ADSP/CORE 1990 NO. 2

AN EVALUATION OF THE FINANCIAL FEASIBILITY OF FOUR NEW WHOLESALE FRUIT AND VEGETABLE MARKETS IN THE YEMEN ARAB REPUBLIC

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IN COOPERATION WITH

THE AGRICULTURAL DEVELOPMENT SUPPORT PROGRAM
AND
THE DIRECTORATE OF AGRICULTURAL MARKETING
MINISTRY OF AGRICULTURE AND FISHERIES
SANA'A, YEMEN ARAB REPUBLIC

JANUARY 11 - FEBRUARY 28, 1990

This study was funded by the United States Agency for International Development, Sana'a, Yemen Arab Republic, through a contract with the Consortium for International Development (CID), Tucson, Arizona and implemented by Colorado State University.

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EXECUTIVE SUMMARY

1. Four new wholesale fresh fruit and vegetable markets are urgently needed in Sana'a, Taiz, Hodiedah and Al-Hosaynieh. A study by Howard Steele in November 1989 found that the value of the benefits of the new markets (from reduced waiting time at the market by farmer/traders who bring their products to be sold, and the reduction in product losses resulting from the better market facilities) far exceeded the construction and operation costs over the 25 years of the projected life of the markets.

   The purpose of this study is to evaluate the financial feasibility of these proposed wholesale markets. To be financially feasible the following three conditions had to be met:

   1. Total construction costs had to be equal to or less than the funds available.

   2. Cash inflows (revenue) from users fees had to be equal to or greater than cash out-flows (operating and maintenance expenses) during the first five years of operation. User fees also had to be at or below the level that users would be willing to pay.

   3. The level of user fees needed so that total revenues for the first five years of operation equalled the total operating cost for the first five years (the breakeven point) needed to be at or below the level that user would be willing to pay.

   The markets at Taiz, Hodiedah and Al-Hosaynieh met all three criteria and were judged to be financially feasible, based on the assumptions made in the analysis and using the best available information.

   A new wholesale market to serve the total wholesale market volume in Sana'a, whose construction costs would be publicly financed with PL-480, funds should be put on hold for the time being. A new privately financed wholesale-retail fresh fruit and vegetable market is currently under construction and the first phase of the market is to be opened about April 1, 1990. If it proves successful it could serve a significant part of the wholesale market volume.

   The progress of the new privately owned wholesale market should be closely monitored, to see if in the future there is a need for a new publicly financed market, but on a smaller scale than is outlined in this report.

Construction costs for the basic market facilities (not including the land) were estimated at 40,163,000 YR for the Sana'a market, 30,941,000 YR for the Taiz market, 29,697,000 YR for the Hodiedah market and 29,697,000 YR for the Al-Hosaynieh market. These construction costs are only 36% to 38% of the estimated construction costs in the Steele report (Steele PP. 44, 50, 61). It was judged that this level of funding would be available.

With user fee levels between 25 to 30 YR. per metric ton of product handled in the markets, cash inflows (revenue) exceeded cash outflows (operations and maintenance) during the first five years of operation.

In preparing the cash flow budget, it was judged that projected market volumes were on the conservative side and that the required level of user fees were at or below those users would be willing to pay, so the markets were judged to be "cash flow" financially feasible.

The average breakeven user fee level per metric ton for the first five years of operation of the markets were 22 YR for the Sana'a market, 23.5 YR for the Al-Hosaynieh market, 24.9 YR for the Hodiedah market and 26.1 YR for the Taiz market. These fees are only slightly higher than users are now paying, so it was assumed that they would not object to the higher fees for much better market facilities and market services. Hence, all the markets were judged to be "breakeven" financially feasible.

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AN EVALUATION OF THE FINANCIAL FFEASIBILITY OF FOUR NEW WHOLESALE FRUIT AND VEGETABLE MARKETS IN THE YEMEN ARAB REPUBLIC

INTRODUCTION

PURPOSE

The purpose of this report is to evaluate the financial feasibility of each of four proposed new wholesale fruit and vegetable market facilities. Three of the markets are to be located in the outskirts of Sana'a, Taiz, and Hodiedah, which are the three largest urban areas in the Yemen Arab Republic. The fourth market is to be located in the rural community of Al-Hosaynieh located in the Tihama region on the main road between Taiz and Hodiedah. There are currently wholesale markets in each city, but they are located in the inner city. They have all outgrown their present locations. Conditions are very crowded and congested, facilities are inadequate and there is not opportunity for expansion.

These wholesale markets urgently need to be relocated as was discussed in greater detail in the Steele report (Steele,P 5).

EARLIER ECONOMIC FEASIBILITY ASSESSMENT REPORT

In June of 1989 the Ministry of Agriculture and Fisheries in the Yemen Arab Republic (YAR) proposed the relocation of the four major wholesale fruit and vegetable markets in the country. New sites were to be selected and new facilities constructed. As a first step in the evaluation of this proposal, Dr. Howard Steele, a TDY consultant through the Agricultural Development Support Program, CORE II did an economic feasibility assessment of the proposed four new wholesale market facilities which he completed in November 1989 (Steele, P1). He concluded that the construction and operation of the four proposed new wholesale fruit and vegetable market facilities at Sana'a, Taiz, Hodiedah and Al-Hosaynieh would all be economically feasible and would be beneficial to the country.

He based this conclusion on the fact that the internal rates of return for the investments in these new markets were all positive and ranged from 22% for the Taiz and Al-Hosaynieh market, to 25% for Hodiedah and 30% for the Sana'a markets. He also found, that based on his projections and assumptions, the stream of benefits over the 25 year useful life of the market facilities will far exceed the cost stream over that same period.

The high IRR's were a result of the expected reduction in losses for the fresh fruits and vegetables that move through the markets and time saved by farmers, middlemen and retailers through use of the new, less congested market facilities.

He estimated the construction costs for the markets and the associated facilities, including land acquisition, were 104,633,000 YR for the Sana'a market, 82,933,000 YR each for the Taiz and Hodiedah markets and 78,038,500 YR for the Al-Hosayneih market. This is a total of 348,537,500 YR for all four markets.

After reviewing his report, a major concern of both the Ministry of Agriculture and Fisheries and the USAID mission was that construction costs for these markets were extremely high. The financial feasibility team was asked to see if ways could be found to substantially reduce the construction costs of these markets.

WHOLESALE MARKET DEVELOPMENTS SINCE THE STEELE REPORT

The major wholesale markets are currently in a very dynamic state, with major changes taking place in the markets at Sana'a, Taiz and Hodiedah.

Sana'a Market. In late January 1990, the Sana'a office of the Ministry of Municipalities and Housing completely cleared everyone out of the Al-Hasaba market area. Since then both wholesalers and retailers formerly using the market have been operating on the sides of the streets in front of, and to the side of the old market.

The Ministry has begun work redoing the market. Their plans call for hard surfacing the entire area, and converting the market into a series of retail shops. They plan to move all the wholesalers to the Al-Madbah market area owned by the Ministry of Municipalities and Housing, and located in the northwest part of Sana'a.

About three months ago work began on a new privately owned wholesale - retail fresh fruit and vegetable market.

The market is located on the Taiz road in the southeastern part of Sana'a. The owners have approximately 3 hectares of land in that location. They also have another 5 hectares on the same road about 2 km further south, on which they could construct additional market facilities.

The private individuals plan to build the market in phases, and will have the first phase open for business by mid March or early April of 1990. Work is under way on other phases. They have already taken 40 reservations for selling spaces in their new market. They have had to stop taking reservations until they see how many vendors their first phase facility will accommodate. They continue to have new requests for space almost daily.

The private market will have large covered areas and loading and unloading docks for trucks, and areas for selling and buying. The market area will be hard surfaced, and it will be well lighted. The city will provide waste disposal. They have their own well and are building a sewage disposal system.

The private market plans to offer other services on demand, such as washing facilities for the products, cool/cold storage facilities and banana ripening rooms.

The private market owners have obtained a license from the office of the Ministry of Municipalities and Housing to operate such a facility and the Ministry is cooperating with them by paving the access road and providing new street lighting.
The owners of the private market have not yet set the level of user fees, but they likely will be higher than the publicly financed market, because the private owners hope to be able to recover their capital costs, which the public market will not have to do.

The owners feel they have a good location from the standpoint of products coming to market and for easy excess by retailers and individual consumers.

If this private venture is successful it has the potential to eventually handle a significant portion of the wholesale market volume for the Sana'a market.

Taiz Market . When the evaluation team visited the site of the current city wholesale market in Taiz, we found it had been closed by the local office of the Ministry of Municipalities and Housing, and has been vacant since early January 1990. All the middlemen and the farmer/truckers had moved to a new area along the side of a main highway on the edge of town several kilometers from the old market. The trucks selling produce are parked on two sides of a cold storage facility.

It is a very temporary location. There are virtually no facilities at that location. There is not even adequate space. A year or so earlier, a dispute over high user fees at the old market resulted in a small privately owned wholesale market being constructed and operated a few blocks away from the old wholesale market.

As is evident the need for new wholesale market facilities in Taiz is urgent. But there are no immediate plans to build such a facility.

Hodiedah Market. The Hodiedah office of the Ministry of Municipalities and Housing is moving rapidly forward with plans to relocate the present wholesale fresh fruit and vegetable market. The market is currently located within the city in a rather small open area that is surrounded on all sides by buildings. The overflow, which often is quite large, has to operate along the narrow city streets leading to the main market area.

Except for the streets and sidewalks the area is not hard surfaced. There are virtually no facilities. Some of the nearby buildings are used to store market supplies and unsold produce.

The Ministry of Municipalities and Housing has located some land they own near the highway at kilometer 4.8 east of the city. They do not as yet have title to the land, nor has the paperwork been completed for them to use the land for a wholesale market.

They have drawn up some preliminary sketches of the market layout, but they not obtained the financing needed to construct the market.

Al-Hosaynieh Market. There are no immediate plans to relocate this market. It operates at night along both sides of the highway for almost a kilometer right in the middle of the little village. There are virtually no facilities at this market. The only light comes from nearby businesses.

It is recognized by those at this market that it needs to be relocated for several reasons. The main highway between Taiz and Hodiedah runs right through the middle of the market, and the market is very congested and dangerous.

They would like a new market to have the market area hard surfaced, be shaded, well lighted, and have sanitary facilities (toilets).

The evaluation team was shown an area just west of the town that could be used as the new market site. Some of the small business owners (mostly small restaurants) have voiced their opposition to relocation. They fear a loss of business if the market were to be moved from directly in front of their businesses. Apparently much of their business now comes from those using or visiting the market.

CRITERIA USED TO EVALUATE FINANCIAL FEASIBILITY

If a project is shown to be financially feasible this implies that there are no financial aspects of the project that would limit its success, given the assumptions and conditions used in the analysis.

Three different methods and criteria were used in this report to evaluate the financial feasibility of each of the four proposed new wholesale fresh fruit and vegetable markets.

1. Since the public funds available to construct the markets are limited, it was necessary to first estimate the construction costs for each of the markets and compare this to the anticipated amount of funds available. To be financially feasible construction costs had to be equal to or less than the amount of funds available.

   Although specific sites have not been selected for each of the markets, it was assumed that suitable sites can be found and that they will be located on presently owned government land. It was also assumed that PL-480 funds that belong to the YAR Government will be used to finance the construction of each of the markets. Hence, there will be no direct costs that will have to be financed or repaid from revenues generated by the markets for land acquisition or market facilities construction.

2. It was assumed that the only other costs associated with the new markets will be for operations and maintenance. It was also recommended that market user fees be levied to generate funds to pay operating and maintenance costs. In order for the new markets to be financially feasible they would need to be able to generate sufficient revenue to cover these costs.

A cash flow budget was completed for each market for the first five years of operations. These budgets were used to determine if projected cash inflows (revenues from each market) would be equal to or greater than the projected cash outflows (operating and maintenance expenses), a necessary condition for financial feasibility.

Revenues were assumed to come from one or more kinds of user fees. Thus, the total revenue projected for any given period is determined by the level of the individual fees and the total volume of fees collected during that period.

Breakeven analysis was also used to evaluate the financial feasibility of the four new wholesale fruit and vegetable markets. The information used in this analysis included:

a. The amount or level of operating costs

b. The amount of user volume (such as number of trucks)

In this study the breakeven point will be where the total revenue generated from user fees equals total annual cash operating and maintenance expenses. Market volumes and operating expenses will be different for each of the first five years of operation for each market.

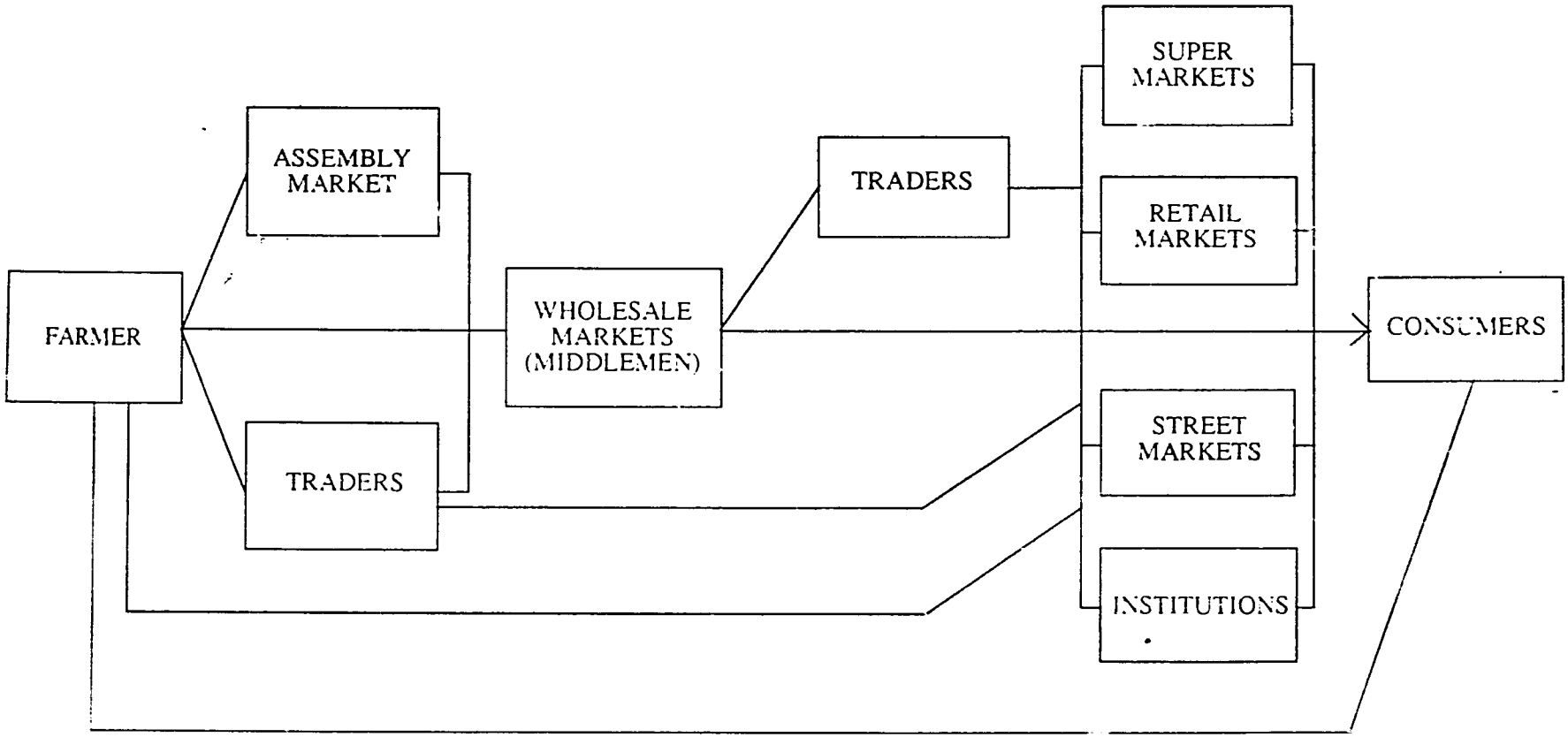
A breakeven user fee level will be calculated for the five year period for each market by dividing the total market volume for each market for the first 5 years of operation into the total operating expenses for each market.

The level of user fees needed for breakeven has to be at or below the level of fees it was estimated users will be willing and able to pay.

MARKETING CHANNELS FOR FRESH FRUITS AND VEGETABLES IN THE YEMEN ARAB REPUBLIC

To help understand the role of the wholesale fruit and vegetable markets and the facilities that will best serve the needs of those using these markets a brief description of the marketing channels and the way in which fruits and vegetables are marketed in the YAR may be useful (see figure 1).

Figure 1. Marketing Channels for Fresh Fruits and Vegetables in the Yemen Arab Republic, 1990



There are about 4.8 million hectares of cultivatable land of which about 1.35 million is used for crop production. Of the total, about 250,000 hectares are irrigated and the remainder is rainfed. Up to 1/2 of all tillable land is terraced and surrounded by borders designed to capture and retain rain water and prevent erosion. Fields are small and irregular in shape, so it is difficult if not impossible to use mechanical power for any of the field work on many of the fields (IAC, P 17).

Efficiency in agricultural marketing is constrained by the dominance of small holdings and the parcelization of holdings into separate often widely separated individual fields. Nearly 90% of all farms are smaller than 5 hectares, and nearly 60% less than 1 hectare (Taha, P 23). Inheritance laws and customs, tradition, population pressure on land use and topography are some of the reasons for this pattern of land holdings. Because of this, there seems little possibility in the foreseable future that either farms or existing fields can be consolidated into larger more efficient production units.

The YAR, although a relatively small country, is fortunate to have a variety of micro-climates which makes possible the production of a wide variety of fruits and vegetables on an almost year round basis.

Most farmers diversify and produce several crops. As a result they usually have a small load or less of fruits and vegetables ready for market at any one time. Nearly all produce is shipped to market in 1 to 1.5 ton pickup trucks which represents the only farm vehicle owned by most farmers. Nearly all farmers personally bring their products to market, often travelling long distances (up to 220 Km) in their own or a neighbor pickup truck (Amann, P3). In most areas there are dealers or traders who buy products directly from farmers and then take them to central wholesale markets. Some of the potatoes, onions and watermelons are assembled in large quantities in rural areas and transported to the urban wholesale markets in 10 to 20 ton trucks. Another reason for the widespread use of small trucks to transport fruit and vegetables from farm to market is the high prices charged by the owners of the large trucks. They have a cartel that fixes and maintains these high prices (FAO, P4).

There are some feelings of mutual mistrust among all participants at the wholesale markets. In part, this mistrust is the result of the lack of product homogeneity and quality standards. Another factor is that produce is usually sold by farmers based on volume (i.e. by the box, or sack), but the retailer sells the products by weight. Some boxes are found to

have excessive amounts of leaves and other packing materials, while sacks of produce sometime have large amounts of soil in the bottom. It is not surprising then that it is necessary for the buyer to personally inspect each lot and often each container of produce they plan to buy. Their inspection is often done as the products are transferred from the farmer's to the buyer's containers.

This means that new wholesale markets facilities will need to be designed to accommodate a large number, perhaps 300 or more selling spaces for pickup truck loads of produce at the Sana'a market and slightly fewer at the other markets.

The wholesale markets provide a place and the opportunity for a large number of buyers and sellers of fresh fruits and vegetables to get together to buy and sell. This is one of the necessary conditions for a competitive market. The markets are generally segregated by products. For example, those selling potatoes are assigned one place in the market and those selling watermelons, another.

Nearly all of the products that move through urban wholesale markets are sold through a middleman. In the Sana'a market there are currently 8 to 10 of these middlemen firms that each have several employees.

Farmers have found that middlemen provide useful services. Some of these services include:

1. Finding buyers for the seller's products.

2. Negotiating the selling price.

3. Settling disputes between buyers and sellers.

4. They are the best source of market information, they have a network that provides them with current market news, and probably are the best informed of anyone at the markets on current local market conditions and also conditions (selling prices, price trends and market volumes) on the other major wholesale markets.

5. They often provide credit to both farmers and retailers.

6. They sometimes provide containers (boxes, sacks) to farmers.

7. If a lot is not completely sold when the farmer has to leave they will often store the product and sell it for him at a later time, usually the next day.

Middlemen do not take title to the products, so the price and product risks are borne by the seller. A middleman may have several employees working with him and usually sells 3 or 4 different products. Which means they often operate in different physical areas of the market.

It would be desirable to have about 8 to 10 small offices, conveniently located throughout the wholesale markets, for use by the middlemen firms.

There are numbers of different kinds of buyers at the three urban wholesale markets, but the overwhelming majority are small volume retail outlet owners who sell less than 500 Kg/day of fruits and vegetables. Supplies are obtained daily or at intervals of up to no more than a week. No retail outlets in the YAR have either cool or cold storage facilities for produce. They often prefer to buy perishable produce products in mixed stages of ripeness. The retailers' ability to pick sequentially through, for example, red and green tomatoes from a box they purchased at the wholesale market is important to the economy of retailing in small scale operations. Volume of sales of fresh fruits and vegetables is low, but turnover is high, so it is important for them to be able to buy products in small lots on an almost daily basis (IAC, P 18).

In another study none of the Yemeni supermarket owner/operators interviewed thought there to be a demand for selected, graded consumer packaged produce in the high consumption urban areas (IAC, P. 18). However, another study found that consumers do differentiate for quality. They were paying a 10 to 35% higher price for first quality produce than for average (ECI, Ltd).

It is not anticipated that volume of produce handled by individual retailers will increase to any extent in the foreseeable future.

Some traders also buy products at the wholesale market to supply small retailers, mini-supermarkets and institutions. They also buy in relatively small volumes on almost a daily basis. Adequate parking needs to be provided for a large number of small volume buyers. Since most buyers are buying on a daily basis, the market needs a daily supply of fresh produce. It also means that the market will need to be open and operate daily.

The wholesale market at Al-Hosaynieh serves a somewhat different function. It operates nightly for about five winter months and at much smaller volume the rest of the year. It serves as an assembly point for the winter fruit and vegetable production in the Tihama region. Al-Hosaynieh is a small rural community so the market is meant to cater to traders and retailers from the urban markets, both wholesale and retail.

One facility that will be needed at each of the three urban wholesale markets is a banana ripening room, Yemeni consumers have a preference for yellow bananas.

In summary the new wholesale markets should be designed to accommodate a large number of small volume sellers, and a large number of buyers for retail stores.

REDUCTION IN PRODUCT LOSSES RESULTING FROM THE NEW MARKETS

Currently, post harvest losses for fresh fruits and vegetables are very high in the YAR. The percentage of loss varies among products and seasons of the year, but for many products these losses amount to over 30%. There are many causes of these losses. They start with production practices on the farm and occur at every stage in the marketing channel including over-production at marketable prices. There is a long list of suggested things that could be done to reduce these losses. Two thirds of the potential gains can only be realized through improved on-farm practice. Only one-third of the gains are achievable through changes in packaging systems and marketing infrastructure (IAC, P 92).

For the ecohomic feasibility study Steele projected that the improvements in marketing services and facilities at the new wholesale market would reduce losses for root, tuber and cabbage crops by 6% and all other fresh fruits and vegetables by 10% (Steele, P 10). He estimated the value of the reduction in product losses to average about 352 YR per truck load of produce brought to market.

One study found that the causes of losses at the wholesale markets resulted from the following (IAC, P93):

* Secondary rot and disease
* Cracks and splits
* Bruising
* Dehydration

This study recommended the following wholesale market improvements to reduce these losses (IAC P96):

* Provision for covered/shaded areas for sales

* Short term storage

* Provision of a hard surface for unloading and loading produce

* Produce washing facilities to reduce the risk of infection

It is unrealistic to expect substantial reduction in product losses solely as a result of building and operating improved wholesale fruit and vegetable marketing facilities. Other changes will also need to be made and other things done earlier in the marketing chain. Otherwise efforts at the wholesale market will be more damage control rather than maintaining quality. In interviews with farmers and middlemen at the wholesale markets they indicated there was little price discrimination because of product quality or damage. Hence, from the producers' standpoint there is currently little incentive to reduce product losses below current levels.

It is suggested that these new wholesale markets be used by the Agricultural Marketing Extension Service staff to deliver production and handling advice to farmers through the use of demonstrations and supported by simple illustrated publications on how to reduce product losses.

NEED FOR COOL AND COLD STORAGE FACILITIES

The Steele report recommended a substantial amount of cool/cold storage capacity for each of the wholesale markets. One 20 ton unit, two 10 ton units and four 5 ton cold storage units were to be constructed at each market (Steele, P 14).

A review of other marketing studies, as indicated below, that have been conducted has lead to the conclusion that in the foreseeable future the 60 tons of capacity recommend by Steele for each market may be more cold storage than would be needed or be utilized.

Most studies indicated that for a number of reasons cold storage facilities are not needed at the wholesale fruit and vegetable markets at this time. However, one study concluded that a small cool/cold storage unit would be in demand. They said that "farmer/traders, especially those selling tomatoes

and grapes are aware of the steady deterioration of produce as it stands in the market. Markets do not clear perfectly every day at agreed prices. There is, therefore, a recognized demand in the market for short term cool/cold storage to be offered on a rental service basis to small users. An experimental initial capacity of some 20 tons could be envisioned" (IAC, P 99).

It is therefore, recommended that a 20 ton cold storage unit be on the optional list of equipment and facilities. If construction of the basic market facilities requires all available public funds then private funding would be sought, and the cold storage unit would be located at the market, but be owned and operated as a private business. However, if sufficient public funds are available it could be a part of the public market facilities.

Following are some of the reasons why cold/cool storage, would not be needed, or the demand for this service would be very limited:

a. Because of the diverse micro-climates in the YAR, there is a continuous supply of fresh fruits and vegetables at the markets on a year round basis. The exceptions are grapes and citrus (IAC, P 30).

b. Produce arriving at the market is of low and variable quality. Shipments frequently contain overripe, damaged, diseased and dirty products that vary in maturity, and hence, are not suitable for storage since they deteriorate very rapidly (Holtzman, P 30) (IAC, P 16).

c. Cold storage is beneficial where the elapsed time from farmers to consumers is 6 days or greater. For most fresh fruits and vegetable products marketed in the YAR, it is 3 days or less (IAC, P 96).

d. It would be the only link in the cold storage chain. Farmers do not have cold storage facilities. There are refrigerated trucks, but they are not used to transport fruits and vegetables. None of the retailers has cold storage and few consumers have refrigerators (IAC, P 18).

e. The time windows when cold storage might be profitable are very narrow and occur infrequently (IAC, P 14).

f. One study indicated that for it to be profitable to use cold storage, grapes require a 50% or greater premium for a 2 months storage period, tomatoes a 75% premium for a 2 weeks storage period and potatoes a 100% premium for a 3 months storage period (IAC, P 96).

g. There is still substantial excess capacity of existing cold storage facilities, in part resulting from the late 1983 government ban on imported fruits and vegetables. Earlier when fresh fruits and vegetables were permitted to be imported into the YAR, they utilized some of the Yemen cold storage facilities (IAC, P 97).

h. One study suggested that a greater benefit would result if the money were spent on developing technology to smooth seasonal produce arrivals at the market rather than on cold storage facilities to smooth out short term supply variation after the product arrived at the market (IAC, P 16).

WHOLESALE MARKET COSTS

CONSTRUCTION AND DEVELOPMENT COSTS

As noted earlier in this report, the MAF and USAID were concerned about the high cost of market construction estimated by Steele. Steele's estimates reflected his perception of the market facilities required and of the unit cost information available to him.

Early in our study we saw that Steele's unit costs for major cost items were not unreasonable. Accordingly, we sought to lower market construction costs by simplifying the market facilities. Our first step was to clarify our concept of market requirements:

Accommodate daily these numbers of trucks: Sana'a 340; Taiz 210; Hod. 225; Al-Hos. 190.

Arrange facility layout to easily handle trucks of length less than 8 meters.

Accept all kinds of fruits and vegetables in any condition.

No information was available on peak daily tonnage of produce.

Paved or gravelled surfaces for all truck traffic.

Long term parking space for 30 trucks.

Market administration/information building

Hangar space where users can install facilities for handling and storing produce. Handling includes sorting, grading cooling, cleaning, and ripening produce. Steele's recommendations with respect to hangar length will be followed.

Clean water for sanitation, and for washing roots and tubers. Produce will not be washed at Al-Hosaynieh.

Electric lighting indoors and out. Standby power for market lights and pumps. Users will need to provide their own standby power equipment for their handling facilities.

Operating hours: Sana'a, Taiz, and Hod. 4 AM - 8 PM; Al-Hos. 4 PM. - 2 AM.

Provide sanitary facilities adequate for these numbers of people daily: Sana'a 700, Taiz 420; Hod. 460; Al-Hos. 270.

Sanitary sewage disposal system.

Garbage and waste disposal system.

Offices and storerooms for use of middlemen.

Telephone system for use of market employees.

Telephone jacks in offices of middlemen.

Storm drainage systems at Sana'a and Taiz (rain is rare on the Tihama).

Having the market requirements, we prepared plans showing the simplest facilities which would satisfy the requirements (see Fig. 2).

The arrangement of facilities in Fig. 2 is intended to allow efficient market operation and yet to minimize land and paving requirements. These layouts and site shapes are hypothetical, exact market locations being somewhat in doubt.

The costs of the basic market facilities are shown in Table 1.

Following Table 1 optional facilities that could be added to the basic market are described and their costs shown.

Then contingent features, such as bringing electric power to the market sites are described, and their costs shown.

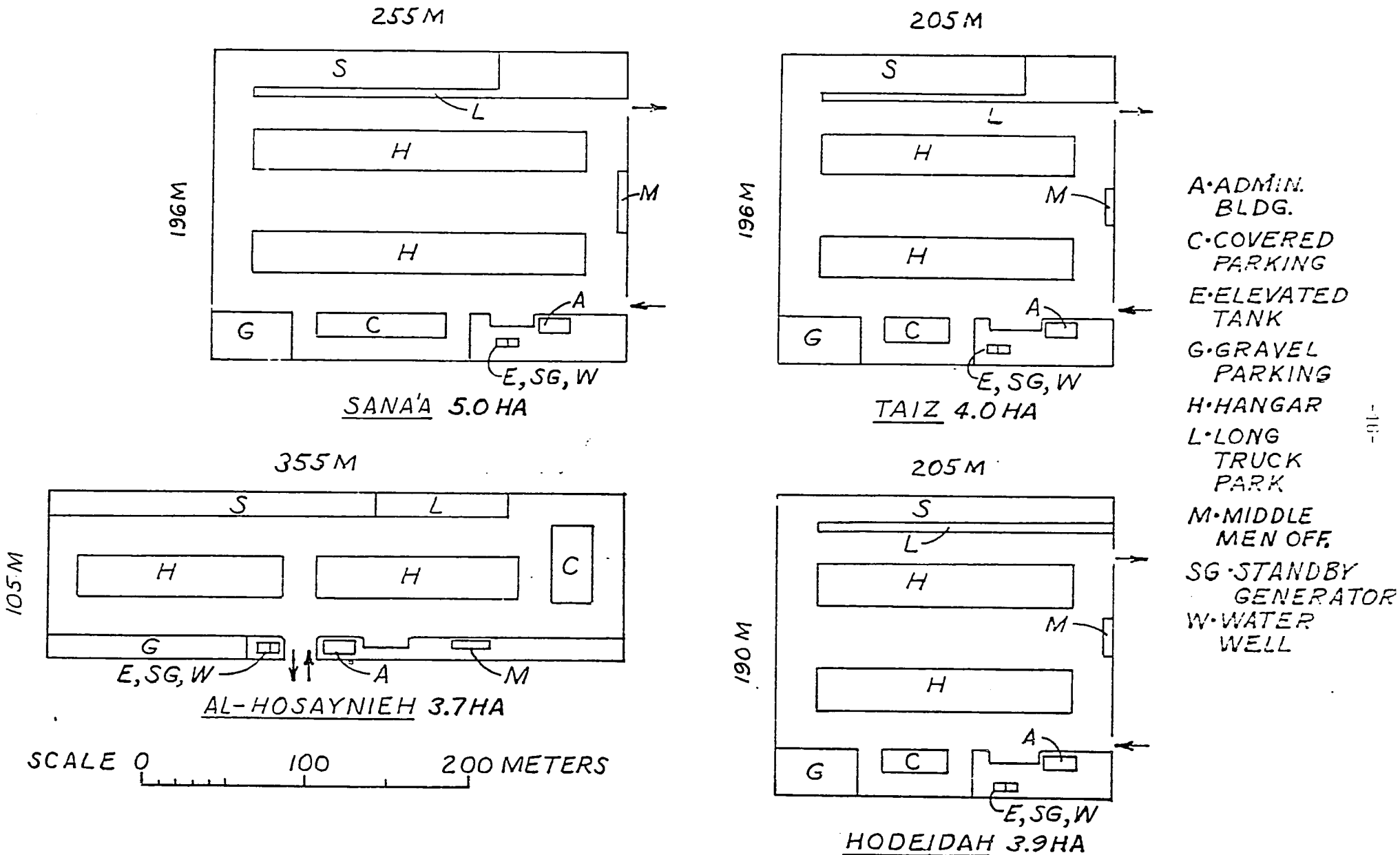


FIG. 2-TRIAL LAYOUTS OF LOW COST FACILITIES FOR THE FOUR MARKETS

TABLE 1. CONSTRUCTION COSTS OF BASIC MARKET FACILITIES ON THE FOUR SITES

CONSTRUCTION ITEMS	MARKET			
	Sana'a	Taiz	Hodiedah	Al-Hosaynieh
(IN RIALS)	(1,000 YR)			
Clearing and grubbing (1) @ 12000/Ha	60	48	47	44
Excavating and filling to subgrade (1) @ 20,000/Ha	100	80	78	74
Perimeter wall and gates (2)@1820/linear meter	1642	1474	1438	1674
Asphalt pavement (3) @ 250/m2	6577	5377	5326	4942
Gravel parking (4) @ 150/m2	780	472	379	672
Main hangars (5) 2@ 26mx206m @2000/m2	21424	-	-	-
Main hangars 2@ 26x 156 @2000/m2	-	16224	16224	-
Main hangars 2@ 26x 126 @2000/m2	-	-	-	13104
Parking hangar(5) 15x80 @1350/m2	1620	-	-	-
Parking hangar 15x40 @1350/m2	-	810	810	-
Parking hangar 25x40 @1350/m2	-	-	-	1350
Administration bldg (6) 10x2 by 1 Story @5000/m2	1000	1000	1000	1000
Offices for middlemen 10@ 4x5x2 story @4000/m2	1600	-	-	-
Offices for middlemen 10@ 4x5x2 story @4000/m2	-	960	960	960
Office equipment (7)	260	175	175	145
Storm drains (1) @ 100,000/Ha	500	400	-	-
Outside lighting (8)	30	30	30	30
Transformer and circuit breaker YGEC estimate	55	55	55	55
Site electrical distribution based on YGEC pole/conductor cost	65	65	65	65
Well S/T 400m;H/ALH 150m;@2100/m	840	840	315	315
Well pump S/T elec. subm; H/ALH	200	200	-	-
Vertical turbine (9)	-	-	100	100
Diesel engine to drive pump (9)	-	-	150	150
Elevated water tank S 200m3, T/H150m3, ALH50m3 (10)	1000	750	750	250
Site water distribution @ 200,000	200	200	200	200
Sewage collection piping and lift station (11)	500	500	500	500
Septic tank @ 150000 (12)	150	150	-	-
Soakaway pits 3 @ 30000 (12)	90	-	-	-
Drainfield (12)	-	100	-	-
Stabilization lagoons (12)	-	-	100	100
Standby diesel generator set(13)	600	430	430	430
Subtotal-Installed facilities	38993	30040	28832	27635
Design and construction supervision @ 3%	1170	901	865	829
Total	40163	30941	29697	28464(14)

( ) See next page for footnotes

TABLE 1. CONTINUED, FOOTNOTES

		Sana'a	Taiz	Hod.	Al-Hos
(1)	Site area - Ha	5.00	4.0	3.9	3.7
(2)	Site perimeter-m	,902	,810	,790	,920
(3)	Asphalt area - m2	26,308	21,508	21,303	19,768
(4)	Gravel area - m2	5,230	3,150	2,525	4,480

(5) Steele's recommendations about total length of hangars were followed.

(6) Steele's recommendations is halved.

(7) See Appendix 3.

(8) Assume hangar perimeter lights will serve adequately. Add six poles near entrance and exit and gravelled parking (pole + base+ lights = 30,000YR).

(9) Diesel-driven, vertical turbine pumps are recommended by Jumaan Equipment Corp.

(10) See Appendix 2 for estimation of water requirements. Concrete tanks to be built by capable foreign contractor.

(11) These stations appear to be essential on nearly level sites.

(12) A septic tank - soakaway pit may be acceptable for Sana'a. It is a quess that a septic tank-drainfield may be more practical in Taiz. Stabilization lagoons appear to be required on the Tihama to avoid polluting the shallow aquifer.

(13) Standby power is intended to provide lighting and pumping power during emergencies. Those installing cool rooms must provide their own standby power systems

(14) The five significant figures recorded here were consilered of assistance in tracking small changes in numbers as this report was developed. It is recommended that they be carried into subsequent documewnts with only two or possibly three significant figures. Thus, Sana'a's total of 40,163,000. YR should be reported as 40,000,000. YR or at the most 40,200,000. YR.

Table 2 shows market construction costs if all the optional facilities are included.

TABLE 2. CONSTRUCTION COSTS OF MARKETS IF THEY INCLUDE ALL THE OPTIONAL UPGRADES

OPTIONAL UPGRADE ITEMS	MARKET			
	Sana'a	Taiz	Hod.	Al-Hos.
	(1,000 YR)			
Least cost facilities (1)	40163	30941	29697	38464
Plus farm input store	+2250	+2250	+2250	+2250
Plus admin. 2nd story	+1000	+1000	+1000	+1000
Minus L.C. hangars (2)	-21424	-16224	-16224	-13104
Plus upgraded hangars	+50400	+37800	+37800	+30240
Minus concrete paving	-6577	-5377	5326	-4942
Plus concrete paving	+39462	+32262	+31956	+29652
Plus additional space	+2800	+2240	+2104	+2000
Plus demons. coolers	+4134	+4134	+4134	+4134
Total costs	112208	89026	87391	79694
Which compare to Steele's costs of	(104633)	(82933)	(82933)	(78038)

(1) From Table 1.
(2) L.C. is least cost

Table 3 shows the costs of the basic markets, and of the markets with upgraded facilities, if certain contingent items were needed.

The future rate of inflation, like almost any future event, is difficult to forecast very accurately. In recent years the inflation rate in the Yemen Arab Republic has been over 20% a year(CPO, P 318). If this level of inflation continues in the foreseable future, it will have a very dramatic impact on the costs of constructing the markets. Hence, the importance of having the market constructed as rapidly as possible. For example, if construction is delayed 2 years the basic wholesale market construction cost would go from 40,163,000 YR to 59,111,000 YR for the Sana'a market, 30,941,000 YR to 45,831,000 YR for the Taiz market, 29,697,000 YR to 44,040,000.. YR for the Hodiedah market, and 28,464,000 YR to 42,265,000 YR for the Al-Hosaynieh market. If the inflation rate turns out to be higher and the delay in building the markets is longer this would increase costs even more. For example, if the annual inflation increases to 30% per year and there is a 3 year delay in building the markets, the cost of the basic Taiz wholesale market would go from 30,941,000 YR as estimated in this report, to 70,293,000 YR in three years. The other markets would have the same relative increases.

TABLE 3. EFFECT OF CONTINGENT COSTS ON CONSTRUCTION COSTS FOR THE BASIC AND UPGRADED MARKET FACILITIES

CONTINGENT COST ITEMS	MARKET Sana'a	Taiz	Hod.	Al-Hos.
	(1,000 YR)			
Basic market costs	40,163	30,941	29,697	28,464
3 km of access road @ 2000/km	6,000	6,000	-	-
1 km access road @ 2000/km	-	-	2,000	2,000
5 km of power line @ 213/km	1,065	1,065	-	-
1 km of power lm @ 213/km	-	-	213	213
5 km of telephone line @ 45/km	225	225	225	225
A chlorination system	234	234	234	234
A second well (1st was dry)	840	840	315	315
A spare pump	200	200	100	100
A spare diesel engine	-	-	150	150
Total costs	48,727	39,505	32,934	31,601
Upgraded market costs	112,208	39,025	37,391	79,694
Adding the contingent costs shown above	8,564	8,564	3,237	3,237
Total costs	120,772	97,590	40,628	82,931

Note: The lengths of needed roads, power lines and telephone lines used above are quite arbitrary. However, it does seem that probable market sites in Hodiedah and Al-Hosaynieh will be near good roads and power lines.

COSTS OF OPTIONAL UPGRADES TO THE BASIC MARKET FACILITIES

1. Add a farm input store 15m x 15m x 2 stories @ 5000/m2 = 2,250,000 YR.

2. Add a second story to the administration building 10m x 20m x 5000/m2 = 1,000,000 YR.

3. Build the hangars to Steele's specifications: Enclose all sides and add a mezzanine over half the width of the hangar. One such hangar 28m x 100m @ 3500/m2 for main structure and 2000/m2 for the mezzanine will cost 12,600,000 YR.

4. Use portland cement concrete paving instead of asphalt paving: The paving costs become:

Sana'a	39,562,000 YR.
Taiz	32,262,000 YR.
Hod.	31,956,000 YR.
Al-Hos.	29,652,000 YR.

5. Supply demonstration coolers:

   1 20 ton)
   2 10 ton) take unit costs from App.1
   4 5 ton) and multiply by 1.5 to include import duty, and multiply again by 13 YR/US$.
   Cost is 4,134,000YR.

6. Additional standby power generation capacity to serve the demonstration cooling facilities, say 20 KW, would cost 200,000 YR.

7. Steele recommends a 60-meter spacing between hangars. This would increase costs for the Sana'a market as follows:

Additional asphalt paving (20+10x10) x 250m @250 =	2,500,000
Additional storm drainage @10,000 YR/Ha =	33,000
Additional storm drainage @ 100,000YR/Ha =	102,000
Additional sewer and water pipe, power condiut, and perimeter wall =	150,000
	2,800,000YR

Additional space costs at Taiz are calculated using the ratio of site areas at Taiz and Sana'a:

Cost for Taiz = (4.0/5.0)(2800,000)=2,240,000YR.

Additional space costs at Hodiedah are calculated similarly to the above but deducting storm drainage costs:

Cost for Hodiedah =(3.9/5.0)(2,800,000-102,000)
=2,104,000YR.

At Al-Hosaynieh additional space costs would reflect a rearrangement of facilities. It was assumed that the cost would be a little less than that at Hodiedah, about 2,000,000YR.

COSTS OF CONTINGENT FACILITIES

1. If the market is not located on a satisfactory road, new, eight-meter wide asphalt road will cost 2,000,000YR per kilometer.

2. If the market is not located next to an electric transmission line, YGEC will bring in power to the market substation at a cost of 213,000 YR per kilometer.

3. If the market is not located next to telephone lines, they can be brought in at a cost of 45,000 YR per kilometer.

4. If the well water is not biologically safe a chlorinating system will cost 234,000YR.

5. If the first well drilled is dry, a second well will cost 840,000 YR in Sana'a and in Taiz, and will cost 315,000 YR in Hodeidah and in Al-Hosaynieh.

6. Spare pumps to guarantee the water supply in the event of pump failure will cost 200,000 YR in Sana'a and Taiz, and will cost 100,000 YR in Hodeidah and Al-Hosaynieh.

7. Spare diesel engines in Hodeidah and Al-Hosaynieh to guarantee the water supply will cost 150,000 YR.

Market Operating And Maintenance Costs

Cash operating expenses were estimated for the first 5 years of operation for each of the 4 new fresh fruit and vegetable markets that have been proposed for Sana'a, Taiz, Hodiedah and Al-Hosaynieh Tables 5,6,7, and 8).

How Costs Were Estimated. The costs in 1990 were used in making all estimates. No adjustments were made for inflation for future years. It was recognized that inflation in the Yemen Arab Republic the last 2 years has averaged over 20% per year (CPO, P315). Certainly future costs will be higher than those estimated in the budgets. However, inflation was ignored because it was assumed that expected revenues will increase at the same rate as will the rate of operating costs. Hence, the relationships will not change. Some operating costs were projected to vary with market volume handled while others were not. For example, each market was assumed to require a full time manager.

Labor. Labor costs were estimated by determining the number of employees in each wage scale group that would be needed each year at each market. The variation in salary costs among years and among markets is primarily due to variation in market volume.

Electricity. Electricity costs were estimated by first estimating the amount needed for each type of use of electricity, for example lights, and then multiplying the total kilowatt hour requirement by 1.1 YR, the current charge for electricity. Electrical costs were higher in Taiz, since it was assumed the well water would require a substantially greater lift, and hence, increased power costs.

Telephone. It was assumed that telephone service would be available in all the offices including market employees and the middlemen. However, in calculating telephone costs it was assumed that each middleman would pay for the telephone service in his office. To estimate the cost of phone service to each market, the number of phone lines needed by market employees was first estimated, then the tri-monthly basic charge was obtained from the phone company and finally an estimate was made for long distance phone expense.

Fuel. Fuel costs were estimated assuming that the stand-by electrical generators would be called on to operate a total of 10 days per year. This cost was higher in Hodiedah and Al-Hosaynieh because the water pumps were assumed to be driven by diesel engines.

Repair and Maintenance. Annual repair and maintenance costs were estimated for the following items at each market: well pumps, sewage lift stations, diesel electrical generators, asphalt pavement sealer, light bulbs replacement and painting.

It was assumed that labor to perform most of the routine repair and maintenance will be done by the market employees (the repair and maintenance crew). Repainting all the buildings and other facilities, and annually applying the asphalt sealer would be contracted out.

Waste Disposal. The cost of waste disposal was estimated based on a charge for the volume or tonnages of garbage and waste materials that will be generated. The total annual cost was assumed to vary directly with market volume of products. It was also assumed that this service would be provided by the city or a private contractor.

Supplier. Supply expense included office supplies, cleaning supplies and bathroom and sanitation supplies.

Major Cost Items. The largest items of cash operating cost for all markets were labor, maintenance and operating expense and electricity. These three items accounted for about 93 % of the total cash operating expense. Labor alone amounted 43% of all cash operating expenses.

WHOLESALE MARKET ISSUES

SUGGESTED SITE SELECTION CRITERIA

Some of the possible sites for all four of the new markets were visited. At this time definite sites have not been selected and the right and permission to use the land for new markets have not been obtained. Listed below are some of the criteria that should be considered in selecting sites for the new markets.

1. Five hectares or more of land should be available. It would be desirable if this were government land for several reasons.

   a. Since this is to be a public-market the land could be made available at no cost to the project.

   b. Private land in or near the cities is very expensive and often is difficult to buy at any price.

2. The land should be located adjacent to or near a good road system. Traffic to and from the market area will be heavy and it would greatly increase the cost of the market if a substantial distance of new wide hard surfaced road had to be constructed.

3. The market should be located on the side of the city closest to the major fruit and vegetable production areas. Most of the farm to market traffic would not then have to travel the narrow heavily congested city streets.

4. There should be a nearby source of electrical power and telephone lines. Other utilities such as a sewage system and water supply would likely have to be self contained in the market complex.

5. The site should have a fairly level topography and have good drainage. This would minimize the cost of site preparation.

6. The market should be located away from residential areas. These markets are open long hours and some are open all night. This could prove disturbing to nearby residential neighbors.

SOURCES OF FUNDING

CAPITAL CONSTRUCTION AND RELATED EQUIPMENT. If all the necessary approvals are obtained from all the government agencies involved and if the necessary funds are available, the construction costs for the four wholesale fruit and vegetable marketing facilities will come from PL 480 funds under the control of the YAR government. Some of the other facilities at the market such as a restaurant, farm supply store and mosque, will be financed by private funds.

OPERATING CAPITAL. There are at least three possible ways the operating capital funds could be generated.

1. They could be provided from public funds either by the Yemeni government or come from donor countries. If all the operating capital came from one or more of these sources then those using the markets and related facilities could do so free of charge.

2. Some sort of user fees could be used to generate the needed operating capital. These fees would need to be at a level, to make the market self supporting. This is discussed in greater detail in another section of this report.

3. A third possibility is to use a combination of both public funding and user fees. One way this could be done is for the government to provide some of the services such as security and market news, and user fees would generate enough revenue to cover all other operating and maintenance costs.

   In many countries of the world marketing services and facilities are provided almost entirely by the private sector. It is therefore recommended that the operating funds be almost entirely generated through user fees. An exception could be the market news service which could be publicly funded.

BENEFICIARIES OF THE SAVINGS FROM THE NEW MARKETS

The Steele report concluded that if the new markets were constructed, the estimated net saving from reduced product losses and time saved by truckers, (after the wholesale market operating costs were deducted) would average about 352 YR per metric ton of product moving through the market (Steele, P 43).

The following is an effort to reason out who would be most likely to capture the savings resulting from the construction and operation of the 4 new wholesale fruit and vegetable markets.

FROM REDUCED PRODUCT LOSSES. Unless the method of selling is changed the farmer/trader will not likely benefit from reduced product losses because he sells his product by volume. At current levels of losses, for many products, there is little or no price discrimination based on differences in quality, or because of damaged, diseased or otherwise unsuitable product. Farmers are paid based on average expected losses. A farmer selling a product with higher than average losses receives about the same price as one selling the same product with lower than average losses.

The middleman would not likely benefit since their commission is based on volume. They either receive a fixed amount per container or a percentage of the selling price.

The retailer could be expected to benefit, since he generally sells the products by weight. Consumers usually hand select the product, so the retailer will have more (greater weight) saleable product per container.

The retail customer can also be expected to benefit from a reduction in product losses. There will be a greater volume of consumable product for sale. This could result in lower prices. They also may have less waste from the products they buy because they don't have to discard inedible parts of the product. Lower prices will also mean they can buy more product for each YR, so consumers may be better nourished, because the same amount of money will buy a greater quantity of food.

FROM TRUCKERS SPENDING LESS TIME AT THE MARKET. The farmer/truckers will probably be the greatest beneficiaries of this savings. They can use the time saved in other productive pursuits.

Middlemen are not likely to benefit from the saving, since their commission is based on volume. However, to the extent the market is less congested and this results in their handling a slightly higher volume of sales they could benefit.

Retailers are not expected to gain much from this time savings. However, they could benefit if the market is less congested, and it takes them less time to get in and out of the market and to buy their products.

Consumers may also benefit if some of the costs savings are passed on in the form of lower prices.

CHARGES FOR USE OF THE WHOLESALE MARKET FACILITIES

It is planned that funds for the construction of the basic market facilities will come from the YAR government from their PL 480 account. The market will not have to generate revenue to repay these costs.

It is recommended that user fees be levied to generate sufficient revenue to cover market operating costs. The system of fees should be simple and the fees easy to collect. They should be set at levels to generate enough revenue to cover operating cost based on projected usage.

Some of the possibilities of charges that could be made include:

1. A market user fee.

   a. A charge for each truck entering the market to sell produce. The charge should differ depending on the size of truck.

   b. A charge paid by middlemen. This could be a weekly or monthly charge or be a percentage of their gross income. It is proposed that middlemen be provided small offices, so it seems fair they should share in the operating and maintenance costs of the market.

2. A fee for washing produce. This charge could be based on weight or container size.

3. A fee for use of the banana ripening and storage facilities. This charge could be based on the time the product was in storage and on the amount of the product stored (i.e. a given number of YR per kilo per week).

4. A fee for use of cool/cold storage. Charges could be based on the amount of product stored and on the time in storage.

The user fees should be at a level to generate sufficient revenue to cover the operating costs of those facilities.

If the market is managed and operated by an agency of the government of the YAR all fees collected go to the Central Bank of the YAR where they are credited to the account of the general government treasury.

It is highly recommended that a revolving fund be set up for each new wholesale market. Initially the government of the YAR or one or more donor agencies could loan each market deposit an amount equal to 4 to 6 months operating expenses. As fees are collected they could be deposited in the revolving fund account, and as expenses incurred they could be paid from the account. Perhaps after a year of operation the account could be reduced to the level of one or two months operating expenses, and the agencies who initially provided the funds could be completely or partially repaid.

If the market is operated in an efficient manner, and to do this it must maintain the services it was designed to provide, facilities need to be maintained and repaired promptly and all expenses paid in a timely manner. Using a revolving fund would be a useful tool to help assure that this occurs. If some of the funds generated from users of the market, for the intended purpose of covering operating and maintenance costs, are siphoned off and used for other purposes, the operation of the market would be seriously jeopardized and would hence not be a feasible undertaking.

OWNERSHIP, OPERATION AND MANAGEMENT OF THE MARKETS

Currently the Ministry of Municipalities and Housing is responsible for the operation and management of the wholesale markets in Sana'a, Taiz and Hodiedah. The formal staffing of each market consists of a market supervisor, a manager, a maintenance engineer, health inspectors, rent and tax collectors, and cleaning and security personnel. The markets have generally been self policing.

It is assumed that the new markets will be located on land owned by either the Ministry of Municipalities and Housing or the Ministry of Agriculture and Fisheries. Ownership of property will be retained by the government. The government will become owners of market facilities and equipment financed from public (PL-480)funds. Equipment and facilities, located at each market that are financed by private funds should be owned and operated by the private owners.

It is recommended that a governing board be created for each new wholesale fruit and vegetable market. Membership of this board should be made up of elected members from the middlemen ("Musalahs") and traders representing the main commodity groups. Representatives from the Ministries of Agriculture and Fisheries, the Ministry of Municipalities and Housing, and the Ministry of Economics, Trade and Supply would also be included as committee members. The Chairman and secretary of the committee would be appointed annually by the committee from elected members.

The day to day operation and management of the market should be handled by a market manager responsible to the committee, but appointed by the Ministry who is given the responsibility for over-seeing and managing the markets.

Some of the manager's duties and responsibilities will include the following:

- Repair and maintenance of all facilities and equipment
- Cleaning
- Collection of fees for use of the equipment and facilities
- Security
- Assigning buying and selling locations to users
- Reporting market prices and volume
- Resolving disputes
- Health inspection
- Assisting with training programs and demonstrations
- Purchasing needed supplies
- Keeping records of all expenses and revenues
- Preparing an annual operating budget for review by the market committee
- Payment of all market operating expenses including salaries of employees. Approximately 20 employees will be needed at the Sana'a market, 14 at Tai.., 15 at Hodiedah and 11 at the Al-Hosaynieh market to assist the manager in the operation of the market.

A national fruit and vegetable committee should be established and be responsible for the establishment of policy, coordination and control of the four new wholesale markets, and other wholesale markets of national importance. The committee should be a senior level policy making body with a suggested membership of:

- Chairman of the Central Planning Organization
- Minister of Agriculture and Fisheries
- Minister of Economics Trade and Supply
- Minister of Municipalities and Housing
- Minister of Interior
- General Director of MECO
- Chairman and Secretary of each new wholesale market

The Directorate of Marketing in the Ministry of Agriculture and Fisheries would act as the Secretariat to the committee and the Director would act as Secretary to the committee.

Availability of Market Management Skills

At the present time, the four major wholesale fresh fruit and vegetable markets primarily provide a location where buyers and sellers of fresh produce can get together to transact their business. Aside from that, very minimal service is provided at the markets.

The major activity of market employees is to collect the rent or fees and taxes from those using the market. Most of the remainder of the market activities such as assigning selling spaces and resolving disputes, are handled on an informal basis. The way the markets are currently operated, the market managers or supervisors are not required to have significant management skills.

As proposed in this report, the new markets will provide substantially more services than the current ones. There will be more employees, and the managers will have the responsibility of seeing that records are kept of revenue collected and expenses incurred, paying expenses in a timely manner and preparing an operating budget to help in the planning and management of the market and its finances.

The evaluation team was unable to determine if there were individuals in the country with the training and experience who would be available to fill management positions at the new markets. However, since the manager's responsibilities will be new, it is doubtful that there are those who would be available that will have the necessary level of market management skills and experience.

Therefore, it is recommended that 2 or 3 qualified individuals be selected for each market and be sent abroad for six months to a year for appropriate management training.

FINANCIAL FEASIBILITY EVALUATION

CONSTRUCTION COSTS COMPARED TO AVAILABLE FUNDS

If construction of the markets is financed with public (PL-480) funds, these funds will not need to be repaid from revenue genrated from the operation of the markets. Construction costs for the basic market facilities, (assuming that the land would be made available at no cost by one of the government ministries) were 40,163,000 YR for the Sana'a market, 30,941,000 YR for the Taiz market, 29,697,000 YR for the Hodiedah market and 28,464.00 YR for the Al-Hosaynieh market. This is a total of 129,265,000 YR for all four markets. If the Sana'a market is not built using public funds or is built on a small scale, this would reduce the total of public funds needed for construction costs. It is not known how much of the PL 480 funds the Central Planning Organization of the government of the Yemen Arab Republic is willing or able to spend on these projects. However, these construction costs are only 36% to 38% of the estimated construction costs for the market facilities in the Steele report (Steele PP. 44, 50, 61).

It is unlikely that all 4 of the markets would be constructed during same time period, so all the funds would not be needed in the same year. Each probably should be considered as a separate project. As will be noted later there may not be a need to construct a new publicly funded wholesale market in Sana'a.

Only others who make decisions about the use of PL 480 funds can decide if the necessary funds are available to construct the markets. If they are, then the proposed new wholesale markets would be feasible, if not they would not be financially feasible.

CASH FLOW EVALUATION

Annual cash flow budgets were prepared for each proposed wholesale market for the first five years of operation. It was assumed that an agency of the YAR government or a donor agency would loan each market an amount equal to about four months operating expenses to be used as beginning cash.

The estimated metric tons of market volumes for each market used to calculate annual cash revenue came from the Steele report. These volumes increased at an annual rate of 3 1/2% a year, roughly equal to the projected annual rate of population increase in the YAR (see Tables 9, 10, 11, 12). This rate of increase is likely conservative since the projected annual rate of population increase in the major urban centers in the country has been projected to be around 8% (FAO, P 8). These are the urban centers that the new markets would serve.

Since new enterprises often cannot achieve full potential market volume in the first few years of operation, it was arbitrarily decided to reduce the first year quantity of products coming to the market, as projected by Steele, by 25% and the second year quantities by 10% for all 4 markets. This is in recognition of some of the risks involved in starting the operation of new facilities with new management and new employees. It was assumed that beginning in the third year the markets would handle 100% of the potential market volume as projected in the Steele report. These market volumes were then multiplied by a series of user fees per ton which equalled annual projected revenues (see Tables 9, 10, 11, 12).

Sana'a Market. A user fee of 25 YR/MT was more than adequate for cash inflows to be equal to or greater than cash outflows (Table 4). The beginning cash could be repaid at the end of the second year and user fees can then be slightly reduced or market services could be increased. This level of user fees is only slightly higher (5 YR) than farmer/truckers were paying in the recently closed Al-Hasaba market.

From the standpoint of cash flow this market would be financially feasible. However, a new privately owned wholesale-retail fresh fruit and vegetable market is already under construction, and the first phase is scheduled to open in about a month. The privately owned new market will likely provide facilities for a significant part of the wholesale market volume in Sana'a. The progress of the new privately owned wholesale market should be monitored to see if perhaps, in the future, there is a need for a new smaller wholesale market located in another part of the city.

Table 4. Sana'a Wholesale Fresh Fruit and Vegetable Market

Annual Cash Flow Budgets
(in 1,000 YR)

	Year				
	1993	1994	1995	1996	1997
Cash Inflow					
Beginning cash	700	613	782	1,215	1,754
User fees*	2,169	2,639	3,098	3,208	3,318
Total cash inflow	2,869	3,252	3,880	4,423	5,072
Cash Outflow					
Salaries	960	1,045	1,125	1,125	1,125
Electricity	745	815	876	876	876
Telephone	10	10	11	11	11
Fuel for generator	17	19	20	20	20
Repairs and maintenance	414	453	487	487	487
Waste disposal	87	105	122	126	130
Supplies	23	23	24	24	25
Total cash outflows	2,256	2,470	2,665	2,669	2,674
Ending cash balance	613	782	1,215	1,754	2,398

* Assuming user fees are equal to 24 YR/MT

Taiz Market. With a 25 YR/MT level of user fees cash outflows were projected to exceed cash inflows in this market the first three years of operation (Table 5). It was not until the fifth year of operation that user fees were comfortably higher than total cash operating costs. To be financially feasible on a cash flow basis, the market should have user fees at a level of 28 to 30 YR/MT the first three years and then they could be lowered to 25 YR/MT. The reason higher fees are needed at this market is that electricity requirements are projected to be higher because water will be pumped with an electrical motor from a deep well.

Hodiedah Market. Projected cash outflows (operating and maintenance expenses) were more than the total user fees for the first two years of operation at this market when the level of user fees was 25 YR/MT (Table 6). To be financially feasible on a cash flow basis, user fees should be at a level of 27 to 28 YR/MT the first three years, and then they could be lowered to 25 YR/MT.

Al-Hosaynieh Market. With user fees at a 25 YR/MT level, annual cash inflows exceeded projected cash outflows beginning the second year of operation (Table 7). By the end of the 4th year some of the beginning cash loan could be repaid, and could be repaid in full in 2 to 3 years. The Al-Hosaynieh market was judged to be financially feasible on a cash flow basis with 25 YR/MT user fees level.

BREAKEVEN ANALYSIS

In this study the financial breakeven point for each market was assumed to be where the total annual revenue generated from the user fees equalled the total annual cash operation expenses. The information used to calculate the breakeven point included projected market volumes, user fee levels and projected cash operating expenses. Market volumes and operation expenses were projected to be different in each of the markets for each of the first five years the markets were operated. A breakeven user fee level was calculated for the five year period for each market by dividing the total market volume for the first 5 years of operation into the total operating expenses for the same period.

The breakeven point for the first five years of operation of the markets ranged from a low of 22.0 YR/MT for the Sana'a market to high of 26.4 YR/MT for the Taiz market (Table 8). These user fee levels are all low enough enough that they should not encounter user resistance. Based on this breakeven analysis all four markets were judged to be financially feasible.

Table 5. Taiz Wholesale Fresh Fruit and Vegetable Market

Annual Cash Flow Budgets
(in 1,000 YR)

	Year				
	1993	1994	1995	1996	1997
Cash Inflow					
Beginning Cash	500	333	360	519	749
User Fees*	1,447	1,797	2,066	2,139	2,215
Total Cash Inflow	1,947	2, 130	2,426	2,658	2,964
Cash Outflow					
Salaries	675	732	788	788	788
Electricity	527	577	620	620	620
Telephone	10	10	11	11	12
Fuel for Generator	12	13	14	14	14
Repairs and maintenance	323	353	380	380	380
Waste disposal	52	70	78	80	83
Supplies	15	15	16	16	17
Total cash outflows	1,614	1,770	1,907	1,909	1,914
Ending cash balance	333	360	519	749	1,050

* Assuming user fees are equal to 28 YR/MT

Table 6. Hodiedah Wholesale Fresh
Fruit and Vegetable Market

Annual Cash Flow Budgets
(in 1,000 YR)

	Year				
	1993	1994	1995	1996	1997
Cash Inflow					
Beginning Cash	600	464	534	743	1,023
User Fees *	1,494	1,856	2,136	2,211	2,287
Total Cash Inflow	2,094	2,320	2,670	2,954	3,310
Cash Outflow					
Salaries	712	775	835	835	835
Electricity	496	453	584	584	584
Telephone	10	10	11	11	12
Fuel for Generator	21	23	25	25	25
Repairs and Maintenance	316	346	372	372	372
Waste Disposal	59	73	84	87	91
Supplies	16	16	16	17	17
Total Cash Outflows	1,630	1,786	1,927	1,931	1,936
Ending Cash Balance	464	534	743	1,023	1,374

* Assuming user fees are equal to 27 YR/MT

Table 7. Al-Hosaynieh Wholesale Fresh Fruit and Vegetable Market

Annual Cash Flow Budgets
(in 1,000YR)

	Year				
	1993	1994	1995	1996	1997
Cash Flow					
Beginning Cash	450	323	354	489	679
User Fees*	1,153	1,433	1,648	1,705	1,765
Total Cash Inflow	1,603	1,756	2,002	2,194	2,444
Cash Outflows					
Salaries	545	593	638	638	638
Electricity	404	442	475	475	475
Telephone	9	9	10	10	11
Fuel for Generator	10	11	12	12	12
Repairs and Maintenance	249	272	293	293	293
Waste Disposal	49	61	70	72	75
Supplies	14	14	15	15	16
Total Cash Outflow	1,280	1,402	1,513	1,515	1,520
Ending Cash Balance	323	354	489	679	924

* Assuming user fees are equal to 25 YR/MT

However, it is recommended that user fees be set at a level slightly above the breakeven point as a hedge against risk, such as unforseen cost increases, unexpected costs, or sales volumes that are below projections.

Table 8. Breakeven User Fee Levels For The Four Proposed Wholesale Fresh Fruit And Vegetable Markets For The First Five Years Of Operation

	FIVE YEAR TOTAL		
MARKET	MARKET VOLUMES	OPERATING EXPENSES	BREAKEVEN USER FEE LEVEL
	(MT)	(1000 YR)	YR
SANA'A	579,405	12,734	22.0
TAIZ	345,145	9,114	26.4
HODIEDAH	369,810	9,210	24.9
Al-HOSAYNIEH	308,155	7,230	23.5

SENSITIVITY ANALYSIS

In the operation of the wholesale markets the total revenue generated is equal to the market volume (of products moving through the market, or of services provided for which a fee is charged (i.e. banana ripening) times the level of user fees. A change in either market volume or the level of user fees will result in a corresponding change in total revenue. Tables 9, 10, 11, and 12 illustrate these relationships.

For example, at the new Hodiedah market, volume for the first year (1993) of operation was projected to be 55,350 MT (Table 11). When the level of user fees is increased from 10 YR/MT to 40 YR/MT (a four fold increase) the total revenue increases four fold.

In the Hodiedah market the market volume was projected to increase 53 % over the first 5 years of operation. If user fees are held at the same level over this period the total revenue increases by 53 %. This demonstrates that the total revenues for the new markets are very sensitive to changes in the market volume and user fees levels.

This is important for several reasons. First, the projections made of user market volumes in this report are "best estimates". There is no guarantee that when these markets begin operation that exactly these levels of volume will be handled at each market. They could and likely will be higher or lower. This means that actual total revenue will likely be higher or lower than projected. The managers of the markets will need to monitor both their total revenue and total operating costs, which can both change because of unexpected events, and make necessary changes and adjustments in the operation of their markets to ensure that market costs do not exceed market revenue.

Table 9. Projected Annual Revenue in Yemeni Rials from User Fees for the Proposed Wholesale Fresh Fruit and Vegetable Market in Sana'a for the First Five Years of Operation

Year	Projected Market Volume in MT*	Level Of User Fees				
		10 YR/MT	20 YR/MT	25 YR/MT	30 YR/MT	40 YR/MT
		1,000 Yemeni Rials				
1993**	86,775	868	1,739	2,169	2,603	3,471
1994**	107,730	1,077	2,155	2,693	3,232	4,309
1995	123,900	1,239	2,478	3,098	3,717	4,956
1996	128,300	1,283	2,566	3,208	3,849	5,132
1977	132,700	1,327	2,654	3,318	3,981	5,308

* Projected market volumes were taken from the Steele report P. 41. These volumes were reduced for the first two years to get projected market volumes.

** It was assumed that the new market will only handle or be able to capture 75% of the potential market volume in the first year of operation, and 90% in the second year. After that it was assumed the market will then be able to handle 100% of the potential volume.

Table 10. Projected Annual Revenue in Yemeni Rials from User Fees for the Proposed Wholesale Fresh Fruit and Vegetable Market in Taiz for the First Five Years of Operation

Year	Projected Market Volume in MT*	Level of User Fees				
		10 YR/MT	20 YR/MT	25 YR/MT	30 YR/MT	40 YR/MT
		1,000 Yemeni Rials				
1993*	51,675	517	1,034	1,292	1,550	2,067
1994**	64,170	642	1,283	1,604	1,925	2,567
1995	73,800	738	1,476	1,845	2,214	2,952
1996	76,400	764	1,528	1,920	2,292	3,056
1997	79,100	791	1,582	1,978	2,373	3,164

* Projected market volumes were taken from the Steele report P. 54. These volumes were reduced for the first two years to get projected market volumes.

** It was assumed that the new market will only handle or be able to capture 75% of the potential market volume in the first year of operation, and 90% in the second year. After that it was assumed the market will then be able to handle 100% of the potential volume.

Table 11. Projected Annual Revenue in Yemeni Rials from User Fees for the Proposed Wholesale Fresh Fruit and Vegetable Market in Hodiedah for the First Five Years in Operations

Year	Projected Market Volume in MT*	Level of User Fees				
		10 YR/MT	20 YR/MT	25 YR/MT	30 YR/MT	40 YR/MT
		1,000 Yemeni Rials				
1993**	55,350	554	1,107	1,384	1,661	2,214
1994**	68,760	688	1,375	1,719	2,063	2,750
1995	79,100	791	1,582	1,978	2,373	3,164
1996	81,900	819	1,638	2,048	2,457	3,276
1997	84,700	847	1,694	2,118	2,541	3,388

* Projected market volumes were taken from the Steele report P. 47. These volumes were reduced for the first two years to get projected market volumes.

** It was assumed that the new market will only handle or be able to capture 75% of the potential market volume in the first year of operation, and 90% in the second year. After that it was assumed the market will then be able to handle 100% of the potential volume.

Table 12. Projected Annual Revenue in Yemeni Rials from User Fees for the Proposed Wholesale Fresh Fruit and Vegetable Market in Al-Hosaynieh for the First Five Years of Operations

Year	Projected Market Volume in MT*	Level of User Fees				
		10 YR/MT	20 YR/MT	25 YR/MT	30 YR/MT	40 YR/MT
		1,000 Yemeni Rials				
1993**	46,125	461	923	1,153	1,384	1,845
1994**	57,330	573	1,147	1,433	1,720	2,293
1995	65,900	659	1,318	1,648	1,977	2,636
1996	68,200	682	1,364	1,705	2,046	2,728
1997	70,600	706	1,412	1,765	2,118	2,824

* Projected market volumes were taken from the Steele report P. 58. These volumes were reduced for the first two years to get projected market volumes.

** It was assumed that the new market will only handle or be able to capture 75% of the potential market volume in the first year of operation, and 90% in the second year. After that it was assumed the market will then be able to handle 100% of the potential volume.

RECOMMENDATIONS

1. It is recommended that work move rapidly forward to do those activities that are needed to construct the new markets. The need is very urgent. Two of the existing markets have been closed, and the markets are in temporary locations and without any services or facilities. Conditions at all the markets are crowded and congested, and hence, are very inefficient in terms of moving products, and market participants in and out of the market areas. Conditions are unsanitary. Most of the market areas are not surfaced and in rainy weather they become seas of mud. In addition, if the recent rate of inflation in the country continues at the same level this would rapidly increase the estimated construction costs. For example, with an inflation rate of 20% it would take only 3.8 years for the costs to double, and if the rate were 25% it would take only 3.1 years. Hence, the longer construction of the markets is delayed the more they will cost to build.

2. Allow space and provide all services at each market to farmer/traders who want to sell their own products without the use of a middleman.

3. Encourage the Agricultural Marketing Extension Services to use the new markets to deliver production and product handling advice through the use of demonstrations and supported by simple illustrated publications on how to reduce product losses.

4. Have a market news reporter stationed at each market to collect daily information about the local market, and post this information at a suitable location in the market daily, along with relavent market information from other markets and major production areas throughout the country. Arrangements should be made to have this information broadcast over local radio stations and be reported in the local papers. This activity should be conducted and financially supported by the Ministry of Agriculture and Fisheries.

5. The markets should be self-sustaining. To achieve this, the level of user fees should be high enough to cover market operating and maintenance costs based on projected usage.

6. Farmer/truckers should not be the only ones to pay user fees, but middlemen should also share in the costs of the market.

7. A permanent revolving fund should be set up for each new wholesale market. Initially the YAR Government or one or more donor agency could loan each market an amount equal to 4 to 6 months cash operating expenses to go into the revolving fund to be used as beginning cash to pay operating expenses. After the markets have been operating 1 to 4 years, and they begin to generate excess cash, these loans could be repaid.

   A revolving fund is recommended for each market rather than have revenues generated go directly into the government treasury. This would help ensure that the markets have the ability to maintain the services they were designed to provide. This means maintaining and repairing facilities when needed and paying all expenses promptly. This would help avoid the temptation of the government to siphon off revenue generated by the market and use it for other purposes.

8. A governing board should be created for each market. Membership of the board should be made up of elected members from the middlemen and traders representing the main commodity groups. Representatives from the Ministry of Agriculture and Fisheries, the Ministry of Municipalities and Housing and the Ministry of Economics Trade and Supply would also be included as committee members. The Chairman would be appointed annually by the committee from elected members. The committee's role would be primarily policy making. The day to day operation and administration of the market would be handled by a market manager.

9. It is recommended that the government Ministry responsible for the management and operation of each market select 2 or 3 qualified individuals for each market and send them abroad from 6 months to a year for intensive, appropriate market management training prior to the opening of the market.

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APPENDIX 1. CONSTRUCTION UNIT COSTS

This is a complication of unit costs gathered from various sources on which the estimates of construction costs were based.

Item and/or description	Cost in YR.	Source
* Site clearing and grubbing	12000/ha	1 (1)
* Excavating and filling to subgrade	20000/ha	1
* Site preparation	20-30/m2	5
* Site preparation	5,000,000/site	2
* Storm drains(Channel or pipe)	100,000/ha	1
* Soakaway pit	25-35,000/unit	11
* Sewage piping system	200,000/mkt	-
* Sewage lift station	300,000/mkt	-
* Septic tank 20-30m3	150,000/unit	-
* Soakaway pit 30m x 15m	30,000/unit	5
* Septic tank drain field	100,000/unit	-
* Sewage stabilization lagoons	100,000/unit	-
* Water distribution system	200,000/mkt	-
* Elevated water tank-100m3 of r.c. built by qualified foreign contractor	500,000+	5
* Perimeter wall 2m high on 50-80 cm foundation, block, w/r.c. posts and w/o plaster	1,500/lm	5
* Wells in Sana'a 400m now, 700m later		3
depth in Taiz more than 500m		3
depth in Tihama 30m		3
* Wells 12" diameter w/o casing	900/m	4
10"	550-600/m	4
8"	400/m	4
Casing costs	550-600/m	4
Depth in Sana'a	500m	4
Depth in Taiz	300m	4
Depth in Tihama	150m	4
Drill and case	1500/m	5
* Elevated water tank-steel tower only 20m high for 100m3 steel tank US$ 45000/unit		11
* Elevated water tank-100m3 r.c. on 12m tower built by Chinese	133,000/unit	1
* Pumps-electric submersible for Sana'a and Taiz - say 300m head and 100m3 in 8 hours		-

*	Pumps-vertical turbine for Tihama driven by diesel engine say 80m and 100m3 in 8 hours		-
*	Diesel engines for Tihama pumps-say 20 horsepower		-
*	Chlorinating system for water supply US$ 18000-		6
*	Refrigerated, humidified rooms 20-ton price including		
	installation	US$ 68,000	6
	10-ton	US$ 32,000	6
	5-ton	US$ 20,000	6
*	Refrigerated rooms		
	5-10 ton $25581 plus shipping		7
	25 ton $ 33681 plus shipping		7
	Elevated water tanks fibreglass 2000 USGAL	20000	12
*	Electric power costs: probable rate per KWH is 1.1 YR. Bulk rates may be as low as 0.65/KWH. To bring power to site - 12 poles/km @ US$ 600 per pole over terrain of average difficulty, and 4 conductors (x35 mm2) @ US 3700/km would require $US 10900/km		8
	an electric power substation would be required on the market site - 100 or 200 KVA transformer @ US$ 1700 and protection equipment up to US$ 2000		
	total cost	US$ 3700	8
	Underground system costs at least 10 times more.		8
*	Standby diesel generator sets. 100 KVA unit with		
	automatic switch	US$ 18-2000)	1
	installation	US$ 2- 3000	1
	housing		
	fuel tank		
	50 KVA		
	150 KVA		
*	Cooler power conduit-central overhead cable with drop cords	US$ 750/100m	1
*	Cooler power distribution system	200,000/hangar	5
*	Electric power distribution system	65,000/mkt	-
*	Fluorescent tube systems (twin tubes) 500/unit		5
*	Switch and wiring for above	280/unit	5

*	Pavement, asphalt 5 cm asphalt on 35 cm of base, subbase	200-250/m2	9
*	Pavement, asphalt	5-7cm on base 120-150/m2	5
*	Pavement, concrete base/subbase	15cm on 35 cm 600-800/m2	9
*	Pavement, concrete	20cm on base 1500/m2	5
*	Pavement, asphalt "good pavement"	200-300/m2	11
*	Gravel for parking, 20cm	US$12/yd3=41/m2	1
*	Stone to face hangar docks	450/1m	5
*	Compacted fill for hangar platforms	150/m3	5
*	Hangar floor drain system		
	pipes	280/m	5
	manholes	3000/unit	5
	Reinforced concrete foundation	3000/m3	5
	Standard steel erection for single sheet frame cladding	90-100/m2	5
*	Walls, interior, hollow block	230/m2	5
	for plastering	add 80/m2	5
*	Doors, metal	1000/m2	5
*	Painting doors 1 coat	30/m2	5
	2 coats	45/m2	5
*	Structural steel frames		
	imported w/o duty	600/m2	5
	local work made up here	900/m2	5
*	Steel frame on flat, mesh reinforced slab plan 30x54m, 6 to 7m high	1500/m2	10
*	Foundation and slab(15 cm. R.C.) for 5 ton pickup trucks	770/m2	11
*	15 meter hangar(2), turnkey	1350/m2	1
*	21 meter hangar(2),	US$ 24-25/ft2	1
*	Pre-engineered hangar, local work	2500+-/m2	1
*	Kirby hangar, 15 meter, turnkey(3)	2020/m2	15
*	Kirby hangar, 18 meter turnkey	1970/m2	15
*	Kirby hangar, 24 meter w/dock, turnkey	2020/m2	15
*	Kirby hangar, 28 meter, w/dock, mezzanine, fully enclosed, turnkey	2590/m2	15
*	Wall system for hangars	2000/m2	1
*	It costs 5% to increase the height of a frame from 15 feet to 30 feet		18

*	Shumaila hangars, materisls and erection, average but steel frames were acquired 5 years ago	1100/m2	11
*	Mezzanine costs	2000/m2	5
*	Telephone	1200/each	17
*	Telephone cable in buildings	7/m	17
*	Telephone poles spaced at 50m	1250/each	17
*	Administration and farm input buildings cast-in-place R/C frame, block walls stone veneer, electrical and plumbing systems-turnkey each floor	5000/m2	1
*	Admin. and input store with brick walls	4000/m2	5
*	Admin. and input store	6000/m2	2
*	Design costs, includes critical inspections	1 1/2 %	5,1
*	Design costs and construction supervision	3%	1
*	Construction supervision alone	5-%	5
*	Hauling cost, Hodiedah-Sana'a	180/Ton	13

(1) <u>COST DATA REF.</u>

1. MEDFORD
2. STEELE
3. NWSA
4. SAWAN
5. AD'DAR
6. SWISS
7. ARMENTROUT
8. YGEC
9. HIGHWAY DEPT
10. AIDENG
11. SHUMAILA
12. CLEOPATRA
13. TRANSPORT UNION
14. JUMAAN EQUIPMENT CO.
15. KIRBY BUILDING SYSTEMS
16. PUBLIC TELEPHONE COMMISSION
17. SIEMENS
18. Effective Warehousing - A book by Burton - 1981

(2) These prices are for hangar styles shown in Figures 3 and 4 of this Appendix.

(3) Kirby Bldg. Systems submitted a formal proposal dated 19/2/1990 for several steel hangars, we added costs of civil works and lighting to calculate these unit costs.

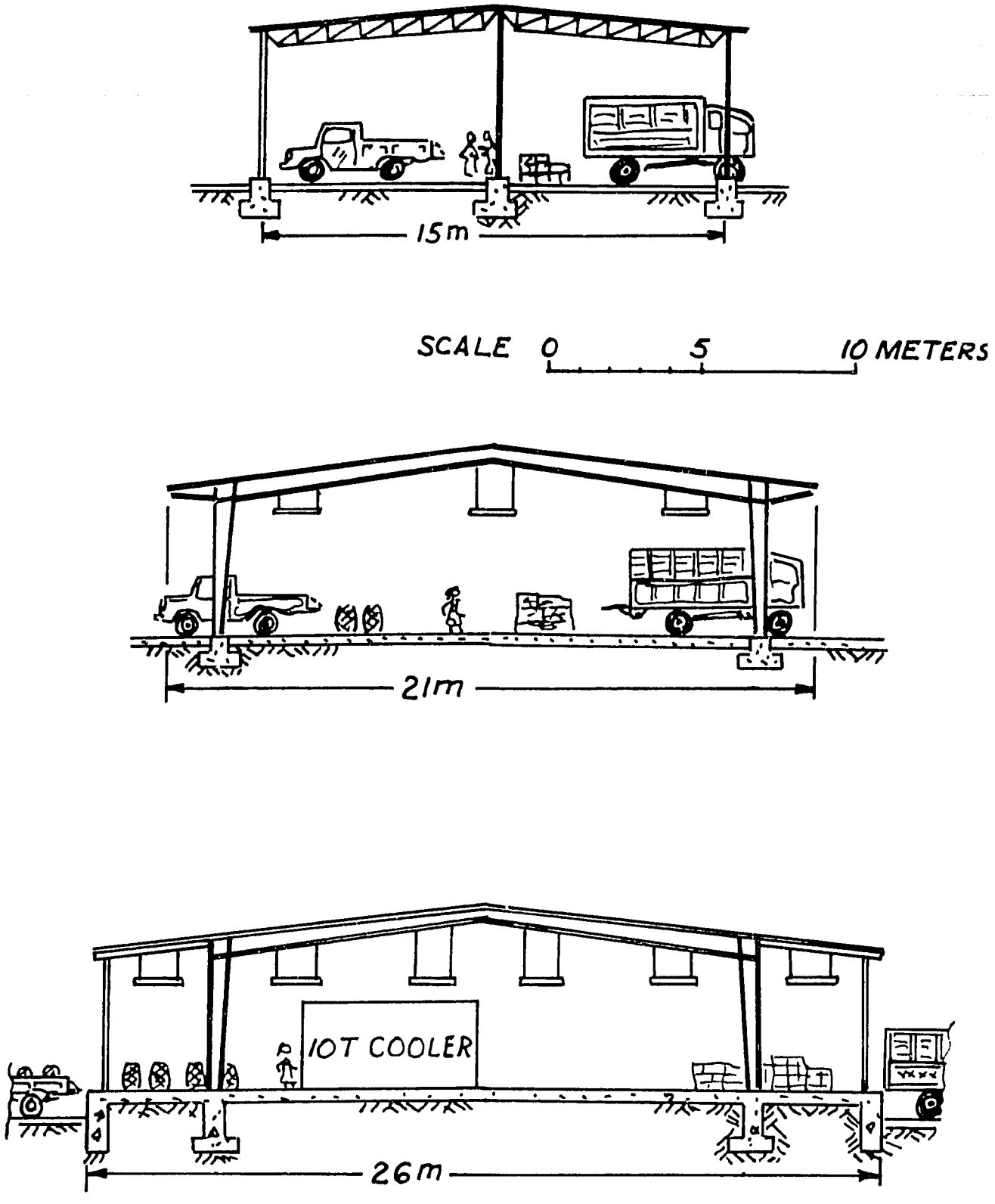
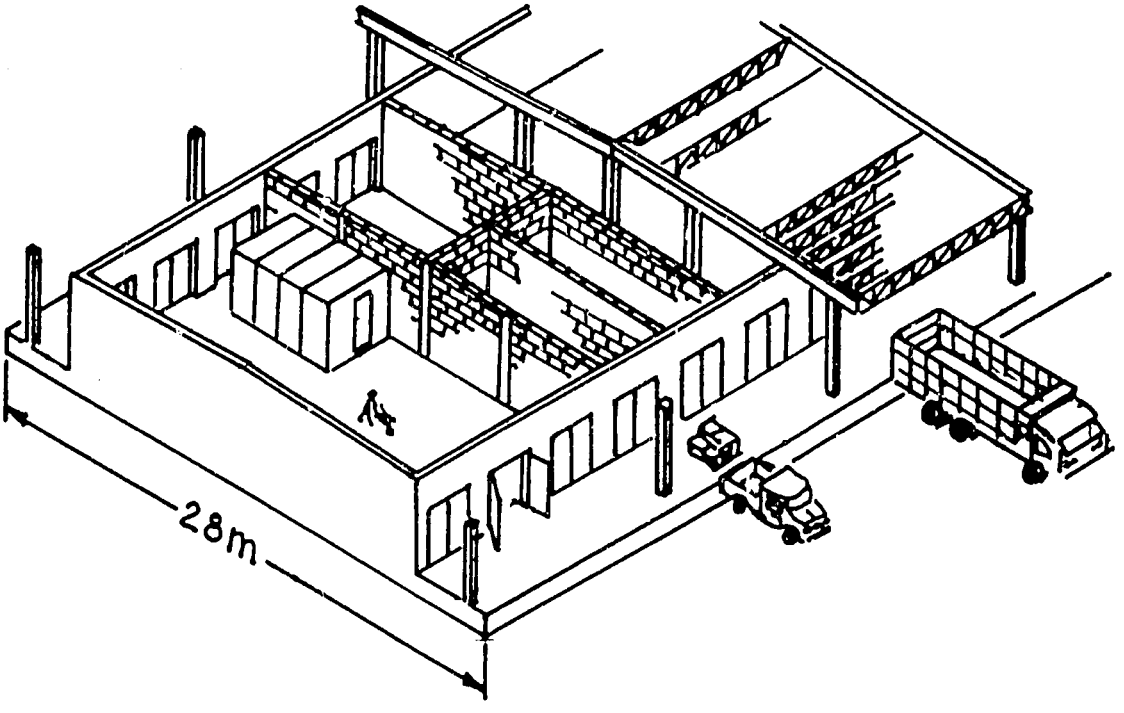
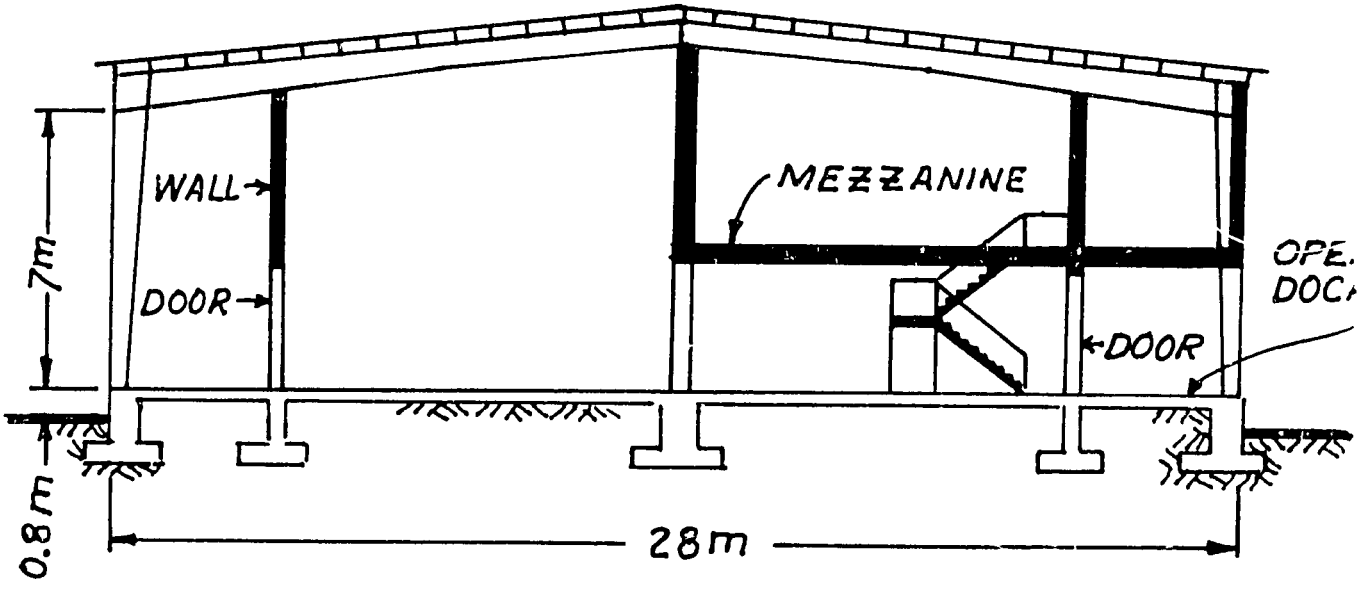


FIG. 3 - OPEN-SIDED HANGARS



HANGAR CONCEPT SHOWING BLOCK WALLS TO SUIT USERS



HANGER TYPE SUGGESTED BY STEELE

FIG. 4 - FULLY ENCLOSED HANGARS

APPENDIX 2. METHOD OF ESTIMATING MARKET DAILY WATER REQUIREMENTS

1. Personal sanitation (washing, and flushing toilets): Assume each person requires 50 liters/day.

2. Washing fruits and vegetables: Assumes only roots and tubers are washed. Water required was estimated using the following equation:

$$MWVPD = \frac{AW}{365} \times C1 \times C2 \times C3 \text{ where}$$

MWVPD = maximum water volume per day (l/d)

AW = annual weight of roots and tubers clearing the market (kg)

C1 = ratio of maximum weight of roots and tubers clearing the market per day to the average daily weight

C2 = ratio of weight of roots and tubers which will be washed to total weight of roots and tubers

C3 = Liters of water to wash a kilogram of roots and tubers

These numerical values were used:

AW from Steele	P 41 for Sana'a	55,000MT=55,000,000Kg
do	P 47 for Hodiedah	35,000MT=35,000,000Kg
do	P 54 for Taiz	33,000MT=33,000,000Kg

C1 = 3 which is an estimate
C2 = 0.5 which is an estimate
C3 = 0.5 which is an estimate

3. Washing hangar floors and hard-surface parking areas:

Estimated that only one third of such surfaces are washed every day using 10 l/m2.

4. Truck bed washing: Estimated that one third of the trucks are washed out each day using 40 l per truck.

According to this analysis daily water requirements for each market would be (litres):

		SANA'A	TAIZ	HOD.	AL-HOS.
1.	Personal sanitation	32,500	32,500	32,500	1,500
2.	Washing fruits and vegetables				
	Sana'a AW=55,000, Steele , P 41		113,000		
	Taiz AW=33,000, " P 54			68,000	
	Hod. AW=35,000, " P 47				72,000
	Al-Hos.AW=29,300, " P 58				0*
3.	Washing hard surfaces				
	Sana'a (4x28x100+15x80)m2, P20		41,000		
	Taiz (3x28x100+15x40)m2, P 31			30,000	
	Hod. (3x28x100+15x40)m2, PP23,24			30,000	
	Al-Hos.(2x28x120+50x25)m2, PP61,38				27,000
4.	Truck bed washing				
	Sana'a 264 trucks	3,500			
	Taiz 280 "		3,800		
	Hod. 280 "			3,800	
	Al-Hos.120 "				1,600
	Total water use litres/day	190,000	134,000	138,000	44,000
	Total water use m3/day	190	134	138	44

* Al-Hosaynieh will not wash produce

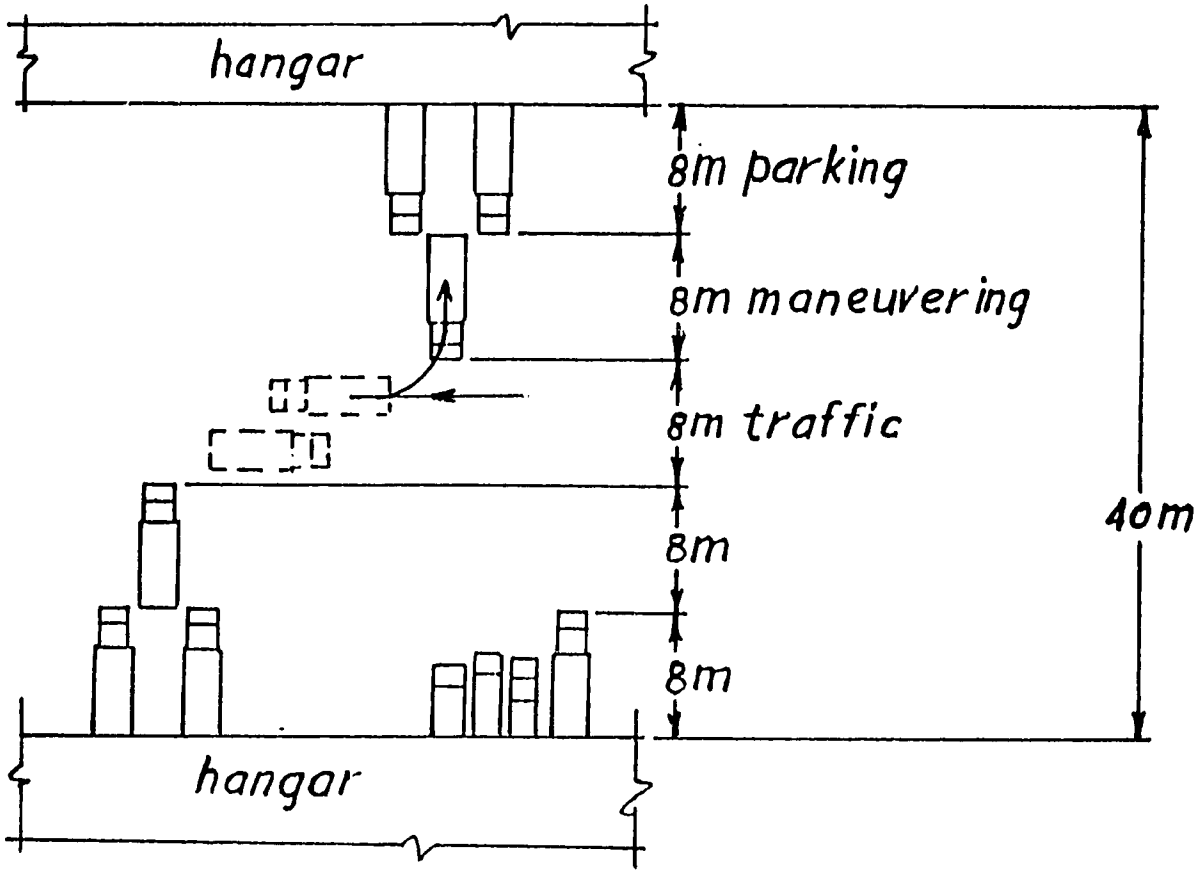
Appendix 3. OFFICE EQUIPMENT COST ESTIMATES

		Sana'a Rials	Taiz/Hodiedah Rials		Al-Hosaynieh Rials	
2	Desks large	12,800	12,800		6,400	1 only
15	Desks 54,000	36,000			28,800	
17	Desk chairs	37,400	24,200		19,800	
60	Chairs	72,000	48,000		42,000	
16	File cabinet	49,600	40,300		31,000	
1	Work table	8,000	8,000		8,000	
1	Electric typewriter	18,500	18,500		8,500	Manual
1	Bookshelf	3,200			3,200	
4	Telephones	4,800	4,800		4,800	
	Totals	260,300YR	179,150YR.			149,300YR

APPENDIX 4. TRUCK LENGTH AND HANGAR SPACING

Truck length affects the space needed between hangars. The market layouts in this report assume almost unlimited access for trucks not longer than 8 meters. Trucks longer than 8 meters will be restricted to areas of the market where they will not be a nuisance.

Inter-shed spacing was calculated in the following manner:



APPENDIX 5. FUEL OIL COSTS PER YEAR

Assumptions:

1. Diesel oil consumption rate 1 litre/4 HP-HR
2. Standby generators run 10 workdays per annum
3. Well pumps at Hodeidah and Al-Hosaynieh are driven by diese engines.
4. Diesel oil costs 2.5 YR/litre.
5.

	Hod.	Al-Hos.
Pump discharge	0.34 CFS	0.11 CFS
Pump head	230Ft	230FT
Pump efficiency	0.7	0.7

Discharges are calculated by assuming the pump will pump th day's volume (138 m3 for Hod., and 44m3 for Al-Hos.) in 4 hours.

Standby generator fuel costs/year:

Sana'a	150KW	x10 Days	x 16 Hours	= 24000 KWH	=32172HP-HR:	20000YR
Taiz	100	10	16	16000	21447	13500YR
Hod.	100	10	16	16000	21447	13500YR
Al-Hos.	100	10	10	10000	13405	8500YR

Pump Fuel Costs/Year.

Hodiedah HP=0.34x62.4x230/550x0.7=12.7: 51HP-HR/Day: 18615 HP-HR/An: which leads to a cost of 11634YR.

Al-Hos. Volume of water is 44/138 that of Hodiedah, therefore cost will be 3709 YR.

Total Fuel Oil Costs/Year

	Generator	Pump	Total
Sana'a	20,000	0	20,000YR
Taiz	13,500	0	13,500
Hod.	13,500	11634	25,200
Al-Hos.	8,500	3709	12,200

APPENDIX 6. ELECTRIC POWER CONSUMPTION AND COST

LIGHTS

	BLDG AREA M2	KW/M2*	HOURS/DAY	KWH/DAY	COST/DAY**
Sana'a	12112	0.010	16	1938	2132
Taiz	8712	0.010	16	1394	1533
Hodiedah	8712	0.010	16	1394	1533
Al-Hos.	8002	0.015***	10	1200	1320

* ADSP inner offices have about 1 TUBE/5m2 = 40W/5m2

** YGEC power cost to markets will likely be 1.1 YR/KWH

*** Al-Hosaynieh is a night market

WATER PUMP POWER

Sana'a

Q = 190 m3/day
= 0.49CFS/4 Hrs.
H = 320 M = 1050FT
EFF = 0.7
HP = 80
KW = 60
KWG = 240
COST = 264 YR/day

Taiz

Q = 138 m3/day
Cost = 190 YR/day

Note:
Hodiedah and Al-Hosaynieh use diesel engines to drive their pumps.

LIFT STATION PUMP POWER

Sana'a
Q = 33 m3/day
H = 40 Ft
Pump 4 hours/day
Q = 0.08 CFS
EFF = 0.7
HP = 0.5
KW = 0.4
KWH = 1.6

Cost = 2 Yr./day
at all sites.

Cost of electricity/day

	Lights		Pump		Lift		YR/Day	YR/Year
Sana'a	2132	+	264	+	2	=	2400	876,000
Taiz	1533	+	190	+	2	=	1700	620,000
Hod.	1533	+	0	+	2	=	1699	620,000
Al-Hos.	1320	+	0	+	2	=	1300	474,000

APPENDIX 7. MAINTENANCE AND REPAIRS

A. Assumptions:

1. Pumps, engines and generators will have a service life of more than 25 years if properly maintained. Budget 15% of first cost for spares every 1000 hours of operation.

2. Engines should have lubricating oil and filters changed every 150 operating hours.

3. Engine coolant (ethylene glycol) should be replaced yearly.

4. Asphalt pavement should be sealed yearly to provide an indefinitely long service life.

5. Fluorescent light tubes will last 2000 hours. Assume need one tube per 4m2 of floor area.

6. Acrylic-clad steel or aluminium roofing and siding will require very little maintenance.

7. Structural steel will require 2 coats of paint at 8-year intervals at Sana'a and at Taiz, and 2 coats of paint at 5-year intervals at Hodeidah and Al-Hosaynieh.

8. Paint costs 120YR/Gallon. Gallon covers 12m2 with 2 coats.

9. Time to scrape, paint, and move scaffolds costs 28 YR/m2 for 2 coats.

10. Area of steel bents, purlins and braces is 60m2 per 6m of hangar length.

B. Cost Computations:

Well pumps

Sana'a/Taiz (first cost 360,000 YR)
15% spares 54,000YR/1000hrs
Pumping 4 hrs/day means pumps
reach 1000 hours in 250 days

$$\frac{365 \times 54000}{250} = 78840 \text{YR/Year}$$

Hod./Al-Hos. 43800YR/Year

Lift station pumps (first cost 100,000YR)
Estimated maintenance cost = 15,000YR/Year

Diesel generators

Sana'a/150KVA/first cost 350,000/15% spares 52500/ Operate 10 days per year/16 hours per day/160 hours per year/takes 6 years to accumulate 1000 hours/cost per year = 52500 - 6 = 8750YR per year.

Taiz and Hodeidah/100KVA/therefore cost per year is (2/3)(8750) = 5862 YR per year.

Al-Hosaynieh/100 KVA/operates 10 hours per day/therefore cost per year is (2/3)(10/16)8750=3646 YR per year

In addition to the spares costs above, oil and coolant changes will cost - coolant $ 15
oil 10
filters 60

$ 85=1105YR/Year

For diesel generators costs will add to

Sana'a	8750	+ 1105	=	9855
Taiz	5862	+ 1105	=	6967
Hod.	5862	+ 1105	=	6967
Al-Hos.	3646	+ 1105	=	4751

Diesel engines for Hod/Al-Hos. pumps

Running 4 hours per day/change oil every 150/4=38 days/which is about 10 times per year/assume oil bath air cleaners which will eliminate need for an air filter/cooling will be by once-through water which eliminates need for ethylene glycol/so cost will be $(10+40)x10 times per year x 13 YR per $ = 6500 YR/year.

Asphalt sealer

Estimate unit cost = 5.6YR/m3

	Sana'a	Taiz	Hod.	Al-Hos.
m2	26,308	21,508	21,303	19,768
cost	147,325	120,445	119,297	110,701

Fluorescent tube replacement

Sana'a/12112m2 of floor area/at 1 tube per 4m2 require 3028 tubes/tubes burn 16 hours per day/tube life is 2000 - 16 =125days/therefore 365-125=2.9 tubes will be required each year for each fixture/this is 2.9 x 3028=8781 tubes per year/each tube costs 25 YR/tube cost per year is 8781x25=220,000.

Taiz has 8712m2 of floor space/it's tube cost per year is (220,000 from above x(8712 - 12112))=158,000YR.

Hodiedah's floor space is same as at Taiz, therefore tube cost per year is 158,000YR.

Al-Hosaynieh's floor space is 8002m2 and its hours of operation are 10 per day therefore tube cost is (220,000x(8002 - 12112)x(10-16)=91,000YR.

Painting

From assumptions 8 - 10 the cost of paint and labor is (120-12)+30=40YR/m2.

	Hangar Length	Area of Steel	Cost/ Painting	No. of Painting/25 Years	Cost 25 Years	Cost Annum
	M	M2	YR		YR	YR
Sana'a	500	5,000	190,000	2	380,000	15,000
Taiz	350	3,500	133,000	2	266,000	10,640
Hod.	350	3,500	133,000	4	532,000	21,280
Al-Hos.	300	3,000	114,000	4	456,000	18,240

Total Maintenance And Repair Costs Per Year(in 1000 YR units)

	Pumps	Lift	Gen.	Pump Engine	Asphalt	Fluor Tubes	Paint	Total
Sana'a	79	15	10	0	147	220	15	486
Taiz	79	15	7	0	120	158	11	390
Hod.	44	15	7	6	119	158	21	370
Al-Has	44	15	7	6	111	91	18	292