report form, stating justifications of recommendations, the need for action, and the need for additional financial assistance.

SECTION V

JUSTIFICATION

The justification for the conclusions and recommendations of the Working Group is as follows:

1. Bulk storage facilities are currently being introduced into the wheat handling and storage system on a fragmented basis and the question exists whether these facilities are correctly designed for sound operations, given the current system and possible changes that may occur in this system in the future.

2. Given the above and many other currently unknown factors, the need exists to implement pilot projects to determine what will or will not work. With implementation, training should be an integral part of such actions so as to increase current skill levels of the persons managing pilot projects. Also, training would lead to the introduction of new concepts and ideas.

3. Due to item 1 above, there exists a need for a comprehensive national plan to select proper locations and sizes for facilities, and to determine the economic feasibility for a facility or groups of facilities.

4. In order to implement pilot projects and associated training and planning, additional resources will be required beyond those currently available. Without these additional resources, full-scale pilot projects, which are required to adequately test operations and procedures, can not be implemented. Neither can the associated required training and planning be adequately conducted.

THE WORKING GROUP ON BULK WHEAT HANDLING AND STORAGE

Inamul Haq Joint Secretary (Food)/MINFA	Chairman
Siraj Uddin Ahmed Deputy Secretary (Storage)/MINFA	Convenor/organizer
Khan Naseem Iqbal Technical Officer (Grain Quality) Storage Cell/MINFA	
Abdul Majeed National Transport Research Center Planning and Development Division Islamabad	
Mujhammad Amin Senior General Manager (Works) PASSCO, Lahore	
S. M. Chaudhary General Manager (Finance & Accounts) PASSCO, Lahore	
Aman Ullah Khan Director Food Government of NWFP, Peshawar	
Nur Muhammad Shah Director General Food Karachi	
A. Rashid Khan Director Food Government of Punjab, Lahore	
Harlan Shuyler Postharvest Management Specialist FFGI	
Henry Lembeck Consulting Engineer FFGI	
Ekramul Haque Agricultural Engineer FFGI	
Roe Borsdorf Agricultural Economist FFGI	

ANNEX 2

Title	Sponsor	Author	For	Year
Recommendations/Study Reports				
Foodgrain Storage and Processing	The World Bank	AgroProgress/Indus	MINFA	1986
PASSCO Bulk Conversion	DANIDA	Hoff & Overgaard	PASSCO	1985
Bulk Handling of Grain Through Mechanized Harvesting		PASSCO		1986
Appraisal of Food Grain Storage Project	ADB	ADB	ADB	1983
Food Security Policy Formation	FAO	FAO	MINFA	1983
Requirement of Additional Storage	NLC	NLC	NLC	--
Food Grain Storage and Handling Master Plan	CIDA	Carr & Donald	MINFA	1980
Study of Problems Associated with Procurement, Storage, and Distribution of Wheat	GOP	MICAS	GOP	1976
Economic and Engineering Study - Food Grain Storage and Handling	CIDA	R.G. Watson	GOP	1970
Database Reports				
Food Grain Transport, Economics and Logistics	The World Bank	Abdul Majeed, NTRC	MINFA	1985
Forecast of Pakistan's Seaborne Trade in Wheat and Rice, 1984 Update	CIDA	Woods Gordon	Port Qasim Authority	1984
Grain Quality, Grain Testing and Quality Control Study	The World Bank	AgroProgress	MINFA	1985
Losses in Public Sector Storage in Pakistan	The World Bank	PARC	MINFA	1986

APPENDIX B

PILOT PROJECT ACTIVITIES

Consultant to MINFA

The apparently uncoordinated, fragmented, and isolated efforts by various agencies in Pakistan to move to bulk storage systems have resulted in very limited success. The lack of a clear understanding of how a bulk system works is apparent. This leads to some unwarranted misconceptions among various agency personnel about the efficiency and effectiveness of the bulk system. The weakness is offset by strengths in civil construction and the supply, manufacture, and maintenance of machinery. The chance of success in conversion to bulk systems could be greatly enhanced by incorporating technical assistance into the pilot projects.

Technical assistance could ensure that the pilot project is planned, engineered, coordinated, and managed properly. In addition, technical assistance could develop and execute a proper training program for Pakistani project personnel and aid in the initial facility operations management.

The technical assistance package will consist of different specialty groups at different phases of the project. This technical assistance could be coordinated with the planning efforts described in Appendix D.

Large-Scale Concept

This section provides a preliminary concept for pilot projects based on the information at hand. First, it must be determined whether the pilot project should include the domestic postharvest chain, the import/export postharvest chain, or both. The objective of a pilot project is to test a system by a simplified and inexpensive model that has all the essential elements of the comprehensive system. This means that the only choice at this time is for the pilot project to include only the domestic postharvest chain. However, the pilot project should be designed so as to link into the import/export chain if needed in the future.

With this broad and open-ended framework, a pilot project for PASSCO is suggested. The essential elements of the scheme are described below and illustrated on page 16. The scheme includes a surplus grain-producing area and a deficit consumption area of Pakistan and all the storage and handling in between. Such a pilot project would fit well into the surplus/deficit corridors of Punjab to NWFP or Sind to Baluchistan. The corridors to be examined include Dipalpur to Okara to Peshawar, Dipalpur to Okara to Rawalpindi, Chichawatni to Rawalpindi, Chichawatni to Peshawar, and Khairpur to Quetta.

Any infusion of a new element in the private-sector segment of the scheme should not dislocate the existing system to the extent that the risk of project failure could increase. The existing system of procuring farmers' grain in bags should be discouraged but not discontinued, because the new practice may exert unnecessary pressures on the producer/middleman, reducing the quantity of grain procured. However, widespread use of threshers and the increased use of combine harvesting could motivate the producer to haul grain to PASSCO in bulk.

Some of the bulk facilities that exist within the public sector should be retrofitted into the scheme so as to maximize their usefulness and reduce the cost of the project. The existing deficiencies pertaining to structural,

operational, mechanical, and electrical systems; facility maintenance; and grain quality maintenance of Chichawatni, Khairpur, and Quetta silos should be removed through a planned program. The proper mechanization of hexagonal bins for ease of bin filling and unloading should also be included as a project activity. Existing bulkheads and house-type godowns in Okara and Dipalpur could also be included. However, permanent covered storage is preferable to outdoor bulkheads at storage centers because outdoor storage may cause excessive grain loss due to bad weather. Pilferage may also be difficult to control. PASSCO's experimentation with the outdoor bulkheads in Punjab shows initial positive results. If grain losses are within the bounds of economic acceptability, the use of bulkheads may be retained and possibly incorporated into the pilot project.

Utilization of the existing house-type godowns should be maximized within the project. The bag to bulk warehouse conversion program for PASSCO should be thoroughly examined for structural, filling and unloading, weighing, inventory control, quality control, and equipment operation and maintenance considerations. Fragmented experimentation should be avoided.

A suitable grain silo should be considered at Peshawar or Rawalpindi to provide bulk receiving capacity by rail and truck from Karachi, Chichawatni, and other pilot project locations. The need for a shipment silo at Okara, to be served by rail and road, should also be evaluated.

Millers should be induced to participate in the pilot programs. The participating millers should be provided with bulk handling facilities.

The projects should include sufficient harvesting and transport equipment to assure that the projects can be serviced. Necessary transport equipment might include trolleys, trucks, and rail cars. Road transportation systems in the project areas have been developed to a level where simple and inexpensive modifications of grain carriers are possible. Development of the bulk rail transportation system will be more difficult and slow. However, rail transportation may be cheap and quick if a sound system is developed. The movement of grain in bulk by unit train should be tested.

Grain grading, cleaning, and quality preservation should be highlighted in the project activities because they are related to loss reduction which is a major benefit of a bulk system.

The entire pilot project should be accompanied by the aid of an external consultant with long experience in bulk storage system design. The consultant should work closely with PASSCO and other agencies to carefully select the silos, and prepare designs and other specifications and guidelines to be incorporated in the detailed engineering design of the project. The consultant may also aid PASSCO with the operation and data collection of the project.

The engineering design, construction, inspection, and initial operations should be done with the assistance of a qualified external engineering firm. The engineer will advise PASSCO and assist in oversight of the entire project until completion of the initial operations stage.

Hexagonal Bins

PASSCO is in the process of experimentation with various means of mechanizing the filling operations for the hexagonal bin facilities. The filling of these bins by hand is costly and the existence of these structures offers a unique opportunity to test bulk handling systems. In some cases, hexagonal bins might be positioned to serve as part of the complete pilot project. Under this suggested task, technical assistance would be provided to work with PASSCO in designing an appopriate bulk handling system which will convert the hexagonal bins into efficient and complete silo operations. A consultant should be employed to work closely with PASSCO. Together they would select the suitable sites and prepare complete general arrangement layouts for the facilities. Detailed design and procurement would be completed by PASSCO with guidance and assistance by the consultant.

Mill Bulk Facilities Concepts

Working closely with PASSCO and certain key flour mill operators, a consultant would prepare prototype designs for bulk wheat receiving and storage facilities at existing flour mills. The designs would take into account requirements for inventory control, separation of types and qualities of wheat, receiving facilities, and general limitation appropriate to typical flour mills in Pakistan. These designs would be displayed in conceptual drawings and diagrams easily understood by millers.

The purpose of this work would be to fully acquaint PASSCO and the PFDs with the requirements of the mills and to promote the bulk concept among the millers.

Existing Silo Improvement Analysis

There are currently six silos in Pakistan, two of which are still under construction. PASSCO has been designated as the operator of these silos. There are a number of problems which have come to light regarding the design and construction of these facilities. Modifications could be made to these silos which would render them more efficient.

This proposed task would include (1) collecting all drawings and technical data on all six silos, (2) making field surveys and observations as necessary to provide a complete understanding of the physical characteristics of the facilities, (3) developing preliminary concepts for required improvements, (4) preparing cost estimates and schedules for implementation of proposed improvements, and (5) preparing an implementation plan for completing the required work. This task could be carried out by a consultant working closely with PASSCO.

APPENDIX C

TRAINING ACTIVITIES

Any development project requires a group of trained personnel to plan, coordinate, manage, and maintain the project. All training should be conducted before undertaking any pilot projects or planning processes so as to minimize failure and encourage success. The training should occur in a country where the bulk grain handling and storage system has been well developed for a long time.

Project planners and policymakers have a different training requirement than engineers and facility operators. FFGI recommends the following approach to training.

Policymakers and Planners

The primary duty of the policymakers and planners is to develop, in conjunction with external technical assistance and PASSCO, an appropriate bulk storage pilot project for Pakistan that could ultimately lead to a commercial bulk system. However, at this time there is not a sufficient amount of background knowledge to recommend projects which will lead to an integrated postharvest bulk system. With the present background, it is not possible for policymakers and planners to fully utilize the benefits of technical assistance.

To assist in resolving this constraint, a special training program is recommended. Training would consist of a broad understanding of the postharvest system, how it works, and the critical elements in it that will lead to success for the system. A major external field trip should be planned so as to follow the grain from the harvest to the final point of processing in a well-developed bulk system.

Engineers

The pilot projects contain some specialized engineering. The training for this group should lead to an understanding of (1) fundamentals of bulk grain storage, (2) engineering design of bulk storage and handling systems, and (3) operation and maintenance of equipment particular to bulk storage facilities.

These training requirements could be achieved by developing a training program directed towards gaining practical experience in these particular areas. Such a training program would involve a university, a consulting engineering firm, and operating grain storage facilities. The duration of the training program would vary from 7 to 12 weeks.

Operational Personnel

This group, which is responsible for day-to-day management and operation of grain storage facilities, must be trained to understand (1) fundamentals of bulk grain storage, (2) inventory control, (3) quality preservation as related to bulk storage, and (4) overall management of a bulk storage facility.

These training requirements could be met by developing a training program directed towards the goal of allowing the participants in the program to gather on-the-job practical experience within a sound operating bulk storage facility. Such a training program would involve a university and several operating grain facilities. The duration of the program would vary from 7 to 12 weeks.

APPENDIX D

PLANNING ACTIVITIES

Dedicated Rail Wagon Unit Trains

To date, 60-wagon unit trains have been utilized for transporting imported wheat from Karachi to Peshawar. The movement of this grain has been relatively fast and efficient. On the other hand, movement of grain from Punjab loading points has been much slower due to long delays required to assemble 60-wagon trains from various points of origin.

If general-purpose wagons are used to transport grain, they must be specially fitted to avoid grain loss or damage, and these fittings are only temporary since the wagons may be used for services other than transporting grain. In addition, when the wagons are used for many purposes, they are often out of position or in short supply when needed for transporting grain. One alternative to general-purpose wagons is a wagon configuration which permits multipurpose use, but which caters to grain requirements. Another alternative which may present advantages is the use of special-purpose railwagons in unit train configurations for high-volume, predictable point-to-point grain movement. Factors such as bulk backhaul movements and simple point-to-point dedicated grain unit train configurations should be reviewed specifically.

As part of the planning process, an analysis should be made to (1) determine specific existing operating conditions and costs for certain high volume movements such as Karachi to Peshawar and Chichawatni to Peshawar, (2) determine the feasibility of PFDs or PASSCO owning specialized railwagons which would be operated by the railroad in unit train configurations, (3) review designs of bulk grain wagons in use in other countries, especially those designed for multipurpose use, (4) establish specifications for conversion of existing wagons to bulk, or improvement for handling bagged cargo to avoid losses, (5) establish specifications and general arrangement layout for new specialized bulk railwagons, and (6) prepare operations and investment cost estimates for various alternative schemes. The planning task should be carried out by designated members of MINFA working closely with the railroad and with the assistance of a qualified consultant.

Port Silo

Pakistan has a growing need for handling ocean-borne imports and exports of grain, oilseeds, oilseed meal and other agriculturally-derived products. These activities could be centralized into a public service facility which would be available to individual merchants, private firms, private-sector groups, or government agencies. Such a public terminal silo facility might be a profitable operation which would encourage growth of the private sector in merchandising and processing. A reduction in handling costs and an improvement in the dependability of scheduling would help both the government and the private sector. Furthermore, the ability to efficiently handle large volumes of imported food grains is an important aspect of food security considerations in time of national disaster or other major disruptions to production.

A detailed feasibility analysis and preliminary engineering design should be carried out. This preliminary effort should include an analysis of the role of various government and private-sector organizations in the planning, design, construction, ownership, and operations of the facility. Planning for the port silo, while somewhat independent of internal bulk handling systems, should be integrated into the overall systems analysis for the country.

Master Plan

A comprehensive master plan which would include both country-wide as well as individual systems analysis to determine sizes, locations, and characteristics of facilities should be developed. The plan would provide accurate financial analysis of the country-wide systems, subsystems, and individual facilities. It would also set forth specific objectives for conversion or development of facilities according to priorities established on the basis of need and financial benefits. The plan should be an ongoing function with data input from pilot programs and from experiences with implemented commercial operations.