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STUDY OF THE PAKISTANIAN GRAIN MARKETING SYSTEM

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PREFACE

The Government of Pakistan requested USAID/Pakistan for assistance into studying its grain storage and marketing system. USAID requested the services of a four-man consulting team from Kansas State University. This is their report.

Section I, the "Executive Summary" will be useful to top government and similar officials.

Section II, discusses economic policies which must be considered in developing a rational, adequate and economical system for grain marketing.

Section III, discusses in detail how a system is developed for the marketing of agricultural products and inputs.

Sections IV and V, discuss technical details of the design and operation of physical facilities for storage and processing from the farm to the consumer.

Appendix Section A, should be studied first by the reader who is not familiar with Pakistan and its agriculture.

Team members included Dr. Harry Pfost, (Agricultural Engineer and Professor), Department of Grain Science and Industry, Kansas State University, William Briggs, Consulting Engineer, Atlanta, Georgia, Dr. Dale Anderson, Department of Agricultural Economics, University of Nebraska, and Cornelius Hugo, Graduate Research Assistant, Kansas State University.

The Team started arriving in Islamabad on October 14 and remained until November 18. The team was given the opportunity to visit many governmental, donor and related agencies in Islamabad.

One week was spent in the Lahore-Lyallpur areas by Pfost and Anderson who were accompanied by Mr. Shaukat Ali Chughtai, USAID, who scheduled meetings with many provincial, university and other agencies. Simultaneously Mr. Wayne Nilsestuen, USAID, accompanied Briggs and Hugo for one week in the Karachi-Hyderabad region. The team visited government agencies, the harbor and numerous storage and processing units.

The team is greatly indebted to Mr. Wayne Nilsestuen, and Mr. Chughtai and USAID/Pakistan for logistical support and professional guidance.

Pakistani agencies which were particularly helpful included the Ministry of Food and Agriculture, the Ministry of Agrarian Management and the Ministry of Finance. The similar agencies at the Provincial levels were also very helpful in furnishing information and providing assistance.

This report is intended primarily to provide guidance in developing a strategy to study and improve the operations of the grain and related marketing system in Pakistan.

I. EXECUTIVE SUMMARY

On July 17, 1976 a "Report of the Special Committee on Development of Foodgrain Storage in Pakistan" recommended the appointment of a "Foodgrains Storage and Construction Coordination Committee." No apparent action was taken until November 10, when Dr. William Wolffer (Acting Director, USAID) and the team visited with Mr. A. G. N. Kazi and Mr. Aftab Ahmad Khan of the Ministry of Finance.

During this time, July to November, there is little evidence of a coordinated approach to solving the storage problems of Pakistan. This was evident to the team because the latest data available to the team regarding storage needs and utilization was contained in a report of the Agriculture and Food Section on "Development of Foodgrains Storages - Priorities and Issues" dated June 29, 1976.

This latest estimate of stocks showed inventories exceeding storage available by about 800,000 tons. If 25 percent of the wheat in emergency storage was lost, this cost the GOP about 200 million rupees to purchase.

Rice is being purchased but we could find no data on total storage available. The Rice Export Corporation has 400,000 tons of the 1975 crop on hand. This unsold inventory could result in 400,000 tons of 1976 rice in emergency storage where it could be subject to heavy losses from weather, insects and rodents.

Wheat production is increasing rapidly due to the success in the agricultural sector - the increase is probably about 500,000 tons per year. The planned construction of 500,000 tons before next harvest will be needed to handle this increase. Extrapolating the government's

estimates of June 29, 1976 through June 1977, a storage deficit of about 800,000 tons of regular wheat storage will exist by June 30, 1977 unless wheat imports are halted immediately.

Construction of the 500,000 tons of storage planned for completion is lagging. The Punjab PWD reported it has received no funds for the 50,000 tons they were to construct. Less than 1000 tons of the 50,000 low cost storage that PASSCO was to construct is underway and there is no good assurance that the structures will be adequate; these are costing over 250 Rs./T rather than the 60 Rs./T originally budgeted.

The first priority, after saving seed for the next crop, is for cotton seed to be processed in expellers at gins. Coleman showed that solvent extraction of cotton seed would yield an additional 50,000 tons of oil. This loss of edible oil represents over 220 million Rupees of additional oil imports needed.

If storage costs were reflected in the purchase price of wheat (that is a time margin for storage were offered to farmers) and if the farmers of Pakistan would store an additional half ton of wheat each and sell it during the year, the government could reduce its storage requirements by over one million tons at a capital saving of about 500 million rupees.

Coordination of storage utilization, multiple use of facilities, can save millions of Rupees. If the Rice Export Corporation can make half of its 700,000 tons of storage available for wheat by July 1, grain storage requirements would be reduced by 350,000 tons, representing a capital saving of over 150 million rupees.

The lack of an adequate grading system fosters delivery of inferior quality products and subsequent adulteration of those of higher quality. Farmers who produce crops of superior quality should be rewarded with price premiums for their efforts.

Grading systems are needed at all levels. If farmers, or others, would add 2% foreign material to wheat, it would cost the government 50 million rupees in 1977 on 2.5 million tons purchased. If farmers market their rice at 19% moisture rather than 17% moisture it would cost the government at least 25 million rupees for water.

Government procurement prices should reflect transportation costs to major consumption centers if long-term dislocation of agricultural production activities with resulting loss of productivity is to be avoided.

The Government of Pakistan should give careful consideration to a consolidation or coordination of all food storage responsibilities within the jurisdiction of a single agency. Such a consolidation would make long-term food storage, processing and distribution planning less costly and more effective. Joint use of storage facilities would be far more feasible and would yield reduced costs through improved utilization of personnel and facilities. Farm inputs should be considered.

Selection of location, type, size and timing of new storage and processing facilities should be made with great care. For the immediate future preference should be given to sites situated on a rail line. Flour mills which have up-to-date equipment, particularly those near rail lines, are prime candidates for an increase in storage capacity. Decisions which can be deferred for a few months can be improved through systematic study of alternatives.

From a technical standpoint, grain storage problems are not particularly difficult in Pakistan. The climate is relatively dry and major grain harvests occur during the dry season. Grain can easily be dried to a low enough moisture level for storage and mold growth should not be a serious problem.

Insect problems are more difficult but proper storage technology for insect control is known and frequently used. Some additional training for grain storage entomologists is recommended. Grain storage technologists should be placed in operating positions in the public sector and in research. Additional emphasis should be given at the farm level by the extension service.

Grain storages in the public sector are generally of very high quality. Consideration should be given to cheaper storages, probably near the farm. Some engineers raised questions regarding design details which could be answered in a relatively short time. Economical designs for bulk storages should be developed if the need is shown by a marketing study.

The extent of farm grain storage losses have not been determined extensively or accurately. Data collection to determine losses is needed. Applied research to develop improved storages to be made from indigenous materials is recommended. The dissemination of information regarding storage technology needs to be expanded.

If farm storage losses in Pakistan are 10% (which is commonly estimated in developing countries and if this could be reduced to 5% by improved farm storage practices at least 300,000 tons more wheat could be sold by the farmers. This represents an export value of at least 300 million rupees.

It is recommended that priority needs for donor assistance include:

1. Aid in planning storage needs -- size and location -- for the second (500,000 tons) phase of the planned public wheat storage.
2. A thorough long range study of the agricultural products marketing structure to minimize costs throughout the system from post-harvest to the consumer. This study should consider farm inputs.
3. Outside consultants might be useful in studying and improving the grading system.
4. Increased government involvement in food marketing activities is precipitating a need for additional skilled people to manage the newly-expanded and centralized activities. Training of entomologists, engineers, food technologists, microbiologists, economists and statisticians is needed.
5. Opportunity exists for improved farm storage structures and operating procedures. This will require some research input, possible some physical material input and considerable extension and educational activity.
6. Major capital investment may be needed in the public sector if present marketing policies continue and if marketable surpluses continue to increase.

II. MARKETING POLICIES

A. Coordination of Government Storage Activities

At least five federal ministries are engaged in planning, construction or operation of food storage facilities. Numerous agencies within these ministries divide responsibilities for various aspects of commodity storage. Agency jurisdictions often overlap, sometimes conflict and are at times poorly defined. More coordination of storage activities is needed from the ministry level down to the smallest government procurement centers. (However, the following first five of these actions are so urgent that they may have to be performed before the coordinating group can be formed).

1. Take immediate steps to determine losses of wheat in emergency storage. Dispose of as follows:
   a. Use rotted wheat for fertilizer.
   b. Sell severely insect or mold damaged wheat for animal feed. There is a shortage of feed grain because of the floods.
   c. Treat salvagable wheat to save it from insects and get it under cover.
2. Obtain data on rice purchases and storage available. Press export sales and other measures as required to insure safety of this crop.
3. Determine how use of storage facilities and processing plans for cottonseed will affect oil import requirements and take immediate action as required.
4. Update data on inventories, storage needs, etc. contained in the report of June 29, 1976 and take action as indicated. This will require action regarding imports, pricing policies and planning for leasing and multiple use of facilities.

5. Determine progress on planning, financing and construction of the storage which will be needed by next wheat harvest.

Longer term function of the coordinating group include:

1. Review the plans for the second 500,000 tons of storage. This review should consider type and design, location and size. Consultants might aid in reviewing and revising these plans.
2. Allocate responsibility for construction and operation of storage facilities.
3. Review fund allocation and construction progress.
4. Plan and coordinate utilization of all facilities suitable and available for the storage of foodgrains.
5. Monitor operation of the system including:
   a. Maintaining and publishing current status of storage utilization.
   b. Forcasting short and long-term storage requirements.
   c. Utilization.
   d. Maintenance of facilities.
   e. Quality maintenance.
6. Aid in coordinating design, location, size and timing of new facilities.
7. Establish short and long-term plans for wheat export.
8. Coordinate establishment and operation of grading systems.
9. Analyze the effect of government policies on the operation and needs for storage.
10. Make long range plans for the most economical system for grain and oilseed marketing. Consider farm imputs.

11. Study the efficiency and use of all storage, processing and grain and oilseed marketing facilities. These include:

    a. Farm storage losses and steps required to reduce them.

    b. The need for agricultural services centers.

    c. Transportation costs and efficiencies.

    d. Most efficient types and operation of processing plants such as flour mills and oil extraction plants.

12. Guide the development of research and extension programs to optimize the operation of the marketing.

13. Plan for the training and development of technical and other personnel.

14. Guide institutional development and linkages.

The exact staffing of the cell cannot be determined at this time. Staff expertise will be needed (or must be available from other sources) in the following areas:

Government administration and policy making.

Economic planning, marketing and statistics.

Agricultural pricing analysis.

Storage engineering.

Processing technology.

Operation of the grain and oilseeds storage and processing system.

B. Multiple Use of Facilities

Responsibility for storage of government-procured stocks of farm products and inputs rests with several different agencies (Section VI-A). Each agency tends to manage its own or leased storage facilities. Since harvest seasons for the various crops are staggered it should be possible

to use the same facilities for storage of two or more crops or inputs. Wheat harvest, for example, occurs in April, May and June, while rice is harvested during November. There appears to be no good reason why both grains cannot be stored at the same site and inside the same structures at different times of the year.

At the local level consideration should be given to coordination of government-supervised distribution of inputs with the procurement of wheat, rice and other products. Since all of these operations tend to be seasonal there is opportunity for improved utilization of management, labor and facilities from a jointly-administered and jointly-housed procurement-distribution arrangement. A network of highly diversified, one-stop farm service centers might be the eventual goal. The centers would be a source of farm supplies, a major first market for farm output and a source of technical assistance. A government extension worker might be housed at each center, or one might be rotated among two or more centers on a regularly scheduled basis.

C. Temporal Price Structure

The Government of Pakistan is a major purchaser of agricultural products. Wheat, rice, cotton and sugar cane are procured directly or indirectly in large measure by the Government. Other crops are purchased from time to time to bolster prices. Prices for those commodities for which there is an on-going procurement program are fixed annually (usually at harvest time) and do not vary during the course of each marketing year.

Announcement of procurement prices at planting time would greatly improve farmers' planning ability. Establishment of a time margin to cover farm storage costs or direct payments to farmers willing to store market grain

beyond harvest would have several benefits. First, additional farm storage would provide additional employment and income to small farmers. Second, encouragement of on-farm storage would relieve the government of the need for construction of large amounts of centralized storage facilities. These facilities cost much more to build and maintain than do the smaller on-farm facilities. Third, gradual marketing of farm production would reduce peak demands on transportation facilities and lower average costs of shipment.

Improved credit extension may be needed if farmers are to take advantage of opportunities for storage income. Any extension of credit must be carefully monitored, however, to insure that loans are repaid.

The Government may also wish to consider making similar time-related prices available to market intermediaries. Alternatively, storage facilities might be leased by the Government from middlemen at fixed rates or at rates established by competitive bidding procedures. Foreclosure of these middlemen from much of their former marketing activities has vacated an undetermined but likely significant amount of storage space.

D. Geographic Price Structure

Government support and procurement prices tend to be uniform for each crop across the entire country even though production and consumption of each crop are far from being uniformly distributed. Resulting distortions in price signals are likely to cause uneconomic shifts in production activities. Transportation costs should be recognized as an important element of comparative advantage.

Procurement prices should be backed off from base prices at major demand centers by costs of transportation to these centers. Commodities for which transportation charges are a relatively high proportion of value of the

delivered product would tend as a result to be produced nearer to their point of consumption. Those for which transport costs are a less critical factor would logically be produced at more distant locations, other things being equal. A study should be made of transportation costs and basic supply and demand factors as a means for establishing basing points and price discounts.

E. Site Selection for Marketing Facilities

It is clear, given likely increases in wheat output during the next few years, along with the need to find replacement facilities for storage formerly provided by arhtis (merchants), that additional grain storage facilities must be leased or built quickly. While location and type of government godowns and bins to be constructed during 1976-77 have already been determined, there is still time for an evaluation of 1977-78 plans. A team of four AID-supported engineers and agricultural economists working with Pakistani counterparts could provide definitive locational and facility-type recommendations after four to six months of study. Such an investigation should be initiated as soon as possible.

In the meantime, consideration should be given to locating new storage or processing facilities on railroad sidings. Access to rail service is particularly important where storage sites are long distances from consumer markets. Construction or new storage space at flour mills appears to have special merit. Personnel qualified to manage a mill are likely well qualified to manage storage stocks. Mills need a reserve of about three month's wheat supply as assurance against transportation bottlenecks; monsoon rains occurring subsequent to wheat harvest make grain transport over many rural roads impossible for extended periods. Since most mills are located in flour-deficit areas storage at the mill gate is unlikely to be out of position. Furthermore, handling charges can be minimized by locating

reserve stocks adjacent to where such stocks are to be milled. Creation of such reserves along with encouragement of increased on-farm storage might sharply reduce the need for large stockpiles at points intermediate between farms and mills. Great care should be taken in selection of mill sites at which storage is to be expanded. Preference should be given to up-to-date mills, especially those having access to rail service.

A thorough study should be made of Pakistan's long-term requirements for additional and replacement storage, processing and transportation facilities. Such a study must account for projected marketable surpluses of each major commodity, costs of constructing and operating alternative sizes and types of new facilities, variable costs of operating existing facilities and transfer costs for all links between farm and consumer. Consideration should be given to costs and benefits of on-farm storage and cooperative farm storage as well as of alternative large-scale government storage schemes.

Such a study might be funded in part or whole by AID and undertaken jointly by AID and the Government of Pakistan. Such a study would require approximately two years of work, occupy the efforts of at least four specialized and highly qualified U.S. investigators and their Pakistani counterparts.

F. Improved Grading System

Generally farmers delivering grain, seeds, cotton or sugarcane to government procurement centers are assessed no price penalty for poor quality products. Nor are they rewarded for providing superior products. The farmer's crop is either accepted, at the official procurement price, or it is rejected as not meeting a set of subjectively measured quality

conditions. Farmers delivering rice not meeting minimum moisture or inert material specifications are, however, afforded the opportunity of having their grain dried or cleaned, for a small fee, by the procurement center staff - a step in the direction of a grading system. Paddy prices also vary by variety, another positive step in recognition of quality.

There is much opportunity for abuse of the system by corrupt procurement officials. Moreover, there is little incentive for farmers to produce and deliver high quality products. In fact, there is an incentive for farmers, middlemen and government procurement and storage officials to add water or other inert material upto the limits of government acceptance. In the absence of strict enforcement of present requirements there are likely to be other abuses: Basmati rice for example, may be mixed with IRRI-6, a rice of similar appearance but of much lower quality. Unless procurement officials are skilled in discerning the difference, the important export market for Basmati rice can be jeopardized.

A careful study should be made of the important quality characteristics of each crop and a grading system devised which accords with technical processing requirements, consumer needs and implementation imperatives. What is most needed is a simple, easily applied, easily understood, yet meaningful grading system. A system of price rewards for superior products would appear to have psychological appeal over a system of discounts for substandard offerings. Farmers are likely to believe they are being cheated under the latter scheme, while a reward is implied under the former.

G. Extension, Teaching and Research Needs

Monitoring of food stocks and their transfer and processing so as to best meet consumer needs requires close supervision by technically trained personnel. The Government of Pakistan has undertaken a large and complex task in its decision to nationalize a large part of the food distribution and processing systems. Many highly motivated and skilled managers have been displaced in the process. Moreover, the task may be larger and more complicated than when it was performed within the private sector. Small farmers and arhtis, for example, can keep grain in condition by primitive but apparently time-tested means such as storage in sealed mud jars, periodic sun drying and use of indigenous organic means for pest control. Keeping large stocks in good condition requires use of another and, in Pakistan at least, less well understood technology.

The Pakistan Government needs to train food technologists and grain storage engineers to work with the Food Departments. Training of engineers and food technologists abroad at places such as Kansas State University in the United States is a high priority need. This is discussed in more detail in Section V.

Agricultural economists specialized in marketing, to work in coordinated planning activities at ministerial level, are needed if longer-term and extremely critical decisions relating to facility location, pricing policies, international trade and the like are to be related to economic criteria.

At the local level many more extension workers are needed. These workers should be trained in the techniques of small and intermediate-scale grain storage. Their expertise will be badly needed if farmers are encouraged to

share in the storage of market grain or if cooperative or government-supervised storage of village-level stocks (the farm service center concept, for example) should be undertaken. Since 70% of the population lives in rural areas it is reasonable to assume that a large amount of food grain does not enter normal cash market channels, preservation of these stocks in good condition is of critical concern in any case. Most grain saved at this level is likely to become part of future marketable surpluses. If additional extension generalists and specialists are to become available the agricultural universities of Pakistan must be strengthened and expanded; their programs should be monitored to insure that the desired results are attained.

H. Product Shrinkage

Government agencies responsible for procurement, transportation, storage, processing and distribution of agricultural commodities are generally required to deliver a unit of product for each unit of product they previously received. Such a policy puts unfair pressure on managers of storehouses, mills and other operations to preserve the weight of products passing through their hands. Rice procured from farmers inevitably loses weight owing to moisture lost during the drying process at the procurement center. Wheat and rice both normally lose weight in the process of milling; the presence of byproducts is proof that the flour and milled rice must weigh less than the grain from which they were milled. Cleaning operations result in further weight loss. Shrinkage caused by spillage, pest damage and the like cannot be eliminated completely.

Requiring a full accounting of all incoming product creates the incentive, even the need, for the handlers of government owned stocks to add inert material to these stocks to bring them up to the required weight. The absence of an effective grading system means there is no penalty assessed for such adultration. It may even be possible for some unscrupulous operators to divert stocks to their own personal use and substitute inert material for the pilfered product. Realistic allowances for normal weight losses along with carefully specified grade requirements through all levels of the marketing system are the solution to the problem.

I. Price Support Policy

The Government of Pakistan should consider the price implications of potential increases in food grains supplies. Such increases may occur on an international scale as well as in Pakistan. In fact, world stocks of wheat and rice have increased substantially during the past year, causing marked declines in world food grain prices.

While present wheat and rice procurement prices appear generally to be in line with world market prices, the government should recognize difficulties inherent in establishing procurement prices substantially above or below world levels. If procurement prices are below world prices, and if farmers are required to sell their crops to the government, farmers will be at a disadvantage, particularly in competing for imported inputs unless subsidized and in world grain markets. Moreover, unless borders with neighboring countries can be sealed (a very difficult task), illegal exports are likely to be prevalent.

If, on the other hand, procurement prices are at a level above world prices, borders must be sealed against imports. Local farmers will be encouraged to produce surpluses and the government will be forced to stock large amounts for extended periods, subsidize sales to domestic consumers, subsidize exports, or some combination of these. Such programs could create a severe drain on the treasury and would tend to overemphasize development of the agricultural sector if continued for any great length of time. It is reasonable, however, that the government should maintain reserve grain stocks to meet needs in time of crop failure or other disaster. Periods of surplus provide opportunity for accummulation of such stocks.

If surplus supplies materialize, as present trends suggest they will, the ration shops may begin to find their business dwindling as consumers take advantage of falling prices on the open market. If the government is to preserve the role of the ration shops it will have to either increase transfer payments to welfare recipients by lowering the price of the atta ration, or prevent competing grain from reaching the open market by keeping its procurement prices higher than prices in the market.

Thus, if world and domestic grain surpluses develop and if the government chooses to establish artificially high procurement prices and to mop up the surplus through whatever means, costs of program operation will escalate. If the government chooses to release its stocks to the open market it will undercut the income redistribution role played by the ration shops.

J. Recommendations for Action Programs

Two major research efforts were recommended to address medium and long-term problems associated with an expanding grain marketing system--problems of site selection, facility type and size, joint utilization of resources and the like. Recommendations for action programs aimed at accomplishing these studies are summarized in Section III.

An AID-supported consultant might aid the Government of Pakistan in establishing the nature and size of recommended temporal price differentials for grain. A single agricultural economist specialized in cost analysis should be able to measure the costs of storing grain and recommend time margins based on storage costs after two to three months of investigation. (Time margins are discussed in detail in the appendix).

Establishing cost-related price differentials associated with spatial separation of production and consumption activities is a more complicated matter. Two consultants skilled in transportation economics could probably provide helpful advice after a visit of two months each. One consultant with academic experience and one with industry experience would be ideal.

AID-sponsored consultants on establishing an effective grading system could be extremely helpful to the government. One agricultural economist specialized in grades and standards is needed to determine what the price differentials should be for alternative grades. The economist might be a university professor or a person with central grain market experience. He/she should have to be thoroughly familiar with both theoretical and practical sides of grain grading. This investigator would need to work closely with a Pakistani counterpart having a close knowledge with institutional problems

likely to be encountered in implementing alternative grading schemes. The study would require two to three man-months of consulting time. (Grading discounts are discussed in the appendix).

A consultant to aid in establishing logical shrinkage allowances for the various grain handling activities is recommended. A single agricultural engineer specialized in grain milling and storage could accomplish the task in two to three months. A Pakistani counterpart would be highly desirable.

An agricultural economist specialized in farm policy should be brought in to assist in establishing rational price support levels. Half or more of the consultant's effort should also be aimed at training Pakistani price policy makers in implications of alternative price policies. A one to two month task is indicated.

The AID mission should follow up to see that the Coordinating Commission is in fact organized and functioning (Section I-J).

III. PLANNING MARKETING SYSTEMS

A. Introduction

The transitional period through which Pakistan seems to be going requires that closer attention be given to some agricultural commodities than to others. It is apparent that the Government is concerned with (1) reaching self-sufficiency in wheat which is the major food grain and ultimately becoming a net exporter (about one million tons of wheat is being imported annually), (2) rice and cotton (major foreign exchange revenue sources), and (3) edible oils (short in supply and supplemented through imports).

B. Present Marketing Channels for Wheat, Rice, and Cotton

The understanding of the present marketing situation and process for the above mentioned commodities as well as possible implications of the nationalization of rice and flour mills was attained by implementing a simplified marketing analysis.

1. A marketing analysis approach:

General marketing analysis is beneficial in several ways, some of these include:

a. Understanding the overall marketing process.

b. Understanding the marketing functions of those involved in the marketing process.

c. Determining the degree of effectiveness.

d. Determining the degree of efficiency.

e Determining logical places within the marketing system where required information for planning purposes can be gathered.

Due to the briefness of this visit and the apparent lack of information required for such a study all of the above stated objectives could not be satisfied. However, an attempt was made to describe as fully as possible the first two steps of the above outline for wheat, rice and cotton.

Generally a useful approach for understanding the complexities of the existing marketing channels is to set up a flow diagram showing the linkages within the marketing system for each commodity.

This approach is a simple and straightforward method for describing:

a. Private and public involvement and practices.

b. Direction of flow and intermediate links.

c. Volume by participant.

d. Prices at intermediate links.

e. Interrelated changes of points one through four over time.

The following is a brief and elementary description of the existing marketing channels for wheat, rice and cotton.

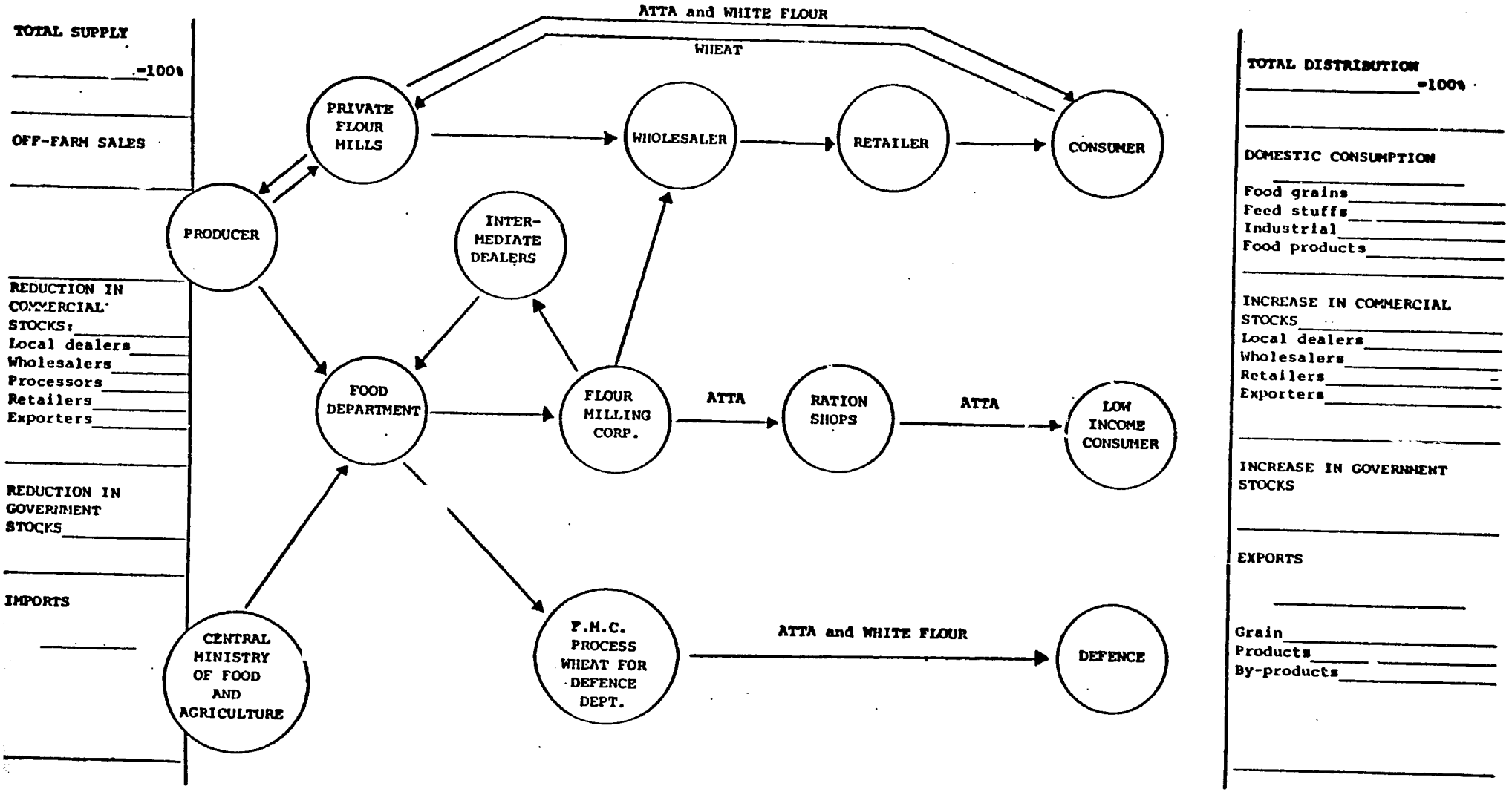
2. Wheat Marketing

Figure III-1 shows the present marketing channels for wheat.

In Pakistan, wheat is cultivated mainly on irrigated land, however, some of it is also produced on dryland. The majority of wheat (8,500,000 tons produced in 1976, government estimate) is cultivated and thrashed by animal and human power. At the farm level wheat is loaded into bags and transported by donkeys, camels and bullock carts to the nearest market or government purchasing center. Trucks and tractors are used only to a very limited extent. Handling and transportation costs are borne by the producer.

When the wheat arrives at the market is is sold either to dealers, commission agents or the Food Department. The wheat delivered to the

FIGURE III - 1. MARKETING CHANNEL NETWORK FOR WHEAT



market is generally piled in heaps on the ground or on brick floors. There the wheat is examined, weighed, and rebagged; the producer pays the full costs of these services. The wheat is placed in "godown" type of storage with little conditioning or treatment. The private dealers in turn sell their wheat to consumers, private flour mills or to the Provincial Food Department which stores it in public godowns.

The Central Ministry of Food and Agriculture is in charge of supplementing national production of wheat through imports. The Ministry allocates the imported wheat to the four provinces. It is estimated that 300,000 to 500,000 tons of wheat will be imported during fiscal year 1976-77.

The Food Department allocates both imported and native wheat to the Flour Milling Corporation (FMC) for processing. The FMC charges the Provincial Food Department Rs.3/maund for processing wheat into atta and white flour. Atta, which is considered an inferior good, is distributed through licensed ration shops in urban areas to low income groups. Atta is bagged into the same bags the wheat came in. These bags are cleaned before the atta is put into them. As of now no processing costs for the flour mills are available.

Some domestic wheat is procured, processed and distributed through private channels. Consumers may bring their own wheat or wheat purchased from farmers or dealers for custom milling to a private mill.

Some mills have been set aside to supply the requirements of the Defense Department for atta and white flour.

Observations:

- Credit binds between farmer and dealers lack adequate grading standards and other factors force many producers to accept less than the stated government support price of Rs.37/maund.

- Ration shops are allowed only a small margin to cover transportation costs. Since they keep the bags, much of their profit comes from the sale of these bags.

- An estimated bumper crop of 8.5 million tons of wheat for 1976 (government estimate) and projected government purchases of 2 million tons plus 1 million tons of imports has clearly overtaxed present government storage facilities (1,152,770 existing storage facilities in May 1976). This led to a peak deficit capacity in July 1976 of 781,000 tons.

- According to government figures present public storage capacity will be almost full by the time of the 1977 harvest.[1/]

- An apparent lack of coordination between the Food Department and the Flour Milling Corporation has in certain cases led to storage of large quantities of wheat under tarpaulins in various emergency storages and outside available storage within flour mills. (See technical section for further observations relating to condition of wheat in emergency storage).

- According to the Secretary of Food in Sind, Mr. M. M. Usmani, 10 percent of imported wheat is consumed in Sind and the rest is distributed to the other three provinces. It can be concluded that under such conditions a tremendous amount of wheat crosshauling is taking place.

- According to estimates of the FMC in Sind, they now have an excessive amount of overcapacity for milling (See Table III-1).

[1/] Development of Foodgrain and Storage Priorities and Issues, June 29, 1976. Government of Pakistan, Planning Division, Agriculture and Food Section.

TABLE III-1

REQUIREMENTS OF RATION ATTA & MAIDA AND
AVAILABLE MILLING CAPACITY IN SIND

S. No.	District	Population (Lacs)	Ration Atta requirements (TONS)		Maida requirements (TONS)		Daily capacity of mills in 2 shifts/16 hours			
			Daily	Monthly	Daily	Monthly	Units	Taken Over	Units	Open
1	2	3	4	5	6	7	8	9	10	11
1.	Hyderabad	22.07	262	6800	20	520	6	757	2	100
2.	Dadu	8.07	38	978	7	182	-	-	-	-
3.	Thatta	6.74	28	743	4	104	-	-	1	40
4.	Mirpurkhas	10.00	32	819	7	182	1	100	-	-
	S. Total	46.88	360	9340	38	988		857		140
5.	Sukkur	13.68	117	3043	25	650	3	350	5	280
6.	Khairpur	7.17	26	667	8	208	-	-	-	-
7.	Larkana	9.22	28	720	8	208	-	-	1	60
8.	Jacobabad	6.94	28	724	6	156	-	-	-	-
9.	Nawabshah	13.41	28	712	8	208	1	150	-	-
10.	Sanghar	6.81	23	584	6	156	1	140	-	-
	S. Total	57.23	250	6450	61	1586		640		340
11.	Karachi	35.89	1000	28000	150	4000	23	4040	11	788
	TOTAL	140.00	1610	43790	249	6574	35	5537	20	1268

Conclusion: Daily requirements of Maida & Atta is 1859 tons against available capacity of 5537 tons with 1208 tons capacity private sector.

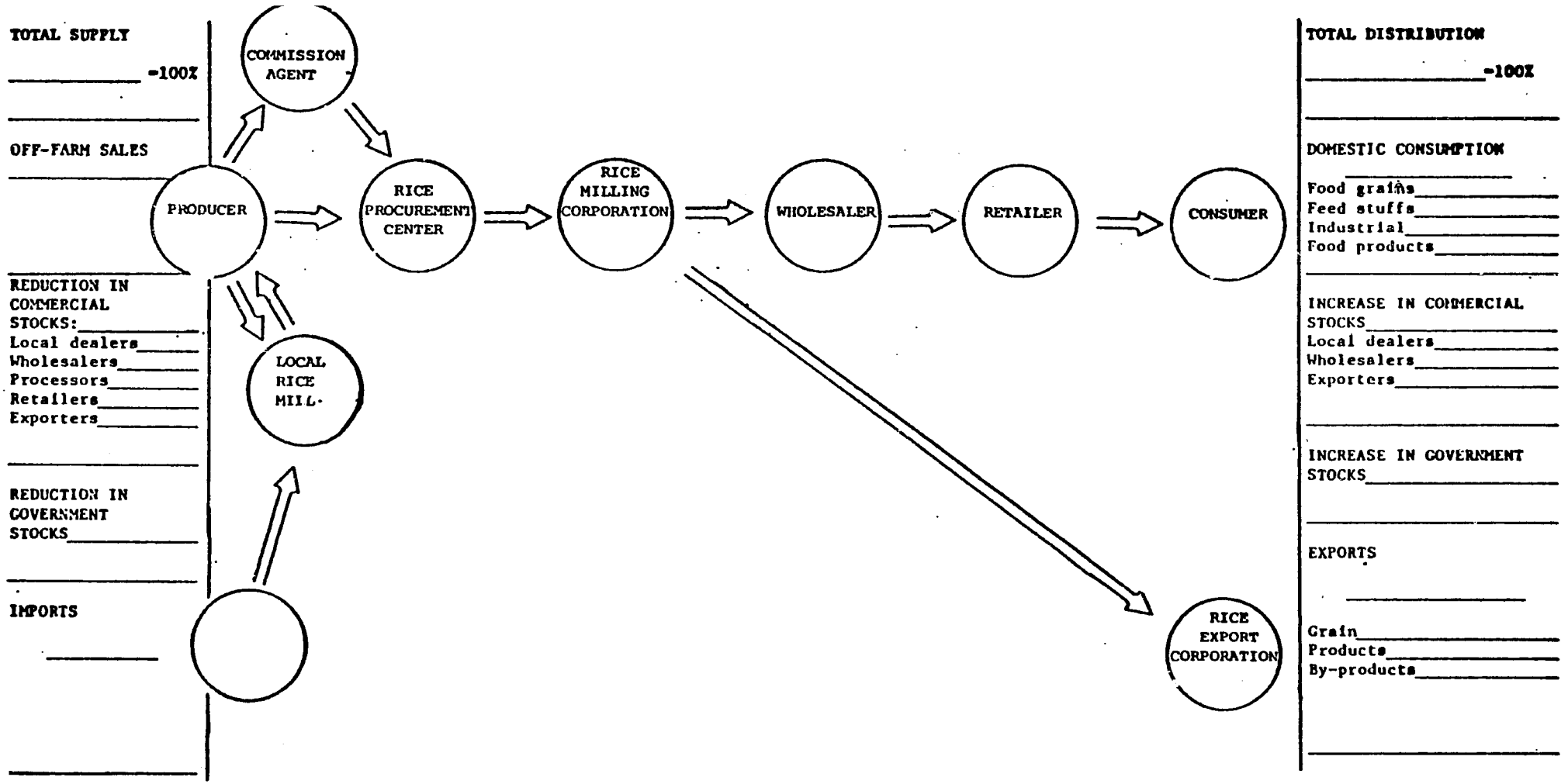
3. Rice Marketing

Figure III-2 shows the present rice marketing channels.

All marketable rice surpluses in Pakistan must, by law, be sold to the Rice Milling Corporation, an agency under the control of the Ministry of Agrarian Management. The government owns 504 rice mills in Punjab. There are another 296 very small privately owned mills in Punjab which mill paddy for farmers for their own use. Middlemen have been authorized to act as commission agents in the rice procurement process, but cannot buy for their own accounts. Commission agents are paid .70 Rs. per maund by the government for their services; in addition, they are permitted to charge farmers a negotiated rate for any transportation provided. Farmers may also deliver their paddy directly to the government's procurement centers.

The first point of producer or commission agent contact with the government is at one of the government's 301 rice procurement centers, (Punjab 127, Sind 174). Some procurement centers are located at mill sites others at sites leased from private owners. As recognition of transportation costs, farmers delivering grain to a mill gate are paid .50 Rs. per maund more than those delivering to the regular procurement centers. Farmers deliver paddy either in bulk or in their own bags; the paddy is dumped on the receiving floor. Paddy must meet minimum moisture requirements and meet foreign material specifications; rejected grain can be dried or cleaned at the center by the deliverers or the tasks will be performed by the center staff for a minimal charge.

FIGURE III - 2. MARKETING CHANNEL NETWORK FOR RICE



There are no discounts for moisture or other quality considerations except rice variety. Basmati, regarded as the most desirable variety, brings the highest price (Rs. 52/maund); other varieties are priced lower (Table III-2). It is important that procurement officials be skilled in varietal identification since some varieties, e.g. Basmati and IRRI-6 are similar in appearance but not in quality.

Once accepted by the procurement centers the paddy is bagged (government bags) and weighed and the farmer receives a check for the full amount of the sale. The farmer must go to a bank to obtain his cash. The paddy is then emptied from the bags and sun dried for a time on the floor provided for that purpose. When sufficiently dry it is rebagged, shipped (usually in privately-owned trucks) to the Rice Milling Corporation where it is stored and later processed into milled rice. Rice milled for domestic consumption is sold to consumers or to dealers who resell it to consumers or to retail merchants. Rice designated for export, primarily Basmati and other higher quality varieties, is sold to the Rice Export Corporation, an agency within the Ministry of Commerce. Rice bran is sold either to operators of privately-owned extraction plants for soap stock or sold to feed manufacturers; no use is made of the husks.

The Rice Export Corporation which started functioning in August 1974 is responsible, on a monopoly basis, for exporting rice from Pakistan. The following rice varieties are being exported:

1) Basmati PAK-10 (well cleaned) - 10% brokens
2) Sela Basmati (Parboiled)- 10% brokens
3) IRRI-6 (Punjab)- 10% brokens

4) Sind white rice - 20% and 40% brokens

5) Sind parboiled rice - 30% brokens

6) 100% broken white rice

The Rice Export Corporation buys rice from the Rice Milling Corporation, then cleans and refines it to satisfy international standards. This Corporation has places for constructing 12 rice mills to process rice for export purposes. The Rice Export Corporation deals mainly with other governments but also with international grain firms.

Declining rice prices during the past marketing year discouraged the Rice Export Corporation from selling its stocks. By early November, 1976 it reported 400,000 tons of milled rice in storage.

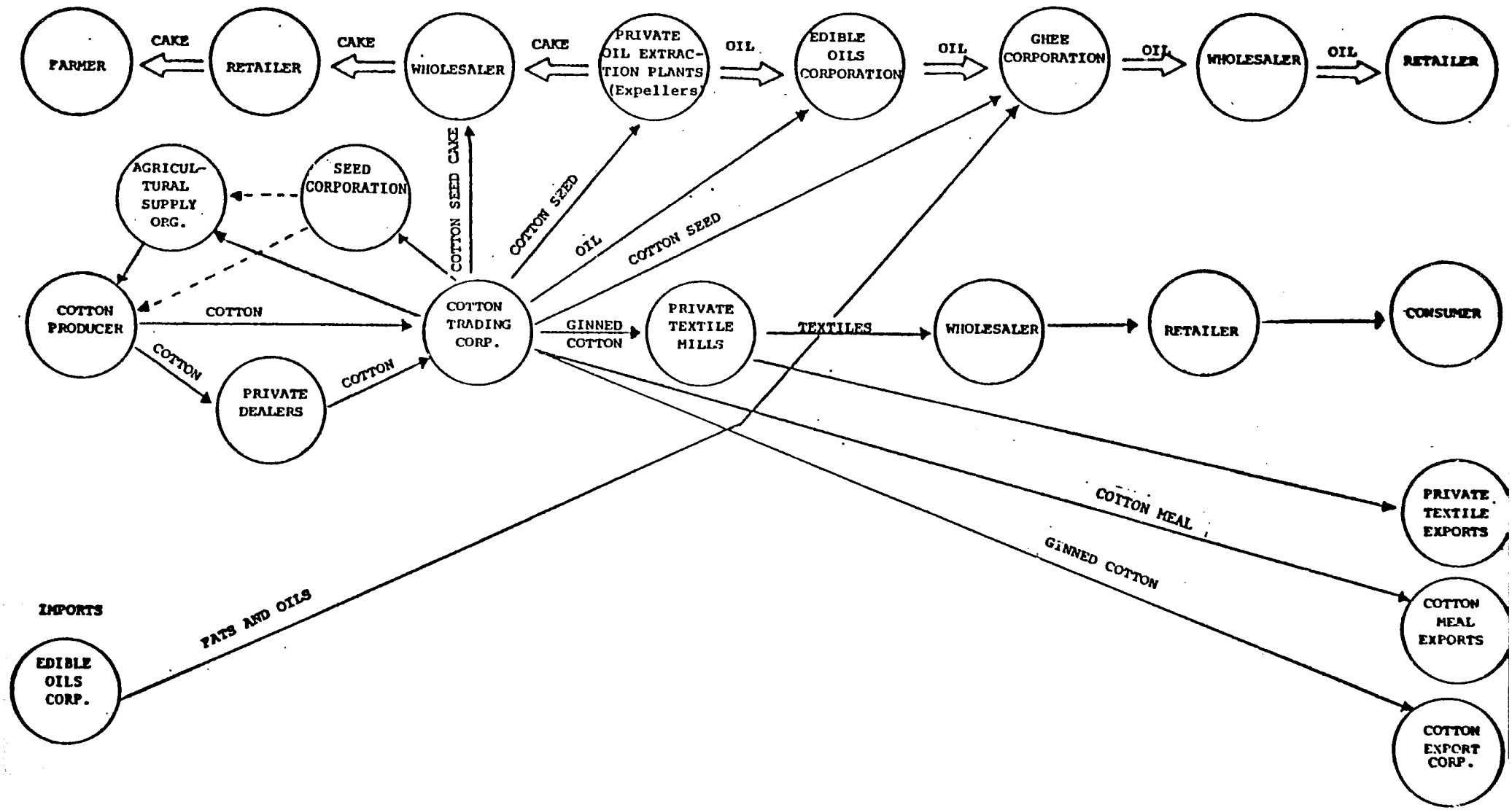
4. Cotton Seed Marketing and Related Products

Figure III-3 shows the marketing channels for cotton and cotton products. Several public corporations deal with the marketing functions.

The Cotton Trading Corporation (CTC) has the responsibility of operating the nationalized gins and is the sole purchaser from cotton producers and intermediate dealers. Of a total of 570 nationalized gins only 280 are operating. Some of those not operating are used as storage places for raw cotton. Some were used for temporary storage of the 1976 wheat crop. Some of the CTC immediate tasks are:

1. Reorganization and improvement of the gins.
2. Reallocation of gins from surplus capacity areas to deficit capacity areas.
3. Provide drying platforms in all gins.
4. Provide improved storage for seed cotton.
5. Designate certain gins for seed processing only.

FIGURE III - 3. MARKETING CHANNEL NETWORK FOR COTTON AND BYPRODUCTS



Since the nationalization in July 1976, CTC has been preoccupied with reorganizing and improving the gins. Excess ginning capacity has led CTC to shut down nearly half of the existing gins. About 25% of the gins are obsolete and in need of major repairs.

In order to decrease the number of idle gins, CTC is planning to reallocate some of them to deficit capacity areas. Secondarily, the Corporation hopes to eliminate intermediate dealers by establishing government purchasing centers; and idle gins will be relocated in those centers where possible. The ultimate goal is to reduce the distances between farms and gins to 10 to 20 miles so that cotton producers will be able to bring their product to the market without having to go through an intermediate dealer.

Another major problem that CTC is trying to aleviate deals with the procurement, processing and storage of seed. Now the provincial agricultural departments are responsible for selecting the growers who will produce cotton for seed purposes. After the cotton has been delivered to the gins it takes the Seed Certification Laboratory 10 to 15 days to determine the quality and purity of the seeds. This represents quite a hindrance for normal operations of the gins. Moreover, some of the lots available for seed are very small which makes it uneconomical to process them. After ginning Sind Agricultural Supply Organization (SASO) and Punjab Agricultural Supply Organization (PAASO) pick the seed up for storage and delivery to cotton producers.

In order to relive this problem, the Seed Corporation has been established (will start operations in 1977) which will select growers for seed production within a designated area. Their aim is to purify and certify the seed as well as to guarantee its quality. It will also multiply seed on its own farms.

Finally, in cooperation with CTC, a plan will be worked out to designate certain gins for seed processing only. This will relieve many gins of having to process seed and allow them to gin cotton for commercial needs only.

Another new corporation, the Edible Oils Corporation (EOC) has been created to allocate the seed after ginning to the solvent extraction plants as well as public and private oil expellers. The oil extracted is turned over to the GHEE Corporation for further processing and distribution.

The responsibilities of the EOC are as follows:

1. Local oil procurement from private and public oil producers.
2. Develop or introduce new processes and achieve better oil extraction rates from available oil seeds.
3. Develop new oilseed crops in coordination with IRC and Provincial Agricultural Research Institutes.
4. Meet remaining deficits by imports.

Finally, in order to increase oil production, instructions have been issued by the government to maximize production capacity and output of solvent plants.

Ginned cotton (lint) is either sold by CTC to private textile mills for further processing or turned over to the Cotton Export Corporation (CEC) which handles all cotton exports. This corporation has its own storage facilities in Karachi. The textile mills either sell their products in the domestic market and/or export it privately.

Finally, at the present time, only cotton meal and rape meal are being exported. Cotton seed cake is not processed any further and is sold by CTC in the open market. Farmers now feed cotton seed cake to their ruminants and do not show any willingness to switch to cotton meal.

The brief description of the marketing channels for wheat, rice and cotton satisfy points 1 and 2 made under the marketing analysis section. It is apparent that the other major points could not be covered in such a short time. Further research and analysis is necessary for any short-run and long-run planning.

C. Medium-Run Planning and Manpower Requirements

Due to the sudden increase in wheat production and subsequent marketable surpluses which have led to an acute shortage of storage space as well as the marketing changes brought about by the nationalization of rice and flour mills. The government of Pakistan decided to construct one million tons of extra storage capacity for wheat alone over the next 2 years (½ million tons for fiscal year 1977 and another half million for 1978).

Since the selection of size, type (some questions remained to be solved in this area, see technical part of the report), the location for the 1977 construction phase have been decided and construction has started in some places the only immediate contribution that can be offered remains within the engineering requirements (see technical part of the report).

It seems feasible and desirable that closer consideration be given to the size, type, location and proportional distribution of the tonnage for the second phase of construction. It is recommended that for this purpose the following consulting specialists should be brought in on a TDY basis:

- one construction and storage engineer
- one transportation specialist
- one marketing specialist
- one economist familiar with the system approach to economic analysis.

The following are suggestions regarding Pakistani counterparts:

1. The consultants should be provided with Pakistani's counterparts who are familiar with the situation.
2. The team of counterparts should be selected and organized as soon as possible and start gathering the required information before the consulting team arrives. This will speed up the work and may help discover possible deficiencies in the data which may have to be improved.

The following is a suggested work plan for the Pakistani's counterparts and subsequent work with their foreign consultants:

Construction and Storage Engineer:

- Gather and summarize current construction plans and engineering details for the proposed government storage.
- Develop questions and suggestions as to possible construction design changes.
- Determine quality of existing storage structures for foodgrains and oilseeds both in private and public sector.
- Gather information on construction costs.

Transportation Specialist

- Gather information about existing and planned transportation facilities, their quality and availability throughout the year (roads, railway).
- Establish linkages of the existing transportation network.
- Gather transportation data including:
  - modes of transportation and where they are used.
  - share of total quantity transported.
  - freight charges and/or costs.
  - minimum, average, and maximum distances traveled.

Marketing Specialist

- Gather production projections of wheat by district.
- Gather consumption projections of wheat for rural and urban population by district.
- Determine marketable surpluses of wheat by district.
- Determine the amount of flow of wheat and timing from surplus to deficit district and from deficit to surplus (spedivically wheat 591).
- Determine type, size, location of existing storage and processing facilities.
- Determine effectiveness and efficiency of existing storage and processing facilities (Costs and margins).
- Determine price of wheat (public and private) by variety and season.
- Determine present and future government policies with respect to wheat.

Systems Analyst

- Review past considerations given by the government as to the size, type, location and proportional distribution of storage capacity for the first ½ million tons.
- Evaluate the adequacy of total projected storage availability for wheat.
- Use given or adapted system analysis to optimize size, type, location and distribution of the government's next ½ million tons of planned wheat storage.
- Analyze the possibility of multiple use of storage facilities.

Access to a computer should be made available in case computer analysis is required. The consulting team should arrive early in 1977. It is estimated that four to six months will be required for the job.

It is clear that priority should be given to the problem of size, type, and location of the second phase of wheat storage construction. However, this exercise can serve as an excellent stepping stone for the recommended country-wide master plan for food grains, oilseeds and agricultural inputs. Therefore, the Pakistani counterparts should be selected on this basis, their capabilities and willingness to commit themselves for a subsequent long-run project.

Finally, it is recognized that time available is very short and, if such a study is to be made immediate action is required.

D. Long-Run Planning Requirements

In years past, Pakistan has undertaken a major and apparently successful effort which is changing their traditional subsistence agriculture into a market oriented agriculture.

This ongoing change which involves a growing urban population and an increasing per capita income can be characterized by some general factors affecting the evolution of an adequate marketing system for agricultural commodities as well as agricultural inputs. Some of these factors are:

1. Production of food crops (specially foodgrain) becomes a priority sector in development plans.
2. Public and private capital is going into farming and marketing to help increase the growth of food crops.
3. Surpluses may appear.
4. Marketing and distribution constraints become apparent.

With an increasing proportion of the country's food crops needing to go to urban areas and more production available for the commercial market, certain kinds of problems become evident. A general expansion of the marketing system is needed, requiring among other things improved and expanded facilities and services. Some of the problem areas include:

1. Product losses in marketing
2. Quality standards for agricultural outputs and inputs
3. Storage to meet expanded production
4. Processing requirements to meet increasing marketable surpluses
5. Transport, farm-to-market roads
6. Marketing credit and other services
7. Market information, research and analysis

The above mentioned problem areas need immediate attention for any rational and continuous long-run planning in order to cope with increasing storage, processing, and transportation requirements for foodgrains and oilseeds in Pakistan.

Recommendations

In order to deal effectively with a country-wide master plan the following recommendations should be seriously considered:

- An efficient and open coordination of existing government agencies involved in the procurement, storage, processing, and distribution of foodgrains, oilseeds and agricultural inputs as well as those agencies and contractors involved in building storage facilities.
- Creation and staffing of a planning department with experienced and capable individuals and necessary equipment for country-wide planning of future storage, processing, and transportation needs for foodgrains, oilseeds, and agricultural inputs. This

department should also take into consideration multiple uses of existing and future storage facilities.

- Creation and implementation of an information center within the above mentioned department for efficient improvement of quality, availability and utilization of required data among all government agencies involved in foodgrain, oilseeds, and agricultural inputs marketing as well as the respective donor agencies.

As mentioned before some of the above mentioned considerations apply also to medium-run planning activities.

An Approach to Long-Run Agribusiness Planning and Development

Over the last 6 years, Kansas State University has developed a computerized package for improving agribusiness development in developing countries. The system is based on a rational step by step approach to determine: (1) future demand for agricultural products; (2) potential supply of agricultural products; (3) transportation networks; (4) optimum shipping patterns; (5) economic feasibility analysis (6) economic impact analysis; (7) financial analysis; (8) master plan.

The following is a brief outline of the step-wise implementation of this systems approach:

1. Demand Projections for foodgrains are developed with the Master Projection Program using natural logarithmic functions to reflect projected growth rates for urban and rural populations, changes in per capita income, income elasticity coefficients, economic, cultural, and commercial factors affecting location and changing taste patterns. The computer program facilitates projections by district as well as by province, regions and nation-wide.

2. Supply Projections for agricultural products and inputs are developed with the Master Projection Program using exponential functions to reflect domestic production factors (areas planted, yields harvesting and marketing practices, milling rates, etc.) as well as import factors. The supply projections provide subtotals by district, province, regions and nation-wide.

3. Transportation Network for highway, railroad and internal waterway transport is developed with the Network Generator Program reflecting the existing and planned transport system links. The program provides assurance that all modes (supply, demand and transfer points) are properly connected and that least-cost routings are used in the network.

4. Optimum Shipping Patterns are developed from the Recursive Linear Programming Transportation Model, using as input the projected output from the three previous computer programs. The output from this program provides information for determining (1) the number, locations and capacity of storage, handling, processing and transportation facilities by type, (2) projected seasonal and annual operating volumes for each facility, and (3) total transportation costs for the projected volumes.

5. Economic Feasibility Analysis is made using internal Rate of Return Cash Flow Analysis Program. The needed input by projected accounting period for capital costs, working capital requirements, operating revenues and operating costs are developed by careful analysis on basis of the computer outputs and the appropriate design criteria, unit costs and operating

practices in the country. This computer program produces the internal rate of return, the net present values and fully-discounted benefit-cost rations for each facility and for the recommended system of facilities as a whole.

6. Economic Impact Analysis is made using the Cash Flow Analysis Program to measure the direct rate of return, the associated rate of return and/or social rate of return for the recommended program. The analysis is made before and after project program to determine the projected net impacts of the recommended facilities upon the country's consumers and producers.

7. Financial Analysis of the proposed facilities under the proposed program are made using the Proforma Financial Analysis Program. Input for the computer program is provided by the economic feasibility analysis, by the analysis of accounting information for existing operations, and by expected terms of financing for the proposed program. The output includes projected depreciation schedules, projected operating statements, proforma source and application statements and proforma balance sheets by accounting period over the planning horizon of the proposed program.

8. Master Plan is developed on the basis of the results from the computer analysis, particularly those from the feasibility analysis, the impact analysis, and the financial analysis.

The above package for a computerized system approach for long-run marketing (agribusiness) planning and development is generally implemented and continuously updated to reflect institutional and developmental changes as required.

It is highly probable that the technical expertise required for such a planning exercise will have to be provided by one of the donor agencies.

However, USAID Mission to Pakistan should consider the possibility of hiring an economist experienced in foodgrain storage and use this position as a basis for medium and long-run foodgrain storage planning program with the Pakistani government.

IV. PRIVATE STORAGE

A. Farm Storage

The traditional farm-village storage is a small mud-dung, straw-reinforced structure. The mixture of mud and straw is formed into a wall about one inch thick. Capacities may reach one ton but most probably hold 100-200 kg. They are provided with a hole for filling at the top and a smaller hole for emptying at the bottom. The holes are closed and sealed with mud to prevent the entry of insects. Since relative humidity is generally low, mold development should be minimal.

The structures are not rodent proof and one farmer reported that rats had entered one of his bins.

Little data is available regarding losses in the traditional storage bins. Limited data (1-2) Table A IV-1, which has been collected, indicate that insect-damaged wheat kernels probably average about 10% which should yield a weight loss of about 2%. Four experienced entomologists were interviewed and they concur that the data is probably correct.

However, team members found some grain in one mud storage which had been destroyed (for human food) by insects.

The team visited one large farm (50 acres) where seed wheat was stored in sacks in a building constructed of fired brick walls with a traditional mud roof. The building walls had been sprayed with malathion before harvest. The building had been fumigated twice in the period (about 6 months) since harvest. About 30% of the kernels showed insect damage. The loss of weight would not be high but the loss of viability would be great.

One sack of wheat at a small farm had been treated with DDT and showed slight insect damage. The same farmers reported that mercury compounds were also used to treat wheat. Obviously, the use of DDT or mercury compounds to treat grain is a great health hazard.

A program to educate farmers on the safe use of safe insecticides is obviously needed. Malathion would be a much safer insecticide and some fumigants probably could be used safely in the mud bins in the house.

Farmers in Pakistan report the use of natural materials as insect repellents. In one area the leaves of a tree (probably chinaberry) are mixed with wheat. In another area of the country farmers burn the leaves of a native plant in their storages. These practices are of unproven value but might well be investigated further to determine the value of these practices. It might lead to the discovery of a new natural insect repellent.

B. Merchant Storage

Grain merchants in public markets were visited. Storage conditions were fair, and samples of grain and oilseeds showed little sign of losses. Merchants reported the spraying of walls and the use of fumigants, mostly phostoxin. Losses observed agree with data published by Qayyum (1), Table A IV-1. Merchants in Gujar Khan reported having about 400 T of storage each.

One custom flour mill visited had very poor sanitation. Since these mills stock little grain the overall loss is probably small.

C. Other Studies

In a study conducted by Adams (2) of Tropical Stored Products Institute for FAO in 1975 be observed little loss. However, he visited the country just after wheat harvest before losses would be evident.

Adams expressed the opinion (it is not in the report) that some insects are probably becoming resistant to lindane and malathion. This needs to be investigated.

Adams also recommended that wettable powders be used for spraying structures. The emulsion forms soak into the masonary and there is no residue to contact and kill insects after the initial application.

The Entomology Department of the Agriculture University at Lyallpur has conducted a major study of stored grain insects under a PL-480 fund grant. This study has been confined primarily to the biological area and of laboratory types of studies.

Because of the large amount of grain stored on farms it is recommended that a study be made to determine the extent of farm storage losses. (It would be desirable to bring Adams back in Feb-March to restudy grain losses before proceeding with a year of loss study). This study should be conducted over a period of at least one year. Methodology for farm loss studies is not well developed. The Tropical Stored Products Center (Tropical Products Institute) has made pilot studies in Africa under the supervision of Adams. The Nutrition Section of AID in Washington has initiated a research project to last for two years and study losses in Africa. Pakistan might be a place where the AID project could conduct some of its work.

D. Recommendations for Possible Donor Inputs

A study of farm and private grain storage losses rates a high priority. This work should be carried out under the direction of some group or person who has a good methodology developed or developing. It might be carried

out under the supervision of Adams of Tropical Stored Products Center with British sponsorship. Estimated personnel requirements are:

1. Grain storage loss specialist (probably an entomologist) --6mm
2. Pakistani entomologists --24mm

Insect resistance to important insecticides and fumigants needs to be checked. The Entomology Department of Agriculture University, Lyallpur should be equipped to handle this. Estimated consultant time required is 2 man months.

The farm and private grain storage loss survey may disclose two areas of further need for support:

1. The need for research to improve farm grain storage structures using indigenous materials.
2. Extension efforts to improve grain storages and management.
3. Minor material inputs to farmers to improve storages.
4. A system to supply farmers with effective and safe insecticides.

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Incidence of Insect Pest Attack on Stored Grain in Different Parts of Pakistan During 1973

Sl. No.	Locality	Commodity stored	Type of godowns	Insect pests recorded	Percentage Infestation
1.	Multan	Wheat (maxi-pak) and desi varieties	Government godowns: House type Binns.	Minor infestations due to, Tribolium castaneum, Trogoderma granarium and Rhizopertha dominca	1-2% 1%
			Private godowns	T. castaneum, R. dominica, S. oryzae, T. granarium and Sitotroga cerealella	8-15%
		Rice (Fine varieties)	Private godowns	S. oryzae, T. castaneum, S. cerealella and R. dominica	5-8%
		Cram and other pulse seeds	Private godowns	Callosobruchus chinensis and Callosobruchus maculatus	2-12%
		Maize	Private godowns	T. castaneum, S. cerealella and R. dominica	8%
2.	Bahawalpur	Maize	Private godowns	T. castaneum and S. oryzae	2-4%
		Wheat	Government godowns (bins)	T. granarium and T. castaneum	1%
			Private godowns	T. castaneum, R. dominica, T. granarium & S. cerealella	6-8%
3.	Rahim Yar Khan	Rice	Private godowns	T. castaneum	5%

	Wheat	Private godowns	T. granarium, R. dominica and T. castaneum	3-10%
	Maize	Private godowns	T. castaneum, R. dominica and C. chinensis	4-6%
	Gram and other pulse seeds	Private godowns	Callosobruchus spp.	10%
4. Rohri & Sukhur Wheat		Private godowns	T. castaneum, T. granarium, R. dominica, S. cerealella and S. oryzae	10-16%
		Government godowns House type Bins	T. castaneum, T. granarium and F. dominica	2%
	Rice	Private godowns	R. dominica, S. oryzae and T. castaneum	4-6%
	Maize and Sorghum	Private godowns	S. cerealella, T. castaneum R. dominica	3-12%
	Pulses	Private godowns	C. chinensis and C. analis	7-10%
5. Hyderabad	Wheat	Private godowns	T. castaneum, R. dominica and T. granarium	4-10%
		Government godowns	T. granarium, T. castaneum	1-1.5%
		House type Bins	and T. castaneum	1%
	Rice	Private godowns	T. castaneum, S. oryzae and R. dominica	4-6%

	Gram	Private godowns	Callosobruchus spp.	3-7%
	Maize & Sorghum	Private godowns	C. chinensis, S. cerealella and S. oryzae	1-10.5%
6. Mirpurkhas	Wheat	Private godowns	T. castaneum, T. granarium and S. oryzae	2-5.3%
		Government godowns (Bins)	T. granarium	0.5%
	Sorghum	Private godowns	S. oryzae and R. dominica	6%
7. Karachi	Rice	Government godowns	T. castaneum, S. oryzae and R. dominica	1-3%
	Wheat	Government godowns	T. granarium, T. castaneum and R. dominica	1-1.5%
		Private godowns	T. granarium, T. castaneum and R. dominica	3-15%
	Gram and Pulses	Private godowns	C. maculatus and C. analis	2-8.5%
8. Hasanabdal (Campbellpur)	Gram	Private godowns	C. chinensis	4.3%
	Maize and bajra	Private godowns	S. cerealella, S. oryzae and T. castaneum	1-8.2%
	Rice	Private godowns	S. oryzae, T. castaneum and S. cerealella	3-8%
	Wheat	Private godowns	T. castaneum, T. granarium, S. cerealeila and R. dominica	8%
		Government godowns	T. granarium and T. castaneum	1%
		House Type Bins		0%

9.	Yusufwala (Sahiwal)	Maize	Farm godowns	Heavy infestation due to S. cerealella, T. castaneum and minor infestation due to R. dominica	In old stock 38-46% In new stock 4-8%
10.	Mianwali	Gram	Private godowns	C. chinensis and C. maculatus	4-12%
		Wheat	Private godowns	T. granarium, T. castaneum and R. dominica	3-10%
11.	Sargodha	Wheat	Private godowns (Bag storage)	T. castaneum, R. dominica and	3%
			(Bulk storage)	T. castaneum	2%
		Gram		C. maculatus	3-5%
12.	Lahore	Wheat	Private godowns	T. granarium, R. dominica and S. oryzae	2.5-7%
		Rice	Private godowns	S. oryzae	4.5%
13.	Rawalpindi	Rice	Private godowns	R. dominica, T. castaneum and S. cerealella	8%
		Wheat	Private godowns	T. castaneum, T. granarium, S. oryzae and R. dominica	5-6%
		Gram, Moong and Mash	Private godowns	Callosobruchus spp.	7-8%
14.	Gujranwala	Wheat	Government godowns	T. castaneum, T. granarium, R. dominica, S. oryzae	1.5%
			Private godowns	R. dominica, T. castaneum, S. cerealella, S. oryzae and T. granarium	10-15%

		Rice	Private godowns	S. oryzae, S. cerealella and R. dominica	6%
15.	Sialkot	Rice	Local grain market dealer godowns	S. cerealella, T. castaneum and S. oryzae	2-4%
		Pulses	Private godowns	Callosobrushus spp.	3-9%
		Wheat	Government godowns	T. granarium, T. castaneum and R. dominica	1.5%
			Private godowns	T. castaseum, S. cerealella, S. oryzae, T. granarium and R. dominica	6-15%
16.	Mian Channu (Multan)	Wheat	Commission Agent's Stores	T. castaneum, T. granarium and R. dominica	10-13%
17.	Okara (Sahiwal)	Rice	Commission Agent's Stores	S. cerealella, T. castaneum and S. oryzae	2.5-5%
		Wheat	Commission Agent's Stores	T. castaneum, S. oryzae and T. granarium	2.5-7%
		Maize	Commission Agent's Stores	S. cerealella and T. castaneum	2-6.5%
18.	Muridke (Sheikhupura)	Rice	Private godowns	S. oryzae and T. castaneum	2-7%
19.	Raiwind (Lahore)	Wheat	Godowns of dealers	T. granarium and R. dominica	1.2-5%

20.	Hafizabad (Gujranwala)	Wheat	Private godowns	No infestation recorded in the new harvest	-
		Gram and other pulses	Private godowns	Callosobruchus spp.	3-4%
		Rice	Private godowns	T. castaneum and S. oryzae	3%
21.	Kamonke (Gujranwala)	Rice	Private godowns	T. castaneum and S. oryzae	2-5%
		Wheat	Private godowns	T. granarium, R. dominica, S. cerealella, S. oryzae and T. castaneum	3-5%
22.	Muree	Wheat	Private godowns	T. granarium and R. dominica	2-4%
23.	Sheikhupura	Wheat	Commission Agents' godowns	T. castaneum, S. oryzae and R. dominica	3-4%
24.	Sahiwal	Wheat	Government godowns	T. granarium and R. dominica	1-2%
		-	Commission Agents' godowns	T. granarium, R. dominica and T. castaneum	6-8%
		Rice	Commission Agents' godowns	S. oryzae and T. castaneum	2-3%

V. GOVERNMENT STORAGE AND PROCESSING

A. Introduction

This part of the study deals with the storage of wheat, rice and cotton seed and processing of wheat. Because of the critical storage problem in wheat the main emphasis will be placed there. Visits were conducted with various officials and site locations in the areas of Islamabad, Lahore, Lyallpur, Karachi, Hyderabad and Mirpurkhas. A great deal of information was gathered to better understand the system. Following are some of tne principle findings.

B. General Comments

1. Bag and Bulk

Wheat from the farmer goes to the market or the collection points in bags and frequently by animal transport. Jute bags holding 2½ maunds, or approximately 205 lbs. of wheat are commonly used. (Consideration should be given to the use of a smaller bag for easier handling and better labor acceptance. Also hooks are frequently used, this damages the bag.) If the supply of jute becomes scarce, cotton bags can be substituted. However, Pakistan now has a program of growing their own jute, which may supply this need in the near future.

It is possible to change from bag to bulk handling starting with the collection point and continuing through the system. However, it is usually not considered economical to change from bulk back to bag. When going to bulk the following changes should be made in the system:

a. Grain should be handled by mechanical equipment for filling storage, discharge and transfer.

b. Grain should be cleaned before storage, especially to remove weed seeds and broken kernels. This is a source of heating and grain deterioration if left in large pile.

c. Grain should be treated against infestation when it is stored, and retreated as required.

d. Buildings to contain bulk wheat must be properly designed to withstand the wall pressures, keep out moisture, be rat and bird proof and be designed for easy fumigation.

e. Transportation equipment must be suitable for bulk loading, transporting and unloading. Trucks which we have observed with high sides and covers are probably suitable, if tail is boarded higher and sealed. It may also be necessary to add chains to hold the sides and prevent spreading. Weights can be recorded on truck scales. Rail cars on the other hand do not appear suitable, and new equipment may be needed for good service. Box cars appear to be the only present rail equipment for bulk wheat. These would, of course, need some type of car door to seal the openings and would probably have to be emptied by manual or a least semi-mechanized equipment. Weights in rail cars would be taken when unloading at the warehouse and again when loaded out.

f. For long term bulk storage the facility should have temperature monitoring equipment, to tell when grain is heating, and aeration equipment for maintaining quality.

g. Bag handling is a simple system to operate, but is much more labor intensive than bulk, People are more readily available to handle bags than those to operate bulk storage, and some accounting can be made by bag count. For the long range, there is no doubt more bulk handling will occur, but this will require special bins and equipment and much training of people through the entire system. It seems the wise choice at this stage of development to stay with bag grain up to the flour mill or export elevator.

Some modified use of bulk may be utilized in house type godowns using walls of baggs to retain bulk grain. Then the bulk grain could be rebagged before shipment, or loaded in bulk for transport.

2. Rice

Rice is handled in bags entirely. It is practical to handle paddy rice in bulk, but this need is not apparent at this time, unless it is desirable at the mill. Rice for sale or export is all bagged.

Storage of rice is, therefore, commonly done in the house type of godowns. Since a large amount of rice produced goes to export, the large rice storage facilities are located in the Karachi area. About 656,000 T of space now exist, and another 100,000 T is being constructed, with plans for an additional 150,000 T in the Landi/Pipri area - about 5 miles from the port facility. In addition the Rice Export Corporation has applied to port Qasim for 400,000 T of space adjacent to the new docks. It is considered necessary by the Rice Export Corporation to have more storage available than the annual exported in a year. Exports have been about 500,000 T per year and expected to go to 1,000,000 T in two years. Present stocks are at 400,000 T with the new crop coming in.

One of the reasons for the extremely heavy concentration of storage in the dock area, has been necessitated by the need to clean, grade and double bag all rice before export, to maintain a uniform product.

Rice is transported to Landhi/Pipri by rail from distant points, and by truck from the Hyderabad and nearby areas.

Basmati rice production export was 153,000 T in 1975. It is highly desired by many Arab countries. It is shipped with less than 10% broken kernels. However, it may be necessary to lower this to 4% broken to meet world standards.

Other rice varieties are sold as the market demands, with 10, 20, 40 and 100% broken. Grading and cleaning are an essential part of the export market system. The system for export of rice seems to be well planned.

This year for the first time most of the marketable rice is being purchased by the Rice Milling Corporation. Previously merchants purchased and stored a large amount of rice. This change together with the large carryover by the Rice Export Corporation may lead to a severe problem in storage space.

3. Cotton Seed

There is an oversupply of cotton ginning capacity in Pakistan, so that since the GOP takover, they have shut down about half of the gins. The Cotton Trading Corporation plans to reallocate some of the idle ginning capacity to remote areas that need gins; for convenience of farmers. Figures given on operations in Sind and Punjab are as follows:

	Sind Province	Punjab Province	Total
Total Gins	158	498	656
Taken over by GOP	148	422	570
Gins operating this year	80	200	280

It was stated that 25% of gins are in bad repair, but will be repaired in anticipation of 6,000,000 bales by 1980. Last years crop was a disappointing 3,567,000 bales.

Some raw cotton is exported; however, most is sold to the private textile plants this year because of the small cotton crop. Some textiles are exported by private concerns.

Some godown storage is provided for cotton seed, but much of it is stored on open platforms. There are problems in the storage of cotton seed, which are recognized by management. Seed heats on occasion with little evidence

of why. Also outside storage are subject to weather losses. It is evident that some special study needs to be given to the best methods of storage of cotton seed for oil extraction, and for seed use.

All oil produced from cotton seed goes into the hands of the Ghee Corporation. Expeller cake with 7 to 8% oil is a desirable item to sell to the farmer for animal feed. However, it is desirable by the GOP to process all seed possible by solvent extraction. Solvent plants are required to reduce oil content on meal to no more than 0.5% which does limit the capacity. Also for good solvent operation cotton seed must be delinted, dehulled and flaked before sending to the solvent extractors. The solvent plant observed at Hyderabad was operating on rape seed and not cotton seed since they had previous contracts to fill, and rape seed extraction is more profitable.

The report by Coleman (1) discusses cotton seed storage needs and makes many good recommendations.

4. Multiple Use of Storage

Most grain storage facilities (excepting perhaps cotton seed), have a potential for multiple use. This is especially true for wheat and rice. The house type godown is extremely flexible for multiple use when product is stored in bags, whereas an exclusively bulk storage facility is somewhat more restrictive.

It is desirable to keep some commodities well separated when it is necessary to store in the same godown, because of possible odor and fumigation contaminations.

A well designed godown can also be a valuable building for storage of many commodities if not needed for grain. Some coordination needs to be in

effect to see that godowns are used to the fullest extent, and not necessarrily built and assigned to one commodity only. This policy could result in less overall storage needs.

5. Quality and Quantity of Grains

Section II stress the need for grading of grains from an economic standpoint. From an operating viewpoint grading is also desirable. When various grades are mixed, it will be impossible to produce a very high quality flour. At the flour mill it is highly desirable to clean and temper different types of wheat separately, and then make a proper blend to suit the product desired. For export a good grading system is essential. This has been discovered, and now carefully utilized by the Rice Export Corporation.

Cleaning is used to upgrade grain, and is a vital part of export trade. The removal of weed seeds, if present in substantial quantities, should be a requirement, especially before storing grain in bulk. A concentration of weed seeds will often cause grain to start heating and cause a loss in quality of varying degrees up to total loss.

In observing the wheat cleaning at the flour mills 3½ and 4% was removed as screenings, 90% of this was said to be inert material (dirt and stones). With a proper grading quality factor the farmer could be encouraged to screen out dirt and stones, or at least minimize their presence.

Moisture in wheat at harvest seems to be no problem, apparently in the 8 to 10% range. This is very desirable, since it discourages mold growth and insect damage. However, moisture does need to be considered in merchandizing grain, so the low level is maintained.

Moisture in rice is very important since most of it must be dried as it comes to market. This was a function of the middlemen until this year. Currently there is a potential problem in properly drying a large rice crop. Most rice is sun dried, however, some drying is done mechanically. Sun drying is cheaper than mechanical drying. Properly operated mechanical dryers will produce a paddy that can be milled with less breakage than sun dried rice. Natural air drying would produce a high quality paddy but at a higher cost than sun drying.

Weight is vital at all movements of grain as a basis for accounting. Bag weights are now taken on the balance beam or platform scale, and seem to be adequate when dealing in small quantities. Truck loads of grain are weighed on truck scales, which are necessary for larger quantities. However, for rail movement in bags there should be an easy way to weigh. When going to bulk handling, weights can be taken by truck scales, rail scales, or scales in the handling system. Flour mills need scales on all input and output to check for yield. Export and large handling systems need large scales compatible with the handling rate.

6. Types of Storage

Bag storage should be in a structure that is dry, rodent and bird proof, capable of being ventilated or closed for fumigation. It should also be locked and secure, with good access for loading and unloading truck or rail. This building may be made of many materials.

Storage for bulk must have walls sufficiently strong to take the pressures of bulk grain. It should have temperature sensing and controlled aeration for long storage. Proper (probably mechanized) unloading, loadout, and weighing systems are also necessary.

All floors should have some sand fill underneath and a moisture barrier such as polyethylene film sheets under the concrete. It should be high enough to minimize flood water damage.

C. Small or Village Level Storages

There is a possible need for smaller and cheaper storage, particularly for emergency storages for use when production exceeds storage capacity.

The team agrees that the construction of small storages at the village level (such as at the Rural Development Centres) can serve a useful function. The economic justification is covered in Section II.

Two types of small, low cost, bulk storages are under construction. One is a circular brick structure being constructed by PASSCO (Pakistan Agricultural Storage and Service Corporation) near Lahore. These are 22 ft. diameter by 25 ft. overall height. They have a domed brick roof. Steel bands are used on the outside to withstand laterial grain pressures. The entire structure is plastered inside and out. The cost is estimated to be 40,000 Rs. or 258 Rs/T for the 155 ton capacity.

CARE is erecting a 100 ton bulk storage near Islamabad. It is built of cement stabilized soil brick, with a cement asbestos roof. The estimated cost is 270 Rs./T.

The team feels that these storages should be bag storage because:

a) Facilities for proper cleaning of grain before storage do not exist, nor are they planned.

b) Inspecting for, and maintaining grain quality requires a new technology where it cannot be closely supervised.

c) Facilities at this level could well be used for storage of other grains, or oilseeds, fertilizer and seed.

Personnel from CARE estimated that a bag warehouse which could use thinner walls and no buttesses could be built for 40 rupees/ft. If bags were piled to a 15 ft. height, and if one-third of the floor space is used for aisles, the cost would be 200 rupees/T. This is probably the most economical type of storage which can be built from local materials. Local personnel should be capable of handling quality control problems.

Grain received at the facilities may be difficult to fumigate. Treating grain as it is received with malathion or a similar insecticide is recommended.

D. Government Storage

Most of the Government storage is the house type godown. These buildings range in inside dimensions from 50' x 100' for 500 T, to 120' x 787' for 16,000 T. These buildings are generally very substantially built of concrete and brick, with concrete roofs and floors. The newest ones at Landhi are also built at truck dock height, with provision for rail siding later.

These buildings are designed for bag storage, or bag contained bulk storage. The design arrangement for bag pattern in the large buildings is to store 15 bags high in a 16' x 19' area. There are 216 piles (74T/pile) with 3' to 4' aisles.

Costs on the Landhi godowns, according to PWD in Karachi, is 400 rupees per ton, including 325 rupees for building and 75 rupees for site work etc. For the small 500 T units the costs is said to be 15 to 20% greater, which would be 460 to 480 rupees per ton total costs. Buildings are under construction at Landhi for 70,500 T and will be complete by next spring. Four large building contractors were working on the buildings, plus others on site work. Progress was in the footing and foundation stage, and workmanship seemed quite good.

These buildings are designed with concrete roof, rat guards, bird screens and windows that open for ventilation. They have steel doors (7' x 8'). Building columns are in 3 rows on the 120' width, and spaced at 15' centers. Fumigation in this large building may be for the entire building, or by individual piles, after covering with plastic sheets.

Older Government godowns are of the same general design, but generally are of the smaller 500 to 1000 ton size. The use of a combination bag retaining wall and bulk inside, may increase the holding capacity by these storages 30 to 100%. However, when this is done it is more difficult to check and control grain condition.

If the GOP desires to go to some large bulk storage, the bins could be of concrete or heavy metal. If storage is for several months or longer, flat bottom bins may be satisfactory. However, if storage is to be short term or for fast loadout, such as export, bins should be hoppered. This design requires a new technology for construction.

Bags should not be placed in direct contact with concrete floors as was observed at most locations in Pakistan. Dunnage (pallets) should be placed under the bags to prevent capillary moisture movement and provide ventilation. This dunnage may be wood strips on wood rails, wood strips on brick rails, bamboo poles, etc.

E. Flour Mill Storage

Flour milling capacity seems to greatly exceed the need. However, principle flour mills to be used should have rather large wheat storage, possibly up to 3 months. This would avoid any transportation problem during the monsoon season. Wheat storage at the mills could be in bulk, being mechanically conveyed into the mill as needed.

Present wheat storage at the mills in Karachi area was 2 to 3 days in the mill building, as a part of cleaning and tempering. In addition there was house godown space for the mill of 2 to 3 days storage.

Within the mill compounds there was considerable additional storage under the responsibility of the Food Department. Emergency storage was still in the yard under tarpaulion but heavy losses had apparently occured from insects, mold and heating from getting wet. The Food Department also has under their charge a separate house type godown building. It is suggested that any storage within the compound be under the jurisdiction of the flour mill manager, who should have a knowledge of storing and handling wheat.

It is common practice in many countries to provide two to three months of needed grain storage at flour mills. There is little change of getting storage out of position, if the flour mill is a good one, and will be kept in operation. We recommend that the selected flour mills be supplied with increased storage if land is available. We also recommend that this be bulk storage because:

a. Once bags are emptied there will be no need to go back to bags.

b. Flour millers are experienced in recognizing and maintaining grain quality.

c. Mechanics who are capable of maintaining conveying equipment are available.

Horizontal, flat bottom, storage or vertical, hopper bottom, storage might be used. A thorough cost analysis for various designs would have to be made, and operation costs will have to be determined, but the team thinks a horizontal storage will probably be most economical.

F. Import/Export

All import and export by sea comes into Pakistan through the port at Karachi with all of the congestion of a very large city. A second port is being developed at Qasim, roughly 20 miles to the East of Karachi. The Qasim port, to start initial operation in early 80's is planned to handle large bulk cargo such as, steel, fertilizer, cement, wheat and rice. Whereas the present Karachi port will be used for general cargo when Qasim is in full operation.

Wheat is off-loaded at berths 15 and 17 on the East Wharf at the Port of Karachi. Ships up to 25,000 T, with a maximum draft of 31 feet can be berthed. The unloading rates are up to 7000 T/day on one ship, or 12,000 T/day on two ships.

Vac-U-Vators are used to pull bulk wheat out of the ships' holds and discharge it on to the concrete dock area. Labor then bags the wheat in 2½ maund bags, (but without weighing).

Loading is then on trucks and rail cars for transport. Rail is used for long hauls, never less than 100 miles. Historically 75 to 80% imported wheat has been sent into the interior by rail.

Rice is all exported in bags, being assembled, cleaned and stored at Landi/Pipri and loaded at Karachi port. Additional storage and milling is being planned for rice in the Landi and Port Qasim area, so that all rice will be exported at the new Port when available. Ships will be able to draw 40 feet or roughly 40,000 tons at the new grain docks.

The possible future export of wheat is planned at Port Qasim. This should be a large facility, all bulk, with weighing, cleaning and fast

load out equipment. This facility would be able to receive bulk grain with marine legs. This new facility, if determined to be necessary, would take 4 to 5 years, at least, to complete and put in service.

If it becomes feasible to export wheat before a new facility is available, it will require some preparation, the following should be considered:

1. Wheat must be cleaned and graded.
2. Accurate weights must be recorded.
3. Loading must be fast to avoid demurrage penalty (average demurrage on export ships is now $4,000/day).
4. All of above is subject to inspection by purchaser and thus must be reliable.

The export of wheat requires some modification of the system used for rice. Contingency plans should be made in case Pakistan reaches an export position in the next year or two.

G. Milling and Processing

1. Wheat Flour

There are two different types of flour mills, one produces a 100% wheat flour called "atta", the other type is the conventional flour mill which separates the bran and germ for feed, and reduces the endosperm to flour of various grades called "maida" or "finos."

At the village level "atta" flour is made on stone burr mills, an extremely simple process, but one which produces a satisfactory product.

"Atta" is produced for distribution through the ration shops by a selected group of conventional type flour mills. A very thorough cleaning is provided for the wheat, complete with washing and tempering. The wheat

is then blended and sent to the mill. The milling process is the gradual reduction system of a long mill, but all products are blended back together to make the 100% "atta" flour. Flour has a 13% moisture content, with a shelf life of only 15 to 20 days.

The use of a conventional gradual reduction system, with all of its multitude of equipment justifies special attention. A study should be made to see if "atta" could be produced on a very short system, while maintaining the quality and acceptance of the product. If this can be done it will save operating many machines with their demand for power, repair and deterioration. This production might be made with a hammer mill with a sifter to remove the coarse material for regrinding. The operating and maintenance costs for a hammer mill would be much less.

The Good Luck Flour Mill at Karachi has a capacity of 257 T/24 hours, but is working on two shifts. It is a blend of 30% imported hard red winter wheat and 70% local wheats. It is a mill with pneumatic equipment (14 double stands), It produces:

Maida #1, top grade flour, bleached	25%
Semolina if needed	3%
Maida #2 - 2nd quality in 90 Kg print bags	34%
Super fine atta (lower fiber content packed in 9 Kg cotton)	20%
Fine Bran (shorts)	10%
Flat Bran (white bran)	8%
	100%

Wheat is tempered to 13.5% moisture. Product is approximately 13.0% moisture. This is an 82% yield, which is quite high but can be accomplished by producing super fine atta.

2. Rice Milling

Rice at the village level is milled with hullers only and not polished. This is very commendable, and should be strongly encouraged, since rice of this type is higher in protein and B-vitamins and much more nutritious than polished rice.

Rice mills, producing rice for urban use, use the conventional process. This cleans, dehulls, polishes and aspirates giving a very acceptable product. Rice mills generally complete their milling of rice within 5 to 6 months after harvest. Polished rice is then held in storage for sale the remainder of the year.

Rice bran which is high in oil content, has been sent to solvent plant for oil extraction. However, there has been a deterioration of quality before solvent extraction, to the extent oil is not suitable for food, but must be used for soap. It is possible the bran could be treated with an antioxidant to prevent this deterioration and preserve the quality for human consumption.

3. Cotton Seed

Cotton seed is a problem to store and maintain the quality. This has been a serious problem, but rather than go into detail, we refer to the "Coleman" report (1), which covers this problem to some extent. Coleman estimates that an additional 50,000 T. of oil could be obtained by solvent extraction of the cotton seed.

H. Emergency Storage

During 1976 the lack of regular wheat storage became apparent. The Food Department had a rated storage capacity for about one million tons

but pruchased an estimated two million tons. This excess was handled by:

1. Piling bags higher in the normal house godowns.
2. Making walls of bags and filling the center with bulk.
3. Leasing other suitable warehouse space from rice mills, cotton gins, etc.
4. Piling on the porches of house type godowns.
5. Storing in bags under tarpaulions.

Steps 1 and 2 above provided excellent storage space. The bulk grain inside bag walls showed little insect damage after fumigating.

Wheat stored in good dry warehouse space, such as a co-op warehouse near Lahore, or under some bulk bins at Sheikhpura, showed extensive insect infestation. Grain in the Co-op warehouse could easily be covered with plastic and fumigated. That stored under the bulk bins could have been saved by a treatment with malathion or other insecticides.

Wheat stored at rice mills and cotton gins could not be examined.

Wheat stored in bags under porches had not been properly protected from weather. It showed extensive mold and insect damage.

Wheat stored under tarpaulions showed extensive mold and insect damage. Much of this wheat is not fit for human consumption and some is not fit for animal feed.

Good emergency storage and better care could drastically reduce storage losses. This storage is not cheap or readily available. Cherwell Valley Silos Ltd, Twyford-Banbury, Oxford, England manufacture a lightweight storage than has been used in many countries. The storage container is white EPDM on butyl rubber.

The bag is placed inside a rodent proof wire fence. The cost fob factory is about 160 Rs./T in 1000 ton sizes. The company could produce 12 units per week. They are shipped in 8 crates having a total weight of 4200 Kg. Similar storages are available in the United States.

Corrugated steel bins would be about the same cost and much more durable.

I. Operating and Technical Personnel Requirements

It was obvious to the team that much grain was not properly managed during storage. The Food Department does not have entomologists or storage engineers in staff positions.

Entomology training in Pakistan is directed toward field pest control. However, these graduate entomologists could be trained locally to handle grain storage problems. Mr. Suleman Chaudhry, of the Agricultural Research Center at Lyallpur has had stored insect pest training at Tropical Stored Products Institute, Slough England, followed by years of experience as a Storage Enforcement Officer. He could easily train 6 - 10 entomologists, in 3 - 6 months to be good storage entomologists. They should be attached to Provincial Food Departments.

Some problems of building maintenance were seen or described. We feel that a maintenance engineer should be attached to the Food Department staff at Lahore and Karachi.

No storage engineers, or food technologists specialized in grain and oilseed processing could be located.

As a shift is made to bulk grain storage, engineers will be needed to assist in design and operation. These could probably best be obtained by sending a few agricultural or mechanical engineers abroad for one to two years of study at a Department, such as the Department of Grain Science and Industry, Kansas State University which specialized in grain drying and storage.

Food technologists will be needed to supervise operations of flour, rice and oil mills. These will require agricultural, mechanical or chemical engineering backgrounds. Rice milling training can probably best be obtained at Louisiana State University. Flour milling is taught at Kansas State University. The team knows of no university where oil seed processing is offered.

At least one stored grain microbiologist should be trained.

J. Grain Grading

Grain grading equipment and personnel are limited. The Punjab Food Department sends samples of large lots to Lahore for grading. Rice was being purchased at one purchasing center with no equipment for grading - not even a moisture tester. If farmers and others are going to be rewarded for high quality grain then grading facilities must be established at each procurement center.

The team thinks that minimum quality standards include:

1. Moisture
2. Foreign material
3. Insect and mold damaged kernels
4. Prohibited materials such as mercury treated seed or poisonous weed seeds.

These quality factors compare to grades now used or recognized. If the government is going to establish hundreds of procurement centers then much additional equipment and trained personnel will be needed. Minimum equipment at a purchasing center would include: balances of about 500 Kg capacity, moisture meter, sieves of an appropriate size for the grain (there are standards for these sieves).

Grain graders at Lahore could be used as trainers.

The Food Department Grading Laboratory is fairly well equipped and staffed. Deficiencies include:

1. Lighting
2. Magnifying glasses to detect insect damaged grains
3. Moisture meters
4. Graders classify as weevily only grains that are highly damaged. Small holes in the seed coat could not be seen easily and were ignored.
5. A white surface should be used for inspection of grains.

The Grading Laboratory at Hyderabad was better equipped than the one at Lahore.

K. Recommendations for Action Programs by Donor Agencies

The training of entomologists and operating personnel should be largely an in-country problem.

Overseas training of grain storage engineers, food technologists and a grain microbiologist is discussed in detail in Section I. Estimated man years of training is 8 - 12 student years if M.S. degrees are desired or 4 - 6 if no degree is planned.

Grain grading systems need to be improved. Local grain graders appear to be capable. If the government decides to extend the grading system to purchasing points a great deal of equipment such as balances, moisture meters, sieves, etc. will be needed. One grain grading consultant might be used for one month.

Capital needs for grain storages, possibly including an export elevator, will be great if agricultural production continues to increase.

REFERENCES

(1) Coleman, W. T., Cottonseed Processing, Ministry of Industries, Government of Pakistan and Investment Advisory Center of Pakistan, February, 1975.

Cropping Season in Hyderabad Area

Commodity	Planting	Harvest	Water Requirement
Paddy	May, July, Aug.	Oct. - Nov.	70"
Cotton	May - June	Oct. - Jan.	36"
Wheat	Oct. - Early Dec.	March - May	20"
Maize	June - July	Sept. Oct.	-
Millet	July	Oct.	24"
Sorghum	June	Oct.	28"
Groundnuts	June - July	Oct. Nov.	29"
Pulses	June - July	Oct. Dec.	-
Gram and Peas	Oct.	Late March	-
Oilseeds	Sept.	Feb.	18"
Sugarcane	Feb. - March	Nov. - Jan.	-
Late Fodder	Oct. - Dec.	Dec. - April	-

Monsoon - "Kharif" - June - Sept.
"Rabi" (Season) - Oct. - March

(From Agriculture Department in Hyderabad 11/5/1976)

Equivalent Weight and Measures

Maund (Md.)	= 82.286#
Seer (Seer)	= 2.057# = 1/40 of maund = 16 chatanks = 4 paos
Pao	= .512# = 4 Chatanks
Chatank	= .1286# = 5 tolas
Kilogram (Kg)	= 2.2#
Bushel (wheat)	= 60# (37-1/3 Bu. Wheat = 1 T (2240#)
Ton	= Long Ton 2240# = 27-1/4 maunds (Mds.)
Hectare (Ha)	= 2.47 Acres (A)
Acre (A)	= .4048 Hectare (Ha)
Moraba (Square)	= 25 Acres
Kanal	= 1/9 of Acre
Foot	= 30.48 Centimeters (CM)
Inch	= 2.54 Centimeters (CM)
Lakh	= 100,000 or (1,00,000)
Crore	= 10,000,000
Arb	= 100 crore = 1,000,000,000
Mds/A x (92.43)	= Kg/Ha
Kg/Ha x (01082)	= Mds./A
Mds/A x (82.28)	= Lbs/A
Lbs./Ax (1,123)	= Kg/Ha
Kg/Ha x (.8905)	= Lbs/A

Glossary of Terms

Barani	-	Rain Fed
Kharif	-	Summar Cropping Season (May thru Oct.)
Rabi	-	Winter Cropping Season (Nov. thru April)
Paddy	-	Unhusked Rice
Jawar	-	Sorghum
Bajra	-	Millet
Gur	-	Country-made Brown Sugar
Bhoosa	-	Finely chopped straw
Zamindar	-	Large land owner
Desi	-	Local Indigenous or unimproved
Katcha	-	Unimproved, low quality, unpaved
Pucca Road	-	Paved road
Palladar	-	One who weighs and unloads grain
Boliotta	-	One who loads and unloads grain
Rolla	-	One who sifts and cleans grain
Arhti	-	Grain Dealer or Merchant (Money lender)
Godown	-	Warehouse, or any structure used for storage purposes
Pulses	-	Vegetables such as: Peas, Beans, Lentils, etc. (Legummous Crops)
Rs.	-	Rupees (9.90 = $1 U.S.) 11/1/76
Ghee or Ghi	-	Clarified Butter (Vegetable Ghee-Cottonseed by-product)
Mandi	-	Market place

(From: Watson Report, 1970)

PAKISTAN - A REVIEW

A. Importance of Agriculture in Pakistan

Pakistan is one of the large countries in the World. Its population of over 73 million makes it the eighth largest country in this respect.

Agriculture is a very large industry which provides most of the nutritional needs of the country and provides some important exports. Major food imports have been wheat and vegetable oils. The major food export is rice. In 1975 an estimated 70% of the population were classed as rural.

Agriculture is extremely variable. Large fertile areas of irrigated agriculture have developed near the Indus River and its tributaries. Nearby areas have sufficient rainfall to support a double-cropping system. Driest areas support a nomadic agriculture.

Table A-1 shows the production of major agricultural products.

B. Farm Size, Land Tenure and Land Use

Agricultural production is concentrated in the hands of small farmers who produce most of their own food and provide a small marketable surplus. These farmers are exposed to and are adopting improved technology including the use of fertilizer and improved seed. Most of the land is tilled by animal power with hand labor used for cultivating and harvesting. Animal transport is used for most of the farmers' marketable activity.

Larger farms are mechanizing. About 15,000 tractors/year are now imported and some self-propelled combines are used.

Table A-1

Production of Major Crops in 1974-75 in thousands of metric tons*

Crop	Production	
Wheat	7,552	
Rice	2,277	
Maize	735	
Total Grains	11,221	
Rape and Mustard	244	
Groundnut	56	
Sesamum	8	
Cottonseed	1,248	
Sugarcane	20,906	
Cotton lint	3,567	in thousands of bales

*From Agricultural Statistics of Pakistan, 1975, Ministry of Food and Agriculture.

Table A-2 shows number and size of the farms. Small farms in the irrigated area produce more product per acre than in other countries which practice dryland agriculture and/or single cropping systems.

Because of the large number of small farms which must depend upon animal transport, the location, size and diversity requirements of agricultural service centers becomes an important problem in designing the marketing system for agricultural products and inputs.

C. Nutrition and Food Supply

Table A-3 shows the estimated daily food intake per person in Pakistan. Cereals play a very important role in the diet; beans and pulses supply a large amount of the protein supplementation.

Pakistan has developed a rather unique system of distributing basic foods to the population - particularly the low-income urban group. A ration system was established after partition in 1947 which has operated almost continuously since then. The present rationing system operates about as follows:

Government owned wheat which is purchased by the Food Department from farmers and merchants is milled in flour mills which are operated by the Provincial Food Department. (All six-roll and larger mills were nationalized in 1976). Flour which is to be issued through the ration shops is a 100% whole wheat flour (atta). The Food Department sells flour to licensed retailers in urban areas who sell to the consumers. Each adult who desires to use the ration shop is entitled to a weekly allotment of 1.75 kg (1 seer, 12 chottoks), children under 12 years receive a half allotment. The sale price is fixed by the Government at below the purchase price for the wheat.

Table A-2

Numbers and Area of Farms by Farm Size in 1972*

Farm size, acres	Number of Farms (in 1,000's)	%	Farm Area (in 1,000 A.)	%
Up to 7.5	1639	24%	5995	12%
7.5-12.5	921	44	8913	18
12.5-25.0	794	24	13067	27
25-50	289	21	9219	19
50-150	103	8	7406	15
Over 150	16	-	4485	9
Total	3762		49085	

*From 1972 Pakistan Census of Agriculture, Ministry of Agriculture.

Table A-3

Intake of Selected Food Items

Food	Rural g/capita/day	Urban g/capita/day
Wheat	398	319
Rice	60	39
Other Cereals	22	7
Total Cereals	480	365
Starchy Roots	18	28
Pulses & Nuts	21	15

An interesting and detailed report of this system was prepared by Rogers and Levinson (1) of MIT in 1976. It discusses the effect of this system as a means of welfare or income redistribution.

As in most developing countries most of the food consumed by the rural population originates nearby. Farmers store for their own consumption. Most villages have a custom flour mill of the stone burr type.

Many consumers purchase their wheat from farmers or grain merchants and have it custom ground on the stone burr type of mill.

There is some market for white flour primarily to higher income urban consumers.

One would expect that for the foreseeable future the major staple food will be the chapati which is a large, flat, unleavened bread cooked on a hot plate.

D. Weather

Pakistan has a very seasonal rainfall pattern, Table A-4, 5, 6, 7. The rainy (monsoon) season occurs in June, July and August. Winter wheat is harvested before the monsoon. Rice, in irrigated areas, is harvested after the monsoon. Wheat and rice or cotton provide a double crop in the irrigated area. In the non-irrigated (Barani) area wheat may be followed by peanuts, sorghum, millet or other forage crops.

Because most grain is harvested in the dry season, harvesting and threshing is simplified, wheat drys well in the field and sun drying of rice is practical.

Most of the year is dry enough that storage molds should not develop. However, grain moisture is generally not low enough to inhibit insects.

Floods have been frequent and severe in the past. This presents some problem in site selection and design of grain storages.

E. Transportation

Transportation in rural areas is dominated by pack animals (donkeys and camels) and by ox carts. Much urban transportation is by ox or horse drawn carts and wagons.

The highway system is being developed rapidly but all weather roads have not yet reached most of the villages. Trucks are readily available and the rates are reasonable.

Railroads serve all large cities. The rail network is relatively good in the major agricultural areas.

Port facilities are at the extreme southern end of the country at Karachi. A new port is under construction and after 1980 facilities for export and import would be good but removed from the center of population in Pakistan.

Because of the use of animal transport, and a lack of trucks and railcars which can haul bulk grain, bags are usually used for the transport and storage of grain. However, the traditional farm storage is in bulk.

Table A-4

Climatic Data of Lahore*

(October, 1975 to September, 1976)

Months	Temperature (°C)			Average Relative Humidity %	Rainfall (m.m)	
	Mean Daily		Average Mean Temp.		Monthly Total	Normal Mean Monthly Total
	Max.	Min.				
October, 1975	34.1	19.2	26.7	57	0.0	9.9
November, 1975	27.1	9.9	18.5	59	0.0	3.6
December "	22.6	6.6	14.6	62	Trace	10.7
January, 1976	19.6	7.1	13.3	70	22.9	31.2
February "	21.0	9.9	15.5	67	28.0	23.1
March "	25.4	13.4	19.4	60	30.6	24.4
April "	33.2	19.2	26.2	47	11.9	15.7
May "	39.1	24.5	31.8	37	20.8	8.1
June "	38.4	26.1	32.3	48	83.2	38.9
July "	36.5	26.7	31.6	67	270.2	121.7
August "	32.4	25.7	29.1	79	511.7	122.9
September "	33.6	25.0	29.3	73	126.2	80.0

Trace: Rainfall less than one cent. (0.3 mm)

* Pakistan Meteorological Department, Regional Meteorological Center, Lahore, Government of Pakistan.

Table A-5

Climatic Data of Peshawar*

(October, 1975 to September, 1976)

Month	Temperature (°C)			Average Relative Humidity %	Rainfall (m.m)	
	Mean Daily		Average Mean Temp.		Monthly Total	Normal Mean Monthly Total
	Max.	Min.				
October, 1975	33.3	16.3	24.8	52	0.0	9.9
November	26.5	7.2	16.9	49	0.0	9.9
December	21.2	5.6	13.4	59	5.9	15.2
January, 1976	18.8	5.3	12.1	61	13.4	38.6
February	17.9	7.0	12.5	67	82.7	41.1
March	22.3	9.8	16.1	63	82.0	64.8
April	30.0	15.8	22.9	57	69.5	41.9
May	37.7	21.9	29.8	40	2.9	14.5
June	40.4	24.1	32.3	39	18.7	6.6
July	37.7	27.2	32.5	65	40.7	44.8
August	33.2	24.3	28.7	77	280.2	40.6
September	35.5	22.7	29.1	66	20.3	14.2

*Pakistan Meteorological Department, Regional Meteorological Center, Lahore, Government of Pakistan.

Table A-6

Climatic Data of Islamabad*

(October, 1975 to September, 1976)

Months	Temperature (°C)			Average Relative Humidity %	Rainfall (m.m)	
	Mean Daily Max.	Min.	Average Mean Temp.		Monthly Total	Normal Mean Monthly Total
October, 1975	32.7	14.5	23.6	54	0.0	38.6
November	25.3	5.6	15.5	53	Trace	22.9
December	20.3	3.5	11.9	57	5.8	41.1
January, 1976	17.6	4.1	10.9	65	115.9	78.5
February	17.3	6.3	11.8	72	208.4	48.3
March	22.0	9.7	15.9	64	117.3	73.9
April	28.8	14.7	21.7	54	65.0	33.5
May	36.0	20.0	28.0	37	3.0	27.9
June	38.1	23.1	30.6	39	33.3	32.5
July	34.6	25.1	29.9	68	366.9	201.9
August	30.7	22.5	26.6	78	442.5	237.2
September	32.8	20.8	26.8	71	202.5	131.6

Trace: Rainfall less than one cent. (0.3mm).

*Pakistan Meteorological Department, Regional Meteorological Center, Lahore, Government of Pakistan.

Table A-7

Climatic Data of Karachi*

Months	Temperature (°C)			Average Relative Humidity %	Rainfall (m.m)	
	Mean Daily		Average Mean Temp.		Monthly Total	Normal Mean Monthly Total
	Max.	Min.				
October, 1975	34.6	22.0	28.3	65	0.0	3.3
November	31.2	14.5	22.8	50	0.0	3.0
December	28.5	12.7	20.6	51	0.3	5.6
January, 1976	25.1	12.7	18.9	63	66.8	7.6
February	26.8	14.4	20.6	55	10.1	12.7
March	30.2	18.2	24.2	63	30.7	4.6
April	32.3	22.1	27.2	68	0.0	2.3
May	33.3	25.6	29.6	74	0.0	1.3
June	33.8	27.6	30.7	73	0.0	8.9
July	32.8	27.3	30.1	78	217.2	101.1
August	31.8	25.9	28.9	75	36.5	47.5
September	31.3	25.5	28.4	78	44.8	23.4

*Pakistan Meteorological Department, Regional Meteorological Center, Lahore, Government of Pakistan.

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Appendix B

Action Programs Discussed During Debriefing

The following section contains memoranda of minutes of meetings held with GOP officials during the debriefing sessions. Recommendations for action programs discussed at these meetings are included.

MEMORANDUM OF CONVERSATION

Time and Place: 1100, Conference Room of Min. of Agri. **Date:** Oct. 27, 1976

Subject: Grain Storage and Marketing Project

Participants:

Mr. I. A. Imtiazi, Secretary, Ministry of Agriculture
Dr. M. Yaqoob Bhatti, Additional Secretary, Ministry of Agriculture
Mr. Mohd Din. Deputy Secretary, Ministry of Agriculture
Mr. S. M. Yasin, OSD, Ministry of Agriculture
Mr. Joseph C. Wheeler, Director, USAID
Mr. Wayne R. Nilsestuen: C/AP
Mr. Harry Bernard Pfost, Consultant, Team Leader
Mr. Dale G. Anderson, Consultant, USAID
Mr. William B. Briggs, Consultant, USAID
Mr. Cornelius Hugo, Consultant, USAID
Dr. Riaz Ahmad Khan, O/AP, USAID

Distribution: D, DD, AD/AP(A), PRO, AD/C, Niel A. Dimick, O/AP, Marvin A. Schwartz, O/DEA, Irshad A. Akhtar, O/CDE L. M. Eldredge, O/CDE, Masud Siddiqui, O/PRO AID/W - 3 copies

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Mr. Wheeler referred to earlier discussions which Dr. Wolffer and Dr. Newberg had with the Secretary Agriculture concerning GOP interest in developing Foodgrain Storage and Marketing Project and the usefulness of bringing out U.S. Team for initial scouting of issues to be addressed in planning, implementation and organization of the activities. Mr. Wheeler said that we look to your Ministry for coordination of the activities. The Secretary Agriculture said that the Ministry of Agriculture is largely concerned with wheat storage only. The storage of rice and oilseeds is the responsibility of the Ministry of Commerce and the Ministry of Agrarian Management. Mr. Wheeler said that two other Ministries are also concerned with storage and marketing. The Secretary liked to know the names of other two Ministries concerned. Mr. Nilsestuen mentioned that the Ministry of Social Welfare and Rural Development and the Ministry of Finance -- PASSCO is administratively responsible to the Ministry of Finance. The Secretary Agriculture said that Rs. 5 lacs has been given to the Ministry of Social Welfare and Rural Development on an experimental basis for various types of storage facilities. He said that his Ministry has liaison with PASSCO. Mr. Nilsestuen asked the Secretary if his Marketing and Grading Directorate located at Karachi is concerned with wheat storage.

The Secretary said that the Directorate is concerned, but not at the heart of the problem. The main focus on the problem is the responsibility of the Food Wing of the Ministry of Agriculture. The Provincial Food Departments are concerned with wheat and sugar storage. The storage of oilseeds, pulses and vegetables is loosely the responsibility of the Marketing Department in the provinces -- more so in Punjab than in other provinces. Mr. Nilsestuen asked the Secretary about the Ministry's assessment of the private sector role in storage. The Secretary said that he cannot give a definite answer to the question. The Ministry of Agrarian Management takes care of the private sector and alluded to the functions of Rice Exporting Corporation, Rice Milling Corporation and Edible Oil Corporation. The Provincial Industries Department is responsible for cold storage. He said that the Ministry of Agriculture is primarily concerned with wheat -- local procurement and imports.

Mr. Wheeler introduced Mr. Pfost, leader of the U.S. team who introduced the individual members of his team. The Secretary Agriculture welcomed the team and observed that the team is very well balanced representing a variety of talent needed for improved storage design. He said that the Government is constructing half a million ton House-type storage capacity during 1976-77. The Secretary said that more efficient types of storage facilities and different types of facilities for different locations are needed. He welcomed the advice of the team on improved design for the half a million ton capacity to be developed during 1977-78. He indicated two major areas in which technically advice is needed: (1) large bulk storage; and (2) farm level storage.

Mr. Wheeler mentioned that the Foodgrain storage report prepared by MICAS Associates for the Prime Minister would be of interest to the team. The Secretary said that the Report can be released by the Cabinet Secretary. He observed that the report contains useful data but it may not be of much interest to the team. He said that the Ministry's immediate interest is in storage facilities to be constructed during 1977-78. Long-term plans are also of interest, but reflect a second priority at the moment.

The Secretary suggested the visit with the following officials:

1. Managing Director, PASSCO.

2. Dr. Ahmed Shah Nawaz
   National Design Corporation

3. Mr. Abdul Qavi
   Additional Chief Engineer, PAK. OWD, Islamabad.

4. Provincial Chief Engineers
   PWD, particularly Punjab.

5. Mr. A. Azom Khan
   Managing Director, National Construction of Pakistan Ltd.
   Karachi.

Mr. Nilsestuen inquired if any official of the Ministry could travel with the team. The Secretary said that he will ask the provinces to depute persons for the purpose. He further mentioned that Mr. S. M. Yasin could also travel with the team where feasible.

Mr. Wheeler asked about the role of the Provincial Planning and Development Departments. The Secretary said that P & D has very little responsibility. Provincial Food Departments prepare the plans and the construction work is done by PWD.

Mr. Wheeler mentioned that Egyptian experience may be of interest where the team members have been involved. Mr. Hugo briefly outlined system analysis approach, which includes derivation of storage capacity and processing requirements on the basis of present and future production and consumption potentials, minimization of storage costs, least cost transportation network, least cost marketing channels for each commodity, and impact analysis. The Secretary expressed keen interest in the potential for applying System Analysis. He said that there is no lack of data in Pakistan but the ability to make use of the data is lacking.

Mr. Nilsestuen inquired if copies of weather and crop reports issued by the Ministry of Agriculture could be made available. The Secretary said that the reports will be made available and additional data could be obtained from the Meteorological Department.

The Secretary indicated his interest in the outcome of the team's study.

Drafted by: RAKhan:aqk:O/AP Date of Preparation, October 29, 1976.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

MISSION TO PAKISTAN

November 12, 1976

MEMORANDUM OF CONVERSATION

Date & Place of Meeting: November 12, 1976
Office of Secretary of Agriculture

Subject: Grain and Oilseed Storage

Participants:

Mr. I. A. Imtiazi, Secretary, Ministry of Food & Agriculture
Mr. M. Ayub, Joint Secretary, Food, M/o Food & Agriculture
Mr. M. Mumtaz Ali, Joint Secretary, M/o Food & Agriculture
Dr. William A. Wolffer, Acting Director, USAID/Pakistan
Mr. Arthur Handley, AD/DP - USAID
Mr. F. L. Headrick, AD/AP(A) - USAID
Mr. Wayne R. Nilsestuen, Agricultural Economist USAID
Mr. Harry B. Pfost, and members of the Kansas State University Team

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Dr. Wolffer's opening remarks summarized the progress that had been made in addressing the storage problem during the KSU team's visit. When the team arrived there was no focal point in the Government for dealing with the grain and oilseed storage sector. Conversation with officials of five different Ministries, their provincial counterparts as well as with the representatives of the public sector firms responsible for procuring, handling, processing and marketing wheat, rice and cotton had dramatized the fragmentation of responsibilities for planning and implementing storage programs that exists. Recent conversations with Secretary General Kazi and Secretary Aftab Ahmad Khan highlighted this problem. Consequently the decision to give the Ministry of Agriculture full authority to deal with countrywide storage problems was welcomed. Dr. Wolffer observed that USAID looked forward to working with the Ministry as it assumed its new expanded role.

Dr. Pfost then made a presentation of the Team's recommendations to the Government. The recommendations addressed the problems perceived to be most pressing in the short, medium and long run. Some of the most significant recommendations and Mr. Imtiazi's reaction to them included:

Short Run Recommendations, Present June 1977

1. Available official statistics suggest that the Food Department may have only 200,000 tons of available storage capacity at the outset of next spring's wheat harvest due to continuing imports and remaining stocks. An immediate update of these projections is needed and plans to deal with impending emergency must be formulated. Secretary Imtiazi asked Joint Secretary Ayub to carry out the exercise immediately.

2. Dr. Pfost suggested the AID might be able to assist in evaluating plans and designs for the 500,000 tons of capacity to be built in FY 78. Secretary Imtiazi expressed keen interest in securing this kind of technical assistance immediately.

3. If wheat crop projections for this year's crop are correct, additional temporary storage space will have to be created and utilized. Mr. Imtiazi expressed interest in two possibilities suggested by Dr. Pfost: (a) purchase of 1,000 ton capacity inflatable buty containers from the U.K.; (b) construction of low cost stabilized soil concrete structures of the type being experimented with by IRDP with CARE's assistance.

4. Damaged stocks lying with the Food Department need to be removed from the godown premises and disposed of immediately; currently these are jeoparadizing the quality of stock in good condition. Mr. Imtiazi said that a November 18th meeting with the Provincial Secretaries of Food would take up this problem.

Medium Run Recommendations, July 1977 - June 1978:

1. Dr. Pfost suggested the need to evaluate and modify as necessary site and capacity plans for storage to be built in FY 78. This exercise might include an evaluation of the suitability of creating bulk storage facilities at flour mills which currently have only very limited storage capacity. Preliminary evidence available to the Team suggests that bulk storage elsewhere in the marketing system is likely to be inappropriate because it would require a major change in grain handling technology presently employed.

2. Dr. Pfost encouraged the Government to continue to work on developing suitable alternative low cost storage facilities. This is an exercist that AID may be able to support; promising starts have already been made by IRDP-CARE and others.

3. Significant quantities of grain are stored at the farm. No research has been conducted to estimate storage losses at this level. Such research is necessary to determine the magnitude of the problem and the need for intervention. The Secretary agreed, stating he felt that losses due to insects and rodents are probably very significant.

4. Dr. Pfost discussed the desirability of introducing a grading system which would offer producers positive incentives for delivering good quality commodities. The Secretary agreed with the soundness of the concept but said that it was difficult to operationalize in Pakistan. Dr. Pfost observed that a system of grades had been satisfactorily introduced in many other countries and that their experience may be relevant to Pakistan. Mr. Imtiazi expressed interest in exploring this possibility.

5. To implement a more effective storage program, Pakistan needs trained storage engineers, entomologists and agricultural economists. This may require initiating college and university training relevant to the problems of the storage sector. Secretary Imtiazi readily agreed with the importance of staffing concerned Government Departments with adequately trained technicians.

6. Dr. Pfost's final medium run recommendation focused on the need to develop contingency plans for exporting wheat, should the need arise before the new Port of Qasim facilities become available after 1981. Mr. Imtiazi agreed that such a planning exercise is needed.

Long Run Recommendations, July 1978:

Dr. Pfost suggested that a master plan was needed to rationalize Pakistan's storage sector. This exercise can be initiated after some of the short and medium run recommendations have been implemented. Mr. Imtiazi agreed with the desirability of carrying out such an exercise. He said that the first priority was dealing with the problems immediately at hand.

The meeding ended with the understanding that USAID stands ready to consider requests for technical assistance and looks forward to working with the Ministry of Food and Agriculture and the Economic Affairs Division on this matter.

Wayne R. Nilsestuen

Clearance:
WA Wolffer (in draft)
Director Acting

Distribution:
D:DD, AD/DP, PROGRAM, DEA, AD/AP, AD/CDE, AID/C, RLA, Embassy ECON, Embassy AGATT, Pakistan Desk, AID/W (6).

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

MISSION TO PAKISTAN

MEMORANDUM OF CONVERSATION

Participants:

Mr. A. G. N. Kazi, Secretary General, Finance and Economic Coordination, Ministry of Finance

Mr. Arthur M. Handly, Assistant Director for Development Policy, USAID/ Pakistan

Mr. Wayne R. Nilsestuen, Agricultural Economist, O/AP, USAID/Pakistan

Dr. Harry B. Pfost and members of the KSU Team

Dr. William A. Wolffer, Acting Director, USAID/Pakistan

Place & Date: Mr. Kazi's office, Ministry of Finance, November 10, 1976

Subject: Grain and Oilseed Storage

Dr. Wolffer introduced the members of the Team to Mr. Kazi and explained that they had held extensive discussions with senior officials in Islamabad regarding the problems of the grain and oilseed storage and marketing sector. The team also visited with provincial officials, market intermediaries, and farmers in the Punjab and Sind. Based on these conversations, the Team has developed a set of recommendations that the Government may wish to consider.

Dr. Pfost then presented the Team's findings and recommendations. He highlighted the problems the country faces in the short run (from the present through June 1977), medium run (July 1977 through June 1978), and the long run (FY 79 and beyond). The need for coordinated planning and implementation was identified as the problem of paramount importance. Mr. Kazi strongly agreed with this conclusion.

The discussions that ensued consider the alternatives of various Ministries assuming overall responsibility for storage. The objective would be to view the problem from a country-wide perspective and charge a single entity with the authority and responsibility for dealing with the problem across Ministerial and Departmental lines. The Ministry of Agrarian Management, the Ministry of Food and Agriculture and the Planning Commission were all discussed as potential candidates for this assignment. It was recognized that each body has special strength and weakness and that an ideal solution does not exist. Secretary General Kazi said that he would seek to resolve this issue after the Team had debriefed the other concerned Ministries.

In closing, Mr. Nilsestuen inquired about the availability of a report on wheat storage and distribution prepared for the Cabinet Division by MICAS Associates of Karachi. He suggested that the Team could review and critique the report if it were made available immediately. Mr. Kazi agreed to assist in making a copy of the report available to the Team.

Wayne R. Nilsestuen
Agricultural Economist

Clearance:
A/DIR:WA Wolffer (in draft)

Distribution: OD/DD, AD/DP, PROGRAM, DEA, AD/AP(A)-6, AD/CDE, AD/C, RLA
Embassy ECON
Embassy AGATT
Pakistan Desk, AID/W (6)

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

MISSION TO PAKISTAN

MEMORANDUM OF CONVERSATION November 10, 1976

Date & Place of Meeting: November 10, 1976 - Office of Mr. Sultan Ali Chaudhry.

Participants:

Mr. Sultan Ali Chaudhry, Special Assistant to the Prime Minister for Agriculture.
Mr. Heshamul Huque, Director-General, Agricultural Research Council.
Dr. William A. Wolffer, Acting Director, USAID/Pakistan.
Mr. Wayne Nilsestuen, Agricultural Economist, USAID.
Mr. Harry Pfost and members of the Kansas State University Team.

The meeting was held in the office of the Special Assistant to bried him on the work shich the KSU team has been doing on grain storage. The Special Assistant was informed of the three-step proposal to deal with the storage problem which he said appeared to be acceptable. We reviewed with him our consultations that day with Secretary-General Kazi and Secretary of EAD Aftab Ahmad Khan and related the decisions which have been reached by those two gentlemen and the Food and Agriculture Secretary Imtiazi to establish a focal point in the Ministry of Food and Agriculture to coordinate the efforts which would be addressed to solving the storage problem. The Special Assistant said he agreed with this decision and that a strong person was needed to take charge and that it was a fulltime job.

Mr. Pfost highlighted the major points in each of the three steps which the team is proposing. In the short run he specifically noted that the Government needed to extend its projections on food grain stocks and storage capacity through June 1977. The data which have been provided to the team by the Government indicate that all available storage will be fully utilized at the time the next harvest starts in April 1977. Therefore, it is urgent that the Government comes to grips now in planning the storage for the 1977 crop.

In the meadium term Mr. Pfost said it is also time now to deal with design and location of facilities for the second 500,000 tons of storage to be built in 1978. For the long-term he described the systems analysis approach being used in the Phillippines and in Egypt. The Special Assistant said this seamed to make a great deal of sense and that the Government should move ahead in this direction. With respect to design and construction of storage facilities, the Special Assistant agreed that under the current situation the several agencies involved would each have their own program and there would not be standardization.

He felt the only way to accomplish this would be to have a special unit in the Government which would approve the designs from an engineering point of view and ensure that quality construction was carried out. He asked that we keep him advised of the progress we were making.

William A. Wolffer
Acting Director

Distribution: DD, AD/DP, PROGRAM, DEA, AD/AP (4). AD/CDE.
AID/C, RLA
Embassy ECON
Embassy AGATT
Pakistan Desk, AID/W (6)

SHORT-RUN RECOMMENDATIONS: Present - June 1977

1. Extend Government projections of Monthwise Food Grain Stocks and Storage Capacity - 1976/1977 through June 1977.

2. Coordinate data collection for wheat, rice and cottonseed:

   A. Production
   B. Consumption/Offtake
   C. Imports/Exports
   D. Stocks
   E. Storage Capacity

      1) Existing
      2) Planned

3. Improve interagency coordination of planning, construction and utilization of storage facilities (for example, PWD/Food Department, Food Department/Flour Milling Corporation/PASSCO).

4. Implement recommendations contained in the Report of the Special Committee on Development of Food Grain Storage in Pakistan, particularly with respect to the establishment of an Executive Committee with the staff and authority specified in the report.

5. Evaluate plans and designs for anticipated 1978 storage construction program.

6. Plan emergency storage measures for 1977 wheat purchases.

7. Dispose of damaged grain stocks now stored by the Food Department.

8. Provide adequate insect control measures for stocks held by the Food Department.

MEDIUM-TERM RECOMMENDATIONS: July 1977 - June 1978

1. Evaluate and modify as necessary site and capacityplans for second 500,000 tons of storage in more detail. Consider:

   A. Cost and appropriateness of bag storage versus bulk storage.
   B. Need for and type of storage at flour mills.

2. Identify, test and evaluate alternative low-cost storage facilities.

3. Evaluate alternative institutional arrangements for constructing, operating and maintaining storage and handling facilities.

4. Create the capability to coordinate the efficient management and use of food grain and oilseed storage.

5. Study and evaluate the use of rail versus truck transportation to minimize transfer costs.

6. Identify magnitude and source of on-farm grain and oilseed storage losses to determine possible need for:

   A. Improved designs
   B. Improved management
   C. Better distribution of insecticides.

7. Evaluate the need for a grain and oilseed grading system to provide more adequate incentives to farmers and others to maintain commodity quality.

8. Train grain storage entomologists to be attached to Food Department and Rice Corporation.

9. Identify training requirements for:

   A. Storage engineers
   B. Economists specialized in marketing

10. Formulate plans for actions required if Pakistan becomes a wheat exporter before 1981. Consider:

   A. Port facilities
   B. Transportation
   C. Pricing

LONG-RUN: July 1978 --

1. Country-wide Master Plan.

A major study should be conducted to develop a Master Plan for improving storage and processing practices in order to reduce marketing costs for food grains and oilseeds. Consideration should be given to establishing:

   A. Time margins for storage incentives.
   B. Simple and effective grades and standards for major agricultural products.
   C. Evaluation of transportation methods as to:

      1) Requirements
      2) Capacity
      3) Availability
      4) Costs

   D. Storage and processing facilities for food grains with respect to:

      1) Site
      2) Type
      3) Timing
      4) Location

E. Consolidation of coordination of various government agencies concerned with storing, handling, processing and marketing of food grains and oilseeds.

F. Strategic reserve requirements

G. Improvement in the quality, availability and utilization of data required to conduct the planning exercise.

H. Organization for carrying out activities A through F and execution of a systems analysis approach.

2. Construct storage, handling and processing facilities identified in Master Plan.

November 10, 1976

Appendix C

Time Margins for Storage

Time margins for storage must be established based upon local conditions and costs. In the United States this cost is presently about $1.60/T/month for wheat as can be seen from grain futures prices. Time margins must reflect the following cost factors:

1. Interest on investment in the commodity (perhaps 13% in Pakistan).
2. Risk (includes fire, theft and quality loss). This might be in the range of 3 to 5% of the value of the commodity.
3. Shrinkage - assume about 1%.
4. Interest on investment on facility (about 13% of half the first cost).
5. Depreciation - about 4% of facility cost.
6. Handling costs - probably a minor item.

Farmers are most likely to consider points 1 and 2.

Appendix D

Grading Factors and Discounts

The following discussion is based upon a grading system to be applied at point of first sale. It would not be applicable to export grading.

Grading factors which are considered most important and most of which are now used by the Food Department include:

1. Moisture
2. Foreign material
3. Insect and mold damage
4. Mixture of other grains
5. Empty kernels in paddy rice
6. Prohibited material such as treated seed or other toxic materials or seeds.

Discounts to be applied for each quality factor should be about as follows:

1. Safe storage moisture is about 12% for wheat and rice. Discount about 1.1% for each 1% above 12% (formulas and tables are available). (Give a premium of 1% for each 1% below 12%). In addition, discount grain above 12% to cover cost of drying using local costs.
2. Allow about 1% foreign material. Discount 1% for each 1% excess.
3. Discount about 1% for each 5% of insect damaged kernels and 5% for each 1% moldy kernels. Field studies to show the discounts which consumers currently apply to these damage factors would help establish the validity of these discounts.

4. Allow about 2% of other grains and/or varieties. Discount 1% for each additional 2%. Field studies could be used to check validity.
5. Allow about 2% (field studies should be used to verify what is a practical minimum). Discount 1% for each additional 1% of empty kernels.
6. Go-no-go. Discount 100% if poisonous materials are present.

Appendix E

Elements of Bag Warehouse Design

As a result of bag storage measurements in Pakistan for wheat, the following values should be used:

Bagged wheat in jute holds 2½ maunds equalling 205 pounds each.

Specifications per bag equal:

Length: 36 inches (3 bags long equal 9 feet)

Width: 21.6 inches (5 bags wide equal 9 feet)

Height: 10 inches (14 bags high equal 11 feet 8 inches)

Wheat Density: Bulk wheat is 48 pounds per cubic feet

Bagged wheat was 4.5 cubic feet per bag equalling 45.5 pounds per cubic foot.

Bags stacked for example: 9'x 45'x 14 bags high equal 1050 bags at 205 pounds equalling 96.1 metric tons.

18'x 18'x 14 bags high equal 840 bags at 205 pounds equalling 77 metric tons.

Using stacks 30 inches from the walls and 3 to 4 feet aisles would give approximately 1/3 aisle space and 2/3 bag floor space. The larger the stack the less aisle space is required for buildings of normal size. Six square feet of warehouse floor per ton including aisle should be adequate when stacked 14 bags high.

Building dimensions and column spacing should be selected for the most effective use of space, consistent with optimum building costs.

Table A-8

MONTH-WISE FOODGRAIN STOCKS AND STORAGE CAPACITY - 1976-77 (ESTIMATES)*

Month	Opening Stocks	Procurement	Imports	Total availability (2+3+4)	Off-take	Closing stocks (5-6)	Govt. storage capacity	Surplus or deficit storage (8-7)
1	2	3	4	5	6	7	8	9
				----------000 tons----------				
May 1976	390	770	36	1,196	170	1,026	948	- 78
June	1,026	600	158	1,784	180	1,604	948	-656
July	1,604	350	12	1,966	190	1,776	995	-781
August	1,776	150	-	1,926	210	1,716	1,028	-688
September	1,716	100	-	1,816	210	1,606	1,051	-555
October	1,606	65	-	1,671	220	1,451	1,080	-371
November	1,451	-	100	1,551	220	1,331	1,105	-226
December	1,331	-	150	1,481	220	1,261	1,113	-148
January 1977	1,261	-	150	1,411	220	1,191	1,119	- 72
February	1,191	-	150	1,341	220	1,121	1,119	- 2
March	1,121	-	150	1,271	220	1,051	1,119	+ 68
April	1,051	-	150	1,201	220	981	1,119	+138
Total		2,035	1,056		2,500			

*From GOP, Planning Div. Ag. & Food Secretary. Report Dated June 29, 1976.