

5.3 Regional Development

5.3.1 Regional Development Approach

In the early stages of economic development of a country, emphasis is focused first on the establishment of social infrastructures in the capital area. Production sectors' comparative advantage exists in international terms of trade, as a means of effective application of limited resources.

Thus, the development plan in the initial phase focuses on establishing a base from which development can spread to other parts of the country. After this base is established, usually the capital area as mentioned above, is established economically to a certain level, and other regional development begins to assume importance in national planning.

Regional development in developing countries, principally in Asia, generally occurred according to the following model:

Phase 1

In this initial stage, occurring generally in the 1960's for many developing nations, an unbalanced development strategy was pursued by implementing large-scale projects to develop local production of basic materials and to promote the import substitution industry. Areas where this production capability existed were consequently the sites of large projects to develop water resources, mineral resources, and trunk infrastructure for transport. Strategy thus centered on natural resources development.

Unfortunately, the unbalanced nature of the strategy skewed development in favor of urban and other population centers at the expense of rural areas. The economy assured a dual structure of society with serious disparity in the level of development between the city and the countryside which tended to get worse as time progressed.

Phase 2

In the 1970's, a growing shift in planning policy was seen in developing countries with focus dispersed away from the economic base in the capital area to the rural area, including an integrated rural development approach which encompassed all regions of the country. Emphasis was placed on increasing the capacity of rural areas to support population, development of distribution infrastructures, introduction of new farming technology, and construction of secondary and tertiary irrigation systems.

Phase 3

Balanced development in both the public and private sectors was pursued with a view to stabilizing the socio-economy. Infrastructures to improve daily rural life were addressed, and projects promoted were of a nature whereby the active participation of intended beneficiaries in both planning and implementation was encouraged.

In the agricultural sector, projects aimed at environmental protection and conservation. Small-scale irrigation and various on-farm projects for which operation and maintenance were within the scope of the farmer's capability, were emphasized.

As this trend progressed, the farm village became the center of agricultural policy combining a strategy of farm and village development including an enhanced living environment and rational irrigation water management.

Through the above process, agriculture is developed as the base industry of the regional community. The agricultural sector comes to represent a rational integration of traditional farming, modern agriculture and related small industries, and is recognized as embodying the function of wise management of the regional environment and its

resources.

Regional development may thus be considered as rural development, with agriculture at the center of a balanced regional economy also containing industrial and marketing components.

In formulating this type of regional development strategy, attention should be given to the following:

- (1) Self-reliance of the regional community (establishment of a rural society capable of independently and vigorously pursuing agricultural activity).
- (2) Environmental conservation.
- (3) Balance between population and land use.
- (4) Balanced availability of goods, and improved income.
- (5) Establishment of small-scale infrastructures (as opposed to large-scale, conventionally emphasized).
- (6) Diversification towards a multi-cultural production system and reassessment of traditional agriculture.

In the case of Oman, the Regional Development Committees have been established for the most backward regions to formulate the regional development program and implement and manage, during the initial stages, the development projects for the region. Once a certain level of development is achieved under the projects in the region, the functions of these are transferred by the committee to the concerned government agencies. Under this program, development results have been achieved in Buraimi and Musandam.

In addition to the above, the various government agencies pursue independent development programs on their own as well. Accordingly, there is much room for more government effort.

The current role of MAF in regional development is limited to the implementation of projects related to the agricultural sector. Nevertheless, agricultural development as a part of regional development is of extreme importance as almost half of the Omani work force is

employed in the agricultural sector, and more than half of the nations' population resides in rural areas. It is expected that MAF will in the coming years assume more and more leadership in the area of regional development.

5.3.2 Regional Development Strategy under the 5-Year Agricultural Development Plan

To date, agricultural development has been pursued from a national standpoint, with the sectoral base being established in the capital region under the previous Five-year Development Plans. Consequently, it is appropriate to disperse this base to the key cities in each region. This corresponds to phase 2 of the previously discussed regional development model.

The government recognizes the importance of regional development and formulates the regional development plan in advance of formulating the Fourth 5-year Development Plan.

Under the 10-year Master Plan, the "upstream" agricultural and livestock production sectors are to be developed through the new technology dissemination effect of agricultural research stations and extension centers in rural areas centering on the key regional towns. The services and activities under the foregoing facilities would reach not only farmers in and around the key towns, but in remote areas as well. Distribution facilities and wholesale markets under PAMAP would also be established at the key towns to facilitate the movement of produce to the "downstream" consumer market.

At the same time, agricultural production infrastructures would be strengthened through projects to construct recharge dams, rehabilitate traditional falaj and well systems, and establish modern irrigation facilities, for efficient management of limited water resources.

The above strategy would function to systematically remove the constraints affecting Omani agriculture. Common constraints to all

regions are:

- (1) Finite water resources, aggravated by overdrafting of groundwater accompanying expansion of cultivated land.
- (2) Inadequate agricultural production infrastructures.
- (3) Depressed levels of agricultural and animal husbandry technology aggravated by lack of trained personnel to introduce appropriate modern methods.
- (4) Underdeveloped distribution system for agricultural and livestock products.
- (5) Migration of youth away from agriculture.

Specific regional issues are as follows:

- (1) Saline intrusion in Batinah and Salalah due to overdrafting of groundwater.
- (2) Degeneration of rangeland in Janubiya due to overgrazing of livestock.

In order to address the above constraints, the JICA team has formulated the following programs:

- (1) Groundwater recharge through construction of recharge dams.
- (2) Economical water use through introduction of efficient irrigation systems.
- (3) Strengthening of research and extension activities pertaining to new agricultural and livestock technology to upgrade farmers' technical levels.
- (4) Subsidies for inputs, equipment and machinery as an incentive for farmers to adopt new techniques.
- (5) Promotion of farm management combining both cropping and animal husbandry as a measure to increase the farm income of the small farmer in particular.
- (6) Improvement of distribution system efficiency through the establishment of wholesale markets under PAMAP and other distribution facilities and organizations.
- (7) Diversification of the rural economy through promotion of rural

industries.

- (8) Stimulation of awareness and interest in agriculture to stem the migration of youth away from the agricultural sector.

Regional divisions designated by the Development Council are as follows: Muscat, Batinah, Sharqiya, Dakhliya, Dhahira, Janubiya, and Musandam.

5.3.3 Regional Allocation of Agricultural Development Budget

Under the Master Plan, the nationwide project development potential over the 10-year period was identified, and its total corresponding budget to achieve the same was calculated. Regional allocation was then determined within this overall framework.

The Development Council has indicated that the allocation of the development budget for the overall national plan should be as follows:

Muscat	25 %
Janubiya	10 %
Batinah, Sharqiya, Dakhliya, Dhahira, and Musandam	65 %

The JICA team formulated its regional allocation plan for agricultural investment bearing in mind the above. However, it must be noted that as the budget in question is specifically for agricultural development, the breakdown by region does not completely correspond with the Development Council's percentages which represent budget allocations covering all sectors, not just agriculture.

The JICA team applied criteria set out in section 5.2.2.2 (2) in determining regional allocation.

As for projects pertaining to criteria (b) and (c), total project load is known, but specific regional outlay will not be clear until the implementation stage. For strictly national projects and programs,

regional outlay is estimated on the basis of arbitrary criteria such as cropped area, number of head of livestock affected in a particular region, etc. Such regional outlays would be subject to readjustment as necessary at the project-implementation stage.

Regional outlay under the total investment target of R.O. 278 million under the 5-year Agricultural Development Plan is indicated in Tables 5.3.1 - 5.3.2. Summarized, it is as follows:

Muscat	7 %
Janubiya	19 %
Total for other regions	75 %

As projects are agriculture-related, the investment proportion for Muscat is as low as would be expected. The reasons for a high investment rate in Janubiya are:

- (1) Of the primary production sectors, animal husbandry is the most backwards and therefore, has the most potential for development. Janubiya would be the focus of efforts to accelerate development of the livestock sector under the Master Plan. 43 % of the total investment in this sector would be allocated to Janubiya.
- (2) The inter-sectoral Integrated Agricultural Development Project for the Nejd Region has the highest priority as a large-scale agricultural project and is accordingly given investment priority in the Master Plan.
- (3) The soil survey program for Nejd and the forestry-improvement program for Jabal are high priority projects.
- (4) The coconut processing plant which has good feasibility and is anticipated to lead to production of export-oriented products in the future will be implemented in the Janubiya Region.

The largest regional outlay is that for the Batinah Region. The reason for this is that it is the major agricultural production area in

Table 5.3.1 Regional Budget Summary (R.O. 1,000) - 5-Year Plan

Sector	Total	Muscat	Batinah	Sharqiya	Dakhliya	Dhahira	Janubiya	Musandam
Irrigation and Dam	135,518	1,982	55,723	15,310	32,474	19,722	7,710	2,597
Agricultural Research	9,625	80	5,150	695	1,425	280	1,885	110
Agricultural Extension	14,123	1,661	4,030	2,594	2,530	1,986	755	568
Agricultural Production	12,960	1,127	6,116	1,640	1,326	1,272	1,217	263
Livestock	47,546	985	9,630	4,415	6,353	4,886	20,323	955
Distribution	15,397	6,706	3,846	1,161	1,063	619	1,911	91
Processing	10,474	1,184	3,925	765	1,209	510	2,779	102
Inter-Sectoral Projects	32,333	5,435	4,422	2,165	2,104	1,860	14,975	1,372
Total	277,976	19,159	92,841	28,744	48,485	31,134	51,555	6,058

Table 5.3.2 Regional Investment Distribution by Sector (%)

Sector	Total	Muscat	Batinah	Sharqiya	Dakhliya	Dhahira	Janubiya	Musandam
Irrigation and Dam	48.8	10.3	60.0	53.3	67.0	63.3	15.0	42.9
Agricultural Research	3.5	0.4	5.5	2.4	2.9	0.9	3.7	1.8
Agricultural Extension	5.1	8.7	4.3	9.0	5.2	6.4	1.5	9.4
Agricultural Production	4.7	5.9	6.6	5.7	2.7	4.1	2.4	4.3
Livestock	17.1	5.1	10.4	15.4	13.1	15.7	39.4	15.8
Distribution	5.5	35.0	4.1	4.0	2.2	2.0	3.7	1.5
Processing	3.8	6.2	4.2	2.7	2.5	1.6	5.4	1.7
Inter-Sectoral Projects	11.6	28.4	4.8	7.5	4.3	6.0	29.0	22.6
Total	100	100	100	100	100	100	100	100

Table 5.3.3 Sectoral Investment Distribution by Region (%)

Sector	Total	Muscat	Batinah	Sharqiya	Dakhliya	Dhahira	Janubiya	Musandam
Irrigation and Dam	100	1.5	41.1	11.3	24.0	14.6	5.7	1.9
Agricultural Research	100	0.8	53.5	7.2	14.8	2.9	19.6	1.1
Agricultural Extension	100	11.8	28.5	18.4	17.9	14.1	5.3	4.0
Agricultural Production	100	8.7	47.2	12.7	10.2	9.8	9.4	2.0
Livestock	100	2.1	20.3	9.3	13.4	10.3	42.7	2.0
Distribution	100	43.6	25.0	7.5	6.9	4.0	12.4	0.6
Processing	100	11.3	37.5	7.3	11.5	4.9	26.5	1.0
Inter-Sectoral Projects	100	16.8	13.7	6.7	6.5	5.8	46.3	4.2
Total	100	6.9	33.4	10.3	17.4	11.2	18.5	2.2

Oman. The next largest regional outlay is for Dakhliya, and the next roughly equal are for Dhahira and Sharqiya.

Sharqiya is the region most lagging in agricultural modernization. Preliminary soil surveys indicated 400 km² of land (S1, S2, S3) appropriate for irrigated cultivation. Although precise reserves of ground water are unclear, the potential for new water-resources development is present.

A "National Water Resources Master Plan" is currently being prepared by MWR for precise identification of water resources in each region. The budget under the 10-year Master Plan for Pilot Projects for Centrally-Controlled Irrigation Systems includes the Al Kamil project (50ha) -- already determined as feasible -- and promising projects of around a 100 ha-scale from among those currently being investigated by MWR.

If in addition to the projects already considered under the 10-year Master Plan, any promising and feasible areas for pilot projects for centrally-controlled irrigation emerge in the future as the result of ongoing study by MWR, these should be incorporated into the Master Plan and corresponding budget outlay should be made, particularly for projects that are identified in the Sharqiya Region where agricultural development is most lagging.

Sectoral agricultural investment allocation by region is shown in Table 5.3.3. The irrigation and dam sector accounts for 49 % of the investment. Next is the livestock sector. Regional allocation trends are basically the same for Batinah, Sharqiya, Dakhliya, Dhahira and Musandam. However, in the case of Muscat, the investment proportion for distribution is largest, while that for livestock and inter-sectoral (including Nejd) development is higher for Janubiya.

Regional investment per unit of cropped area and per capita are shown in Tables 5.3.4 - 5.3.5. Investment per cropped hectare is largest in Janubiya for the five regions excluding Muscat and Musandam. However, it must be noted that the cropped area for Janubiya does not include the 200,000 ha of rangeland and 70,000 ha of natural pasture in the region.

Table 5.3.4 Ratio of Investment/Cropping Area (R.O./ha)

Sector	Total	Muscat	Batinah	Sharqiya	Dakhliya	Dhahira	Janubiya	Musandam*	Maximum/ Minimum
Cropping Area (ha)	55,671	2,115	29,092	8,615	7,728	5,603	1,488	1,030	
Irrigation and Dam	2,434	937	1,915	1,777	4,202	3,520	5,181	2,521	2.92
Agricultural Research	173	38	177	81	184	50	1,267	107	25.35
Agricultural Extension	254	785	139	301	327	354	507	551	3.66
Agricultural Production	233	533	210	190	172	227	818	255	4.77
Livestock	854	465	331	512	822	872	13,658	927	41.26
Distribution	277	3,171	132	135	138	110	1,284	88	11.62
Processing	188	560	135	89	156	91	1,868	99	21.03
Inter-Sectoral Projects	581	2,570	152	251	272	332	10,064	1,332	66.21
0									
Total	4,993	9,058	3,191	3,337	6,274	5,557	34,647	5,882	10.86

Note: (*) exclude Muscat and Musandam

Table 5.3.5 Ratio of Investment/Omani Population (R.O./capita)

Sector	Total	Muscat	Batinah	Sharqiya	Dakhliya	Dhahira	Janubiya	Musandam*	Maximum/ Minimum
Omani Population in 1990	1,218,344	158,763	406,202	203,606	183,345	118,413	125,361	22,654	
Irrigation and Dam	111	12	137	75	177	167	62	115	2.88
Agricultural Research	8	1	13	3	8	2	15	5	6.36
Agricultural Extension	12	10	10	13	14	17	6	25	2.78
Agricultural Production	11	7	15	8	7	11	10	12	2.08
Livestock	39	6	24	22	35	41	162	42	7.48
Distribution	13	42	9	6	6	5	15	4	2.92
Processing	9	7	10	4	7	4	22	5	N.A.
Inter-Sectoral Projects	27	34	11	11	11	16	119	61	10.97
Total	228	121	229	141	264	263	411	267	2.91

Note: (*) exclude Muscat and Musandam

The unit area investment for Sharqiya, Dakhliya and Dhahira Regions are all larger than for Batinah, reflecting the need to address the particularly backward levels of agriculture in these regions.

In terms of per capita, the investment rate is highest for Janubiya out of the five regions excluding Muscat and Musandam. The reason for this is that numerous high priority projects, as discussed previously, are concentrating on this region. The differential rate in per capita investment among the five regions is a factor of 2.9, which is larger than the 1.9 for the 10-year Master Plan due to concentrated investment in priority projects in Janubiya, the largest receiver of investment per capita.

Also, a comparison of per capita investment in Batinah and the other regions of Sharqiya, Dakhliya and Dhahira reveals that with the exception of Sharqiya, the investment rate in this regard is higher than for Batinah, indicating that regional allocation of funding is directed at bringing balance into skewed levels of development between regions.

Nevertheless, it is important that efforts at balanced development in the agricultural sector be complemented by programs under other government agencies in the areas of rural housing, education, etc.

5.3.4 Regional Development Plan

Regional agricultural development plan under the target budget of R.O. 278 million is as follows:

(1) Muscat

(a) Irrigation and dams

- Falaj rehabilitation in proportion to cropped area.

(b) Agriculture

- Establishment of Development Support Communication Center, sponsoring of International Agriculture and Food Exhibitions, and

- strengthening of two existing plant quarantine stations.
- Establishment of Agricultural Technology Information Units in existing extension centers.

(c) Livestock

- Establishment of concentrate feed plant of Livestock Input Company in harbor vicinity.
- Implementation of appropriate project load for NLL-2, NLE-1, NLM-1, NLL-4 and NLL-5 in proportion to livestock head number in region. The JICA team estimates of livestock numbers based on 1982 GRM study are given in Table 5.3.6.
- Strengthening of animal quarantine station at one location.

(d) Others

- Strengthening of facilities at MAF headquarters.
- Establishment of central wholesale market at Muttrah.
- Strengthening of facilities at PAMAP headquarters and other distribution facilities under PAMAP.
- Establishment of processing facilities for dates as well as a pilot plant for pickling.

Breakdown and sectoral share for investment in the Muscat Region are shown in Table 5.3.7.

(2) Batinah

(a) Irrigation and dams

- Construction of recharge dams, modern irrigation projects, and centrally-controlled water-distribution systems towards recharge of groundwater resources and economical water use. Recharge dams are to be constructed at 12 locations. Pilot projects for centrally-controlled irrigation at 6 locations for a total benefit area of 3,000 ha.
- Project load for modern irrigation facilities and falaj rehabilitation in proportion to cropped area in the region.
- Batinah is also considered promising for F/S studies and pilot projects for underground dams.

Table 5.3.6 Animal Unit Distribution Ratio by Region

Region	goats (Animal Head)	sheep	cattle	AnimalU.	%	Modified %
Muscat	24,000	7,500	2,100	8,400	2.9	3
Batinah	216,300	67,200	18,500	75,200	25.7	25
Sharquiya	113,000	22,500	9,600	36,700	12.6	12
Dakhaliya	93,100	13,100	7,900	29,140	10.0	10
Dhahira	117,100	18,300	9,400	36,480	12.5	12
Janubiya	106,200	4,000	77,900	99,940	34.2	35
Musandam	26,500	3,100	500	6,420	2.2	3
Total	696,200	135,700	125,900	292,280	100	100
Animal Unit	139,240	27,140	125,900			

Source: JICA estimation

Note: Calculation method of Animal Unit is:

Goats and Sheep: Head numberx0.2--①

Cattle : Head numberx1.0--②

①+②=Animal Unit of each Region

Table 5.3.7 Regional Budget in Muscat - 5-Year Plan

(UNIT: 1000 R.O.)

SECTOR	PROJECT NUMBER	NAME OF PROJECT/PROGRAM	7 REGIONS TOTAL BUDGET (1)	MUSCAT REGION BUDGET (2)	SHARE BY REGION (%) (2)/(1)	SHARE BY SECTOR (%)
Irrigation and Dam	NW-1	Improvement of Irrigation System and Centrally-Controlled Water-Distribution System	135,518	1,982	1.5	10.3
			19,800			
	NW-2	Subsidy for New Irrigation System Project	16,250	325	2.0	1.7
	NW-3	Legal Framework for Agricultural Water Use	170	7	4.1	0.0
	NW-4	Recharge Dams	48,025	325	0.7	1.7
	NW-5	Sub-surface (Underground) Dams	2,500			
	NW-6	Aflaj	29,670	1,220	4.1	6.4
	NW-7	Wells	9,000	60	0.7	0.3
	NW-8	Springs	1,969			
	NW-9	Erosion Control and Protection of Agricultural Land against Floods	3,870			
	NW-10	Survey and Monitoring	4,264	45	1.1	0.2
Agricultural Research			9,625	80	0.8	0.4
	NAR-1	Support for Agricultural Research Stations	2,710			
	NAR-2	Establishment of New Research Units and Laboratories	3,075			
	NAR-3	Development and Establishment of Experimental Farms and Nurseries	1,040			
	NAR-4	Forestry Improvement Program	1,000	40	4.0	0.2
	NAR-5	Establishment of Locust Survey and Central Unit	1,000	40	4.0	0.2
	NAR-6	Soil Surveys	800			
Agricultural Extension			14,123	1,661	11.8	8.7
	NAE-1	Improvement and Development of Extension Centers and Facilities	3,520	172	4.9	0.9
	NAE-2	Establishment of Development Support Communication Center(DSCC)	1,190	1,190	100.0	6.2
	NAE-3	Training of Researchers, Extension Staff and Statistics Staff	1,503	39	2.6	0.2
	NAE-4	Intensive Extension Guidance Program	7,910	260	3.3	1.4
Agricultural Production			12,960	1,127	8.7	5.9
	NAA-1	Collection and Organization of Agricultural Statistics	1,360	41	3.0	0.2
	NAA-2	Agricultural Exhibitions and Festivals	700	486	69.4	2.5
	NAA-3	National Project for Plant Protection and Aerial Spraying	5,000	150	3.0	0.8
	NAA-4	Agricultural Technology Transfer to Farmers Project	5,000	150	3.0	0.8
	NAQ-1	Development and Improvement of Plant Quarantine	900	300	33.3	1.6
Livestock			47,546	985	2.1	5.1
	NLL-1	Rangeland Revegetation Project in Southern Region	2,352			
	NLL-2	Animal Health and Disease Control Project	16,425	366	2.2	1.9
	NLE-1	Livestock Extension Development Project	482	5	0.9	0.0
	NLR-1	Livestock Research Development Project	4,050			
	NLM-1	Livestock Marketing Improvement Project	6,371	10	0.2	0.1
	NLL-3	Livestock Input Company Project	1,359	376	27.7	2.0
	NLL-4	Small Farm Development Support Project	15,285	191	1.3	1.0
	NLL-5	Livestock Specialized Services Program	1,222	37	3.0	0.2
Distribution			15,397	6,706	43.5	35.0
	ND-1	Establishment of Wholesale Market	3,656	3,577	97.8	18.7
	ND-2	Supply and Demand Forecast of Agricultural Produce	444	444	100.0	2.3
	ND-3	Establishment of Shipping Organization for Farmers	1,220	165	13.5	0.9
	ND-4	Fortification of PAMAP	10,077	2,520	25.0	13.2
Agricultural Produce Processing			10,474	1,184	11.3	6.2
	NP-1	Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services	5,100	204	4.0	1.1
	NP-2	Establishment of Agro-Industrial Complex for Processing of Dates, Limes and Tomatoes	1,134	173	15.3	0.9
	NP-3	Establishment of Pickling and Vinegar-Processing Plant	1,614	807	50.0	4.2
	NP-4	Establishment of Coconut-Processing Plant	2,626			
Inter-Sectoral			32,333	5,435	16.8	28.4
	NI-1	Integrated Agricultural Development Project in Nejd	13,242			
	NI-2	Improvement and Maintenance of MAF Facilities	16,991	5,351	31.5	27.9
	NI-3	Artificial Rainfall Project				
	OI-1	Citizen's Compensation against Natural Crisis	1,500	60	4.0	0.3
	OI-2	Master Plan for Development of Date Palm Cultivation	600	24	4.0	0.1
Total			277,976	19,159	6.9	100.0

(b) Agriculture

- Strengthening of facilities at Rumais Agricultural Research Center as the focus for basic agricultural research with impact on the country as a whole. Also, an agricultural research station would be established at Sohar, given the importance of agriculture in northern Batinah for the nation as a whole.
- Establishment of nurseries for fruit trees at two locations.
- Given the comparative disadvantage of poor quality dates grown in Batinah, allocation under the date extension program would be relatively less than the proportional amount of date cropped area in the region.
- Workload for other programs in proportion to cropped area in the region.
- Establishment of Agricultural Technology Information Units in both existing and new extension centers.

(c) Livestock

- Strengthening of facilities at Rumais Livestock Research Center and CVIL. A training center adjacent to the Rumais Livestock Research Center would also be constructed.
- Of the total small poultry holders targeted throughout all regions under the Small Holder Poultry Production Project, 535 are to be created through subsidy in Batinah.
- Other livestock project load in proportion to numbers of livestock in the region.
- One new animal quarantine station and two new animal clinics will be established. Facilities at one existing animal clinic will be strengthened.

(d) Others

- Facilities of the Directorate General of Agriculture at Sohar will be strengthened.
- New construction and strengthening of existing distribution facilities under PAMAP.
- Improvement of facilities at MAF dates processing plant at Rustaq.

Breakdown and sectoral shares for investment in the Batinah Region are shown in Table 5.3.8.

(3) Sharqiya

(a) Irrigation and dams

- Construction of recharge dams, modern irrigation projects and centrally-controlled water distribution for groundwater recharge and economical water use. Recharge dams are to be constructed at two locations. Study of new development potential for water resources is to be continued, referring to findings of the "National Water Resources Master Plan" of MWR.
- Implementation of pilot projects for centrally-controlled irrigation at three locations for total benefit area of 250 ha. Of these, the Al Kamil project (50 ha) has already been determined as feasible and would be scheduled for implementation in 1991. Project load for new irrigation facility projects and falaj rehabilitation would be in proportion to cropped area in the region.

(b) Agriculture

- Establishment of a part of Al Kamil Agricultural Research Station.
- Establishment of one new extension sub-center in remote area.
- Implementation of soil survey, given promising farmland in the region.
- Relatively heavier outlay under the date extension program, given the superior dates grown in the region.
- Remaining program outlay in proportion to cropped area in the region.
- Establishment of Agricultural Technology Information Units in both existing and new extension centers.
- Afforestation research and pilot project to counter desertification at edge of Wahiba desert.

(c) Livestock

- Establishment of one new animal clinic and strengthening of facilities at one existing animal clinic.

Table 5.3.8 Regional Budget in Batinah - 5-Year Plan

(UNIT: 1000 R.O.)

SECTOR	PROJECT NUMBER	NAME OF PROJECT/PROGRAM	7 REGIONS TOTAL BUDGET (1)	BATINAH REGION BUDGET (2)	SHARE BY REGION (%) (2)/(1)	SHARE BY SECTOR (%)
Irrigation and Dam			135,518	55,723	41.1	60.0
	NW-1	Improvement of Irrigation System and Centrally-Controlled Water-Distribution System	19,800	11,160	56.4	12.0
	NW-2	Subsidy for New Irrigation System Project	16,250	8,936	55.0	9.6
	NW-3	Legal Framework for Agricultural Water Use	170	88	51.8	0.1
	NW-4	Recharge Dams	48,025	23,618	49.2	25.4
	NW-5	Sub-surface (Underground) Dams	2,500	300	12.0	0.3
	NW-6	Aflaj	29,670	6,680	22.5	7.2
	NW-7	Wells	9,000	2,890	32.1	3.1
	NW-8	Springs	1,969			
	NW-9	Erosion Control and Protection of Agricultural Land against Floods	3,870	70	1.8	0.1
	NW-10	Survey and Monitoring	4,264	1,981	46.5	2.1
Agricultural Research			9,625	5,150	53.5	5.5
	NAR-1	Support for Agricultural Research Stations	2,710	1,200	44.3	1.3
	NAR-2	Establishment of New Research Units and Laboratories	3,075	2,860	93.0	3.1
	NAR-3	Development and Establishment of Experimental Farms and Nurseries	1,040	320	30.8	0.3
	NAR-4	Forestry-Improvement Program	1,000	250	25.0	0.3
	NAR-5	Establishment of Locust Survey and Central Unit	1,000	520	52.0	0.6
	NAR-6	Soil Surveys	800			
Agricultural Extension			14,123	4,030	28.5	4.3
	NAE-1	Improvement and Development of Extension Centers and Facilities	3,520	840	23.9	0.9
	NAE-2	Establishment of Development Support Communication Center(DSCC)	1,190			
	NAE-3	Training of Researchers, Extension Staff and Statistics Staff	1,503	765	50.9	0.8
	NAE-4	Intensive Extension Guidance Program	7,910	2,425	30.7	2.6
Agricultural Production			12,960	6,116	47.2	6.6
	NAA-1	Collection and Organization of Agricultural Statistics	1,360	680	50.0	0.7
	NAA-2	Agricultural Exhibitions and Festivals	700	36	5.1	0.0
	NAA-3	National Project for Plant Protection and Aerial Spraying	5,000	2,700	54.0	2.9
	NAA-4	Agricultural Technology Transfer to Farmers Project	5,000	2,700	54.0	2.9
	NAQ-1	Development and Improvement of Plant Quarantine	900			
Livestock			47,546	9,630	20.3	10.4
	NLL-1	Rangeland Revegetation Project in Southern Region	2,352			
	NLL-2	Animal Health and Disease Control Project	16,425	3,841	23.4	4.1
	NLE-1	Livestock Extension Development Project	482	204	42.2	0.2
	NLR-1	Livestock Research Development Project	4,050	1,696	41.9	1.8
	NLM-1	Livestock Marketing Improvement Project	6,371	149	2.3	0.2
	NLL-3	Livestock Input Company Project	1,359			
	NLL-4	Small Farm Development Support Project	15,285	3,435	22.5	3.7
	NLL-5	Livestock Specialized Services Program	1,222	306	25.0	0.3
Distribution			15,397	3,846	25.0	4.1
	ND-1	Establishment of Wholesale Market	3,656	79	2.2	0.1
	ND-2	Supply and Demand Forecast of Agricultural Produce	444			
	ND-3	Establishment of Shipping Organization for Farmers	1,220	397	32.5	0.4
	ND-4	Fortification of PAMAP	10,077	3,371	33.4	3.6
Agricultural Produce Processing			10,474	3,925	37.5	4.2
	NP-1	Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services	5,100	2,652	52.0	2.9
	NP-2	Establishment of Agro-Industrial Complex for Processing of Dates, Limes and Tomatoes	1,134	466	41.1	0.5
	NP-3	Establishment of Pickling and Vinegar-Processing Plant	1,614	807	50.0	0.9
	NP-4	Establishment of Coconut-Processing Plant	2,626			
Inter-Sectoral			32,333	4,422	13.7	4.8
	NI-1	Integrated Agricultural Development Project in Nejd	13,242			
	NI-2	Improvement and Maintenance of MAF Facilities	16,991	3,330	19.6	3.6
	NI-3	Artificial Rainfall Project				
	OI-1	Citizen's Compensation against Natural Crisis	1,500	780	52.0	0.8
	OI-2	Master Plan for Development of Date Palm Cultivation	600	312	52.0	0.3
Total			277,976	92,841	33.4	100.0

- Establishment of 550 poultry small holders under subsidy program.
- Other livestock project load to be implemented in proportion to number of livestock in the region.

(d) Others

- Upgrading of existing Directorate General of Agriculture facilities at Ibra.

Breakdown and sectoral share for investment in the Sharqiya Region are shown in Table 5.3.9.

(4) Dakhliya

(a) Irrigation and dams

- Construction of recharge dams, modern irrigation projects and centrally-controlled water-distribution systems for groundwater recharge and economical water use, given the threatened nature of water resources in the region. Recharge dams would be constructed at five locations, and pilot projects for centrally-controlled irrigation at three locations, for a total benefit area of 800 ha.
- New irrigation and falaj rehabilitation project load would be in proportion to cropped area in the region.

(b) Agriculture

- Establishment of Jimmah Agricultural Research Station, to conduct research on dates and field crops.
- Establishment of one new extension center.
- Relatively heavier outlay under the date extension program, given the superior dates grown in the region.
- Establishment of nursery for dates, grapes, etc., at one location.
- Remaining program outlay in proportion to cropped area in the region.
- Establishment of Agricultural Technology Information Units in both existing and new extension centers.

(c) Livestock

- Strengthening of facilities at existing Livestock Research Center

Table 5.3.9 Regional Budget in Sharqiya - 5-Year Plan

(UNIT: 1000 R.O.)

SECTOR	PROJECT NUMBER	NAME OF PROJECT/PROGRAM	7 REGIONS TOTAL BUDGET (1)	SHARQIYA REGION BUDGET (2)	SHARE BY REGION (%) (2)/(1)	SHARE BY SECTOR (%)
Irrigation and Dam			135,518	15,310	11.3	53
	NW-1	Improvement of Irrigation System and Centrally-Controlled Water-Distribution System	19,800	1,440	7.3	5.0
	NW-2	Subsidy for New Irrigation System Project	16,250	2,113	13.0	7.4
	NW-3	Legal Framework for Agricultural Water Use	170	26	15.3	0.1
	NW-4	Recharge Dams	48,025	4,019	8.4	14.0
	NW-5	Sub-surface (Underground) Dams	2,500	35	1.4	0.1
	NW-6	Aflaj	29,670	5,000	16.9	17.4
	NW-7	Wells	9,000	2,200	24.4	7.7
	NW-8	Springs	1,969			
	NW-9	Erosion Control and Protection of Agricultural Land against Floods	3,870	50	1.3	0.2
	NW-10	Survey and Monitoring	4,264	427	10.0	1.5
Agricultural Research			9,625	695	7.2	2.4
	NAR-1	Support for Agricultural Research Stations	2,710	235	8.7	0.8
	NAR-2	Establishment of New Research Units and Laboratories	3,075			
	NAR-3	Development and Establishment of Experimental Farms and Nurseries	1,040			
	NAR-4	Forestry-Improvement Program	1,000	150	15.0	0.5
	NAR-5	Establishment of Locust Survey and Central Unit	1,000	150	15.0	0.5
	NAR-6	Soil Surveys	800	160	20.0	0.6
Agricultural Extension			14,123	2,594	18.4	9.0
	NAE-1	Improvement and Development of Extension Centers and Facilities	3,520	561	15.9	2.0
	NAE-2	Establishment of Development Support Communication Center(DSCC)	1,190			
	NAE-3	Training of Researchers, Extension Staff and Statistics Staff	1,503	133	8.8	0.5
	NAE-4	Intensive Extension Guidance Program	7,910	1,900	24.0	6.6
Agricultural Production			12,960	1,640	12.7	5.7
	NAA-1	Collection and Organization of Agricultural Statistics	1,360	204	15.0	0.7
	NAA-2	Agricultural Exhibitions and Festivals	700	36	5.1	0.1
	NAA-3	National Project for Plant Protection and Aerial Spraying	5,000	700	14.0	2.4
	NAA-4	Agricultural Technology Transfer to Farmers Project	5,000	700	14.0	2.4
	NAQ-1	Development and Improvement of Plant Quarantine	900			
Livestock			47,546	4,415	9.3	15.4
	NLL-1	Rangeland Revegetation Project in Southern Region	2,352			
	NLL-2	Animal Health and Disease Control Project	16,425	1,519	9.2	5.3
	NLE-1	Livestock Extension Development Project	482	18	3.7	0.1
	NLR-1	Livestock Research Development Project	4,050			
	NLM-1	Livestock Marketing Improvement Project	6,371	72	1.1	0.3
	NLL-3	Livestock Input Company Project	1,359			
	NLL-4	Small Farm Development Support Project	15,285	2,659	17.4	9.3
	NLL-5	Livestock Specialized Services Program	1,222	147	12.0	0.5
Distribution			15,397	1,161	7.5	4.0
	ND-1	Establishment of Wholesale Market	3,656			
	ND-2	Supply and Demand Forecast of Agricultural Produce	444			
	ND-3	Establishment of Shipping Organization for Farmers	1,220	165	13.5	0.6
	ND-4	Fortification of PAMAP	10,077	997	9.9	3.5
Agricultural Produce Processing			10,474	765	7.3	2.7
	NP-1	Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services	5,100	765	15.0	2.7
	NP-2	Establishment of Agro-Industrial Complex for Processing of Dates, Limes and Tomatoes	1,134			
	NP-3	Establishment of Pickling and Vinegar-Processing Plant	1,614			
	NP-4	Establishment of Coconut-Processing Plant	2,626			
Inter-Sectoral			32,333	2,165	6.7	7.5
	NI-1	Integrated Agricultural Development Project in Nejd	13,242			
	NI-2	Improvement and Maintenance of MAF Facilities	16,991	1,850	10.9	6.4
	NI-3	Artificial Rainfall Project				
	OI-1	Citizen's Compensation against Natural Crisis	1,500	225	15.0	0.8
	OI-2	Master Plan for Development of Date Palm Cultivation	600	90	15.0	0.3
Total			277,976	28,744	10.3	100.0

at Wadi Quriyat.

- Consulting service to operate modern research facilities and transfer of technology regarding the same.
- Strengthening of facilities at one existing animal clinic.
- Promotion of artificial insemination and improvement of dairy cow breed for medium and small dairy farmers in areas adjacent to the capital region.
- Establishment of a poultry breeding farm for supply of broilers under the Livestock Input Company at Wadi Quriyat.
- Establishment of 670 small poultry holders under subsidy program.
- Other livestock project load to be carried out in proportion to number of livestock in the region.

(d) Others

- Strengthening of existing Directorate General of Agriculture facilities at Nizwa.
- New construction and strengthening of existing distribution facilities under PAMAP.
- Strengthening of facilities at MAF date-processing plant at Nizwa.

Breakdown and sectoral share for investment in the Dakhliya Region are shown in Table 5.3.10.

(5) Dhahira

(a) Irrigation and dams

- Construction of recharge dams, modern irrigation facilities and centrally controlled water distribution systems for groundwater recharge and economical water use. Although locally there are both areas of excessive drafting and areas of resource surplus in the region, the overall trend in Dhahira is one of overdrafting of groundwater. Recharge dams would be constructed at four locations and pilot projects for centrally controlled irrigation at three locations for a total benefit area of 500 ha.
- New irrigation and falaj rehabilitation project load would be in proportion to cropped area in the region.
- A proportionately heavier outlay would be made for the Buraimi area

Table 5.3.10 Regional Budget in Dakhliya - 5-Year Plan

(UNIT: 1000 R.O.)

SECTOR	PROJECT NUMBER	NAME OF PROJECT/PROGRAM	7 REGIONS TOTAL BUDGET (1)	DAKHLIYA REGION BUDGET (2)	SHARE BY REGION (%) (2)/(1)	SHARE BY SECTOR (%)
			135,518	30,474	22.5	65.6
Irrigation and Dam	NW-1	Improvement of Irrigation System and Centrally-Controlled Water-Distribution System	19,800	2,100	10.6	4.5
	NW-2	Subsidy for New Irrigation System Project	16,250	2,275	14.0	4.9
	NW-3	Legal Framework for Agricultural Water Use	170	24	14.1	0.1
	NW-4	Recharge Dams	48,025	8,526	17.8	18.3
	NW-5	Sub-surface (Underground) Dams	2,500	2,095	83.8	4.5
	NW-6	Aflaj	29,670	11,190	37.7	24.1
	NW-7	Wells	9,000	1,620	18.0	3.5
	NW-8	Springs	1,969			
	NW-9	Erosion Control and Protection of Agricultural Land against Floods	3,870	3,700	95.6	8.0
	NW-10	Survey and Monitoring	4,264	944	22.1	2.0
Agricultural Research			9,625	1,425	14.8	3.1
	NAR-1	Support for Agricultural Research Stations	2,710	600	22.1	1.3
	NAR-2	Establishment of New Research Units and Laboratories	3,075	50	1.6	0.1
	NAR-3	Development and Establishment of Experimental Farms and Nurseries	1,040	415	39.9	0.9
	NAR-4	Forestry-Improvement Program	1,000	140	14.0	0.3
	NAR-5	Establishment of Locust Survey and Central Unit	1,000	140	14.0	0.3
Agricultural Extension	NAR-6	Soil Surveys	800	80	10.0	0.2
			14,123	2,530	17.9	5.4
	NAE-1	Improvement and Development of Extension Centers and Facilities	3,520	737	20.9	1.6
	NAE-2	Establishment of Development Support Communication Center(DSCC)	1,190			
Agricultural Production	NAE-3	Training of Researchers, Extension Staff and Statistics Staff	1,503	163	10.8	0.4
	NAE-4	Intensive Extension Guidance Program	7,910	1,630	20.6	3.5
			12,960	1,326	10.2	2.9
	NAA-1	Collection and Organization of Agricultural Statistics	1,360	190	14.0	0.4
Livestock	NAA-2	Agricultural Exhibitions and Festivals	700	36	5.1	0.1
	NAA-3	National Project for Plant Protection and Aerial Spraying	5,000	550	11.0	1.2
	NAA-4	Agricultural Technology Transfer to Farmers Project	5,000	550	11.0	1.2
	NAQ-1	Development and Improvement of Plant Quarantine	900			
Livestock			47,546	6,353	13.4	13.7
	NLL-1	Rangeland Revegetation Project in Southern Region	2,352			
	NLL-2	Animal Health and Disease Control Project	16,425	1,225	7.5	2.6
	NLE-1	Livestock Extension Development Project	482	15	3.1	0.0
	NLR-1	Livestock Research Development Project	4,050	973	24.0	2.1
	NLM-1	Livestock Marketing Improvement Project	6,371	66	1.0	0.1
	NLL-3	Livestock Input Company Project	1,359	983	72.3	2.1
	NLL-4	Small Farm Development Support Project	15,285	2,969	19.4	6.4
	NLL-5	Livestock Specialized Services Program	1,222	122	10.0	0.3
Distribution			15,397	1,063	6.9	2.3
	ND-1	Establishment of Wholesale Market	3,656			
	ND-2	Supply and Demand Forecast of Agricultural Produce	444			
	ND-3	Establishment of Shipping Organization for Farmers	1,220	165	13.5	0.4
Agricultural Produce Processing	ND-4	Fortification of PAMAP	10,077	899	8.9	1.9
			10,474	1,209	11.5	2.6
	NP-1	Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services	5,100	714	14.0	1.5
	NP-2	Establishment of Agro-Industrial Complex for Processing of Dates, Limes and Tomatoes	1,134	495	43.7	1.1
Inter-Sectoral	NP-3	Establishment of Pickling and Vinegar-Processing Plant	1,614			
	NP-4	Establishment of Coconut-Processing Plant	2,626			
			32,333	2,104	6.5	4.5
	NI-1	Integrated Agricultural Development Project in Nejd	13,242			
Inter-Sectoral	NI-2	Improvement and Maintenance of MAF Facilities	16,991	1,810	10.7	3.9
	NI-3	Artificial Rainfall Project				
	OI-1	Citizen's Compensation against Natural Crisis	1,500	210	14.0	0.5
	OI-2	Master Plan for Development of Date Palm Cultivation	600	84	14.0	0.2
Total			277,976	46,485	16.7	100.0

at the border with UAE.

(b) Agriculture

- Establishment of three extension sub-centers in remote areas.
- Relatively heavier outlay under the date extension program, given the superior quality of dates raised in the region.
- Strengthening of existing facilities at one existing plant quarantine station, and new establishment of one station.
- Remaining program outlay in proportion to cropped area in the other region.
- Establishment of Agricultural Technology Information Units in both existing and new extension centers.

(c) Livestock

- Establishment of one new animal clinic.
- Establishment of two new animal quarantine stations.
- Establishment of 295 small poultry holders under subsidy program.
- Other livestock project load to be carried out in proportion to number of livestock in the region.

(d) Others

- Strengthening of existing Directorate General of Agriculture facilities at Ibri.

Breakdown and sectoral share for investment in the Dhahira Region are shown in Table 5.3.11.

(6) Janubiya

(a) Irrigation and dams

- Irrigation project in the central Salalah plain to counter water resource depletion, and one recharge dam at Wadi Darbart where water resources are plentiful.
- Construction of one centrally-controlled water-distribution system at the Salalah plain with benefit area of 500 ha.
- New irrigation and falaj rehabilitation project load in proportion to cropped area in the region.

Table 5.3.11 Regional Budget in Dhahira - 5-Year Plan

(UNIT: 1000 R.O.)

SECTOR	PROJECT NUMBER	NAME OF PROJECT/PROGRAM	7 REGIONS TOTAL BUDGET (1)	DHAHIRA REGION BUDGET (2)	SHARE BY REGION (%) (2)/(1)	SHARE BY SECTOR (%)
Irrigation and Dam			135,518	19,722	14.6	63.3
	NW-1	Improvement of Irrigation System and Centrally-Controlled Water-Distribution System	19,800	1,980	10.0	6.4
	NW-2	Subsidy for New Irrigation System Project	16,250	1,463	9.0	4.7
	NW-3	Legal Framework for Agricultural Water Use	170	17	10.0	0.1
	NW-4	Recharge Dams	48,025	7,993	16.6	25.7
	NW-5	Sub-surface (Underground) Dams	2,500	35	1.4	0.1
	NW-6	Aflaj	29,670	5,580	18.8	17.9
	NW-7	Wells	9,000	2,080	23.1	6.7
	NW-8	Springs	1,969			
	NW-9	Erosion Control and Protection of Agricultural Land against Floods	3,870	25	0.6	0.1
			4,264	549	12.9	1.8
			9,625	280	2.9	0.9
Agricultural Research	NAR-1	Support for Agricultural Research Stations	2,710			
	NAR-2	Establishment of New Research Units and Laboratories	3,075			
	NAR-3	Development and Establishment of Experimental Farms and Nurseries	1,040			
	NAR-4	Forestry-Improvement Program	1,000	100	10.0	0.3
	NAR-5	Establishment of Locust Survey and Central Unit	1,000	100	10.0	0.3
	NAR-6	Soil Surveys	800	80	10.0	0.3
			14,123	1,986	14.1	6.4
Agricultural Extension	NAE-1	Improvement and Development of Extension Centers and Facilities	3,520	643	18.3	2.1
	NAE-2	Establishment of Development Support Communication Center(DSCC)	1,190			
	NAE-3	Training of Researchers, Extension Staff and Statistics Staff	1,503	143	9.5	0.5
	NAE-4	Intensive Extension Guidance Program	7,910	1,200	15.2	3.9
			12,960	1,272	9.8	4.1
Agricultural Production	NAA-1	Collection and Organization of Agricultural Statistics	1,360	136	10.0	0.4
	NAA-2	Agricultural Exhibitions and Festivals	700	36	5.1	0.1
	NAA-3	National Project for Plant Protection and Aerial Spraying	5,000	450	9.0	1.4
	NAA-4	Agricultural Technology Transfer to Farmers Project	5,000	450	9.0	1.4
	NAQ-1	Development and Improvement of Plant Quarantine	900	200	22.2	0.6
			47,546	4,886	10.3	15.7
Livestock	NLL-1	Rangeland Revegetation Project in Southern Region	2,352			
	NLL-2	Animal Health and Disease Control Project	16,425	2,867	17.5	9.2
	NLE-1	Livestock Extension Development Project	482	18	3.7	0.1
	NLR-1	Livestock Research Development Project	4,050			
	NLM-1	Livestock Marketing Improvement Project	6,371	72	1.1	0.2
	NLL-3	Livestock Input Company Project	1,359			
	NLL-4	Small Farm Development Support Project	15,285	1,782	11.7	5.7
	NLL-5	Livestock Specialized Services Program	1,222	147	12.0	0.5
			15,397	619	4.0	2.0
Distribution	ND-1	Establishment of Wholesale Market	3,656			
	ND-2	Supply and Demand Forecast of Agricultural Produce	444			
	ND-3	Establishment of Shipping Organization for Farmers	1,220	165	13.5	0.5
	ND-4	Fortification of PAMAP	10,077	455	4.5	1.5
			10,474	510	4.9	1.6
Agricultural Produce Processing	NP-1	Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services	5,100	510	10.0	1.6
	NP-2	Establishment of Agro-Industrial Complex for Processing of Dates, Limes and Tomatoes	1,134			
	NP-3	Establishment of Pickling and Vinegar-Processing Plant	1,614			
	NP-4	Establishment of Coconut-Processing Plant	2,628			
			32,333	1,860	5.8	6.0
Inter-Sectoral	NI-1	Integrated Agricultural Development Project in Nejd	13,242			
	NI-2	Improvement and Maintenance of MAF Facilities	16,991	1,650	9.7	5.3
	NI-3	Artificial Rainfall Project				
	OI-1	Citizen's Compensation against Natural Crisis	1,500	150	10.0	0.5
	OI-2	Master Plan for Development of Date Palm Cultivation	600	60	10.0	0.2
Total			277,976	31,134	11.2	100.0

- Improvement of 100 out of the 400 springs scattered throughout the Jabal Region as livestock water source.
- Integrated Agricultural Development in Nejd Region on confirmed aquifer development based on the results of the JICA study. Development would start with a 50 ha pilot project to be monitored for subsequent implementation of a project with benefit area of 350 ha. At present, MAF is conducting a separate study aimed at development of 1,000 ha in the same area, and project scale under the Master Plan would be subject to modification as the results of this study become known.

(b) Agriculture

- Strengthening of facilities at the existing Salalah Agricultural Research Station. This was originally planned under the Third Five-year Development Plan and then postponed for implementation under the next Five-year Development Plan.
- Establishment of a new nursery for coconuts, papayas, etc. adjacent to the Salalah Agricultural Research Station.
- Establishment of an Arabian coffee experimental farm in the Jabal Region.
- Establishment of research facilities for irrigation, honey bees, and medicinal and perfume plants.
- Agricultural extension facilities to be established under Nejd pilot project.
- Wide-scale soil survey for implementation of Integrated Agricultural Development for the Nejd Region Project.
- Research and project implementation towards afforestation in the Jabal Region.
- Strengthening of facilities at one existing plant quarantine station and establishment of one new station.
- Establishment of Agricultural Technology Information Units in both existing and new extension centers.

(c) Livestock

- Rangeland Revegetation Project to preserve 200,000 ha of rangeland.
- Strengthening of facilities at eight existing animal clinics, and construction of five new facilities.

- Establishment of one new veterinary laboratory at Salalah.
- Strengthening of facilities at the existing Salalah Livestock Research Center and consultancy services in modern research management.
- Establishment of the public corporation Company for Livestock Products through both public and private financing.
- Establishment of training center adjacent to Salalah Livestock Research Center for training key farmers.
- Construction and operation of livestock-processing plant, and guidance in marketing distribution and subsidy from the government for the on-going de-stocking project.
- Establishment by the public corporation of a fattening farm at Nejd to upgrade beef quality.
- Establishment of small new animal quarantine stations at two locations.
- Establishment of 480 small poultry holders under subsidy program.
- Other livestock project load to be carried out in proportion to number of livestock in the region.

(d) Others

- Strengthening of existing Directorate General of Agriculture facilities at Salalah.
- New construction and strengthening of distribution of facilities under PAMAP.
- Construction of new coconut-processing plant at Salalah.

Breakdown and sectoral share for investment in the Janubiya Region are shown in Table 5.3.12.

(7) Musandam

(a) Irrigation and dams

- Construction of a recharge dam at one site.
- New irrigation and falaj rehabilitation project load in proportion to cropped area in the region.

(b) Agriculture

Table 5.3.12 Regional Budget in Janubiya - 5-Year Plan

(UNIT: 1000 R.O.)

SECTOR	PROJECT NUMBER	NAME OF PROJECT/PROGRAM	7 REGIONS TOTAL BUDGET (1)	JANUBIYA REGION BUDGET (2)	SHARE BY REGION (%) (2)/(1)	SHARE BY SECTOR (%)
Irrigation and Dam			135,518	7,710	5.7	15.0
	NW-1	Improvement of Irrigation System and Centrally-Controlled Water-Distribution System	19,800	3,120	15.8	6.1
	NW-2	Subsidy for New Irrigation System Project	16,250	975	6.0	1.9
	NW-3	Legal Framework for Agricultural Water Use	170	5	2.9	0.0
	NW-4	Recharge Dams	48,025	1,254	2.6	2.4
	NW-5	Sub-surface (Underground) Dams	2,500	35	1.4	0.1
	NW-6	Aflaj	29,670			
	NW-7	Wells	9,000	120	1.3	0.2
	NW-8	Springs	1,969	1,969	100.0	3.8
	NW-9	Erosion Control and Protection of Agricultural Land against Floods	3,870	25	0.6	0.0
	NW-10	Survey and Monitoring	4,264	207	4.9	0.4
Agricultural Research			9,625	1,885	19.6	3.7
	NAR-1	Support for Agricultural Research Stations	2,710	675	24.9	1.3
	NAR-2	Establishment of New Research Units and Laboratories	3,075	165	5.4	0.3
	NAR-3	Development and Establishment of Experimental Farms and Nurseries	1,040	235	22.6	0.5
	NAR-4	Forestry-Improvement Program	1,000	300	30.0	0.6
	NAR-5	Establishment of Locust Survey and Central Unit	1,000	30	3.0	0.1
	NAR-6	Soil Surveys	800	480	60.0	0.9
Agricultural Extension			14,123	755	5.3	1.5
	NAE-1	Improvement and Development of Extension Centers and Facilities	3,520	283	8.0	0.5
	NAE-2	Establishment of Development Support Communication Center(DSCC)	1,190			
	NAE-3	Training of Researchers, Extension Staff and Statistics Staff	1,503	217	14.4	0.4
	NAE-4	Intensive Extension Guidance Program	7,910	255	3.2	0.5
			12,960	1,217	9.4	2.4
Agricultural Production	NAA-1	Collection and Organization of Agricultural Statistics	1,360	82	6.0	0.2
	NAA-2	Agricultural Exhibitions and Festivals	700	36	5.1	0.1
	NAA-3	National Project for Plant Protection and Aerial Spraying	5,000	350	7.0	0.7
	NAA-4	Agricultural Technology Transfer to Farmers Project	5,000	350	7.0	0.7
	NAQ-1	Development and Improvement of Plant Quarantine	900	400	44.4	0.8
			47,546	20,323	42.7	39.4
Livestock	NLL-1	Rangeland Revegetation Project in Southern Region	2,352	2,352	100.0	4.6
	NLL-2	Animal Health and Disease Control Project	16,425	6,046	36.8	11.7
	NLE-1	Livestock Extension Development Project	482	219	45.3	0.4
	NLR-1	Livestock Research Development Project	4,050	1,381	34.1	2.7
	NLM-1	Livestock Marketing Improvement Project	6,371	5,992	94.1	11.6
	NLL-3	Livestock Input Company Project	1,359			
	NLL-4	Small Farm Development Support Project	15,285	3,907	25.6	7.6
	NLL-5	Livestock Specialized Services Program	1,222	428	35.0	0.8
			15,397	1,911	12.4	3.7
Distribution	ND-1	Establishment of Wholesale Market	3,656			
	ND-2	Supply and Demand Forecast of Agricultural Produce	444			
	ND-3	Establishment of Shipping Organization for Farmers	1,220	165	13.5	0.3
	ND-4	Fortification of PAMAP	10,077	1,746	17.3	3.4
			10,474	2,779	26.5	5.4
Agricultural Produce Processing	NP-1	Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services	5,100	153	3.0	0.3
	NP-2	Establishment of Agro-Industrial Complex for Processing of Dates, Limes and Tomatoes	1,134			
	NP-3	Establishment of Pickling and Vinegar-Processing Plant	1,614			
	NP-4	Establishment of Coconut-Processing Plant	2,626	2,626	100.0	5.1
			32,333	14,975	46.3	29.0
Inter-Sectoral	NI-1	Integrated Agricultural Development Project in Nejd	13,242	13,242	100.0	25.7
	NI-2	Improvement and Maintenance of MAF Facilities	16,991	1,670	9.8	3.2
	NI-3	Artificial Rainfall Project				
	OI-1	Citizen's Compensation against Natural Crisis	1,500	45	3.0	0.1
	OI-2	Master Plan for Development of Date Palm Cultivation	600	18	3.0	0.0
Total			277,976	51,555	18.5	100.0

- Construction of new experimental farm at Khasab.
- Construction of two new extension sub-centers in remote areas.
- Remaining program outlay in proportion to cropped area in the region.
- Establishment of Agricultural Technology Information Units in both existing and new extension centers.

(c) Livestock

- Establishment of one new livestock quarantine station.
- Establishment of 45 small poultry holders under subsidy program.
- Other livestock project load to be in proportion to number of livestock in the region.

(d) Others

- Strengthening of existing Directorate General of Agriculture facilities at Khasab.

Breakdown and sectoral share for investment in the Musandam Region are shown in Table 5.3.13.

Table 5.3.13 Regional Budget in Musandam - 5 Year Plan

(UNIT: 1000 R.O.)

SECTOR	PROJECT NUMBER	NAME OF PROJECT/PROGRAM	7 REGIONS TOTAL BUDGET (1)	MUSANDAM REGION BUDGET (2)	SHARE BY REGION (%) (2)/(1)	SHARE BY SECTOR (%)
Irrigation and Dam			135,518	2,597	1.9	42.9
	NW-1	Improvement of Irrigation System and Centrally-Controlled Water-Distribution System	19,800			
	NW-2	Subsidy for New Irrigation System Project	16,250	163	1.0	2.7
	NW-3	Legal Framework for Agricultural Water Use	170	3	1.8	0.0
	NW-4	Recharge Dams	48,025	2,290	4.8	37.8
	NW-5	Sub-surface (Underground) Dams	2,500			
	NW-6	Aflaj	29,670			
	NW-7	Wells	9,000	30	0.3	0.5
	NW-8	Springs	1,969			
	NW-9	Erosion Control and Protection of Agricultural Land against Floods	3,870			
			4,264	111	2.6	1.8
Agricultural Research			9,625	110	1.1	1.8
	NAR-1	Support for Agricultural Research Stations	2,710			
	NAR-2	Establishment of New Research Units and Laboratories	3,075			
	NAR-3	Development and Establishment of Experimental Farms and Nurseries	1,040	70	6.7	1.2
	NAR-4	Forestry-Improvement Program	1,000	20	2.0	0.3
	NAR-5	Establishment of Locust Survey and Central Unit	1,000	20	2.0	0.3
	NAR-6	Soil Surveys	800			
Agricultural Extension			14,123	568	4.0	9.4
	NAE-1	Improvement and Development of Extension Centers and Facilities	3,520	284	8.1	4.7
	NAE-2	Establishment of Development Support Communication Center(DSCC)	1,190			
	NAE-3	Training of Researchers, Extension Staff and Statistics Staff	1,503	44	2.9	0.7
	NAE-4	Intensive Extension Guidance Program	7,910	240	3.0	4.0
Agricultural Production			12,960	263	2.0	4.3
	NAA-1	Collection and Organization of Agricultural Statistics	1,360	27	2.0	0.4
	NAA-2	Agricultural Exhibitions and Festivals	700	36	5.1	0.6
	NAA-3	National Project for Plant Protection and Aerial Spraying	5,000	100	2.0	1.7
	NAA-4	Agricultural Technology Transfer to Farmers Project	5,000	100	2.0	1.7
	NAQ-1	Development and Improvement of Plant Quarantine	900			
Livestock			47,546	955	2.0	15.8
	NLL-1	Rangeland Revegetation Project in Southern Region	2,352			
	NLL-2	Animal Health and Disease Control Project	16,425	561	3.4	9.3
	NLE-1	Livestock Extension Development Project	482	5	0.9	0.1
	NLR-1	Livestock Research Development Project	4,050			
	NLM-1	Livestock Marketing Improvement Project	6,371	10	0.2	0.2
	NLL-3	Livestock Input Company Project	1,359			
	NLL-4	Small Farm Development Support Project	15,285	342	2.2	5.6
	NLL-5	Livestock Specialized Services Program	1,222	37	3.0	0.6
Distribution			15,397	91	0.6	1.5
	ND-1	Establishment of Wholesale Market	3,656			
	ND-2	Supply and Demand Forecast of Agricultural Produce	444			
	ND-3	Establishment of Shipping Organization for Farmers	1,220			
	ND-4	Fortification of PAMAP	10,077	91	0.9	1.5
Agricultural Produce Processing			10,474	102	1.0	1.7
	NP-1	Establishment of Private Company for Agro-Industry and Supply of Agricultural Inputs and Services	5,100	102	2.0	1.7
	NP-2	Establishment of Agro-Industrial Complex for Processing of Dates, Limes and Tomatoes	1,134			
	NP-3	Establishment of Pickling and Vinegar-Processing Plant	1,614			
	NP-4	Establishment of Coconut-Processing Plant	2,626			
Inter-Sectoral			32,333	1,372	4.2	22.6
	NI-1	Integrated Agricultural Development Project in Nejd	13,242			
	NI-2	Improvement and Maintenance of MAF Facilities	16,991	1,330	7.8	22.0
	NI-3	Artificial Rainfall Project				
	OI-1	Citizen's Compensation against Natural Crisis	1,500	30	2.0	0.5
	OI-2	Master Plan for Development of Date Palm Cultivation	600	12	2.0	0.2
Total			277,976	6,058	2.2	100.0

5.4 Human Resources

5.4.1 Demography

In general, as a country develops economically, a phenomenon referred to as demography transition occurs whereby population trends shift from a higher birth-rate and higher mortality rate to a lower birth-rate and lower mortality rate. This process passes through several historic stages beginning with a significant drop in the mortality rate while birth-rate remains steady, then moving to a phase where the birth-rate drops accompanied by an even further drop in the mortality rate.

At the pre-industrialized stage of economic development, natural environmental factors including land area, soil fertility, etc. define population capacity. A balanced condition is present where a high birth-rate and high mortality rate are seen, and an average life expectancy is short. With advances in medicine and technology, epidemic disease is brought under control, and improved agricultural productivity and movement of resources and produce through improved transportation serve to increase food supply and eliminate famine. Under such conditions, the birth-rate remains initially the same while the mortality rate drops. Consequently, population increases with the pressure of such an increase released through emigration, in the case of Europe for example, to North and South America and Australia.

As time elapses, industrialization progresses, and at a certain point the mortality rate further decreases but is accompanied by a corresponding decrease in the birth-rate. This drop in the mortality rate is attributed to improved health conditions, improved nutrition from increased income, as well as improved medical care.

The decline in the birth-rate is attributed to the increased burden of raising children brought on by urbanization increasing this tendency with a growing affluence to postpone having a family in order to enjoy other aspects of life, satisfaction with fewer number of children due to a drop in the child mortality rate, and improved birth-control methods.

As economic development progresses even further, a drop in the birth-rate accelerates beyond the drop in the mortality rate with a corresponding decrease in the natural population and an increase in the average age in the society. This phenomenon is seen in the developed countries.

The above described demographic transition is expected to appear in developing countries also. However, there are important differences:

- (1) Following World War II, WHO and other international agencies have, through various assistance programs brought about a revolution in medicine and public health in developing countries which otherwise would not have occurred until these societies had reached a more mature level of development.
- (2) The birth-rates and mortality rates in third world countries are higher than those in Europe for example when it was on the eve of industrial revolution. The birth-rate for Europe at that time was 30 - 35 per million and the mortality rate was 25 - 30 per million. In contrast, the same rates today in developing countries are much higher at 35 - 45 per million for the birth-rate and 30 - 40 per million for the mortality rate. Accordingly, a sharp drop in the mortality rate would combine with the high birth rate to induce an explosion in the population.
- (3) Increased population pressure cannot be relieved through emigration as was the case with Europe. Rather, emigration that does occur from developing countries is generally by those people with specialized training like doctors, engineers, etc. In other words, precisely those people whose absence retards development.
- (4) Population in the developing countries accounts for approximately 80 % of the total world population. Thus, the collective demographic transition in these nations implies a huge and sudden world population increase.

If employment opportunities fail to keep pace with the population

increases resulting in a large number of unemployed and disguised unemployed, the economic burden placed on the government intensifies promoting social instability. Nevertheless, under certain circumstances this population pressure can provide the dynamism for social change resulting in spurred modernization.

If the economy is composed of a traditional sector centered on agriculture and a modern sector centered on industry, and there is present in the traditional sector a certain degree of disguised unemployment for which the marginal productivity of labor is zero, this disguised unemployment will continue to remain in the traditional sector if conditions are such that the labor supply is in excess of demand in the modern sector thereby suppressing wages. Because this disguised labor makes no contribution to production, if it is removed from agriculture and employed on capital forming works such as dams, roads and irrigation facilities construction with the rural community continuing as in the past to bear living costs, then the society as a whole would experience saving and investment growth as the consumption on the part of this disguised unemployment would remain the same as before. In other words, the population growth increment can be a valuable resource. In the case of Japan during the 1970's where conditions of high growth and increasing labor demand were present, the proportion of productive population (15 - 64 year olds) increased with the greater portion of the population employed. This in turn accelerated economic production.

In the case of Oman, the nation is in a process of rapid modernization. Shortages of skilled and unskilled labor required for this effort have been serious and numerous foreigners have been brought into the country to work.

However, as economic development continues and Omanization intensifies, the demand for Omani labor will increase. The population increment will readily be able to find employment.

Diversification of the economy will also create new employment opportunities, potentially accelerating economic development. However, moving away from an economy dependent on oil production will not be easy

as can be seen in the case of other Gulf countries. Therefore, it is important that the country adopt a conservative population policy for the foreseeable future, given factors of the difficulty of diversifying the economy away from oil. Fluctuating oil prices tend to destabilize the economy.

5.4.2 Demography in Oman

The government has not as yet implemented a population census at the national level. Various government agencies and international organizations, however, have carried out independent estimations. According to World Bank Report No. 6899-OM, the population of the Sultanate is estimated as follows:

Omani	1,200,000
Employable population	298,000
Employed population	288,000
Non-Omanis	400,000
Total population	1,600,000
Employable population	
as % of total population	24.8 %
Unemployment	3.5 %

According to the World Development Report, 1988 published by the World Bank, the population growth rate from 1980 - 1987 was estimated at 4.6%. This is a 1 % increase over the growth rate for 1965 - 1980 which was estimated in the same report. This increase in the growth rate is mainly attributed to rapid modernization and high economic growth sustained by oil income, occurring over the 20-year period subsequent to 1970, resulting in increased labor demand met by the importation of personnel from abroad.

Conventionally, foreign capital plays a major role in the initial stages of modernization of the economy. In the case of Oman, reliance on outside labor (engineers, academics, etc.) rather than outside capital is a special feature.

The Development Council of the government puts population at 1.5 million as of 1989. The council sees the need for development planning to take into account population increase, and Omanization of the labor force as key issues.

On the basis of assumptions by the Development Council, and the reference data and criteria set out below, sex and age of the population, and breakdowns of Omani and non-Omani work-force were estimated for 1990, 1995 and 2000.

(1) Reference Data

(a) World Bank Report No. 6899-OM

(b) Planning Committee for Environment and Development in the Southern Region:

Southern Region Development Plan

(c) Ministry of Housing:

Muscat Regional Development Plan

Batinah Regional Development Plan

Dakhliya Regional Development Plan

Dhahira Regional Development Plan

Sharqiya Regional Development Plan

(d) Statistical Yearbook 1988

(2) Criteria

(a) Total population estimated (including Omani and non-Omani for 1990, 1995 and 2000; assume a population of 1.5 million in 1989, and 3.5 % growth rate for each year thereafter).

(b) Increase in the rate for non-Omani labor is assumed at zero for 1988 - 1990, and 1% for 1991 - 2000. Total non-Omani population (including non-Omanis in the government and their families) is 1.2 times the non-Omani work-force.

(c) Figure for Omani population is obtained by subtracting the non-

Omani population from the total population.

(d) Calculation of Omani labor is made as follows:

- (i) The non-working population is assumed at 53.4 % of the total population. 51.0 % of this is accounted for by the 0 - 14 age group, and 2.4 % by the over 65 age group.
- (ii) Of the employable work force of 46.6%, females comprise 46.8 %. Employed females are assumed at 10 % of the total employable females. Accordingly, the female population not participating in the labor market is calculated at 19.7 % of the total population.
- (iii) Of the remaining employable labor force of 26.9 % (total employable labor population minus the female component in (ii) above assumed not to participate in the labor market), a further 2.5 % is disregarded as currently students in institutions of higher learning. Thus, the realistic employable population (economically active population) is estimated at 24.4 % of the total population.

(e) Population by region is as follows (Development Council, 1989):

Muscat	:	22.19%
Batinah	:	29.05%
Dakhliya	:	12.67%
Dhahira	:	9.03%
Sharqiya	:	14.52%
Janubiya	:	10.95%
Musandam	:	1.59%

Results of the calculations from the above are shown in Tables 5.4.1 - 5.4.2. The population pyramid is indicated in Figure 5.4.1.

Table 5.4.1 Estimated Population Structure in 1990, 1995 and 2000

(1) AGE-SEX STRUCTURE IN 1990

AGE	MALE POPULATION		FEMALE POPULATION		TOTAL		SEX COMPONENT	
	POPULATION	%	POPULATION	%	POPULATION	%	MALE(%)	FEMALE(%)
0-4	131,578	21.2	126,957	21.2	258,535	21.2	50.9	49.1
5-9	104,060	16.8	97,268	16.3	201,328	16.5	51.7	48.3
10-14	82,987	13.4	78,473	13.1	161,460	13.3	51.4	48.6
15-19	67,493	10.9	59,678	10.0	127,171	10.4	53.1	46.9
20-24	48,962	7.9	45,372	7.6	94,334	7.7	51.9	48.1
25-29	37,744	6.1	38,428	6.4	76,172	6.3	49.6	50.4
30-34	30,927	5.0	32,502	5.4	63,429	5.2	48.8	51.2
35-39	26,030	4.2	27,002	4.5	53,032	4.4	49.1	50.9
40-44	21,506	3.5	21,788	3.6	43,294	3.6	49.7	50.3
45-49	18,779	3.0	18,137	3.0	36,916	3.0	50.9	49.1
50-54	15,804	2.6	15,024	2.5	30,828	2.5	51.3	48.7
55-59	11,776	1.9	11,852	2.0	23,627	1.9	49.8	50.2
60-64	9,049	1.5	10,295	1.7	19,344	1.6	46.8	53.2
65-69	5,764	0.9	6,884	1.2	12,647	1.0	45.6	54.4
70-74	3,595	0.6	4,549	0.8	8,144	0.7	44.1	55.9
75-79	2,231	0.4	2,813	0.5	5,044	0.4	44.2	55.8
80-84	1,054	0.2	1,257	0.2	2,311	0.2	45.6	54.4
85-	434	0.1	299	0.1	733	0.1	59.2	40.8
TOTAL	619,772	100.0	598,578	100.0	1,218,344	100.0	50.9	49.1

(2) AGE-SEX STRUCTURE IN 1995

AGE	MALE POPULATION		FEMALE POPULATION		TOTAL		SEX COMPONENT	
	POPULATION	%	POPULATION	%	POPULATION	%	MALE(%)	FEMALE(%)
0-4	160,911	21.3	156,177	21.2	317,088	21.2	50.7	49.3
5-9	124,591	16.5	121,930	16.5	246,521	16.5	50.5	49.5
10-14	101,712	13.5	96,024	13.0	197,735	13.3	51.4	48.6
15-19	79,738	10.6	76,096	10.3	155,834	10.4	51.2	48.8
20-24	61,238	8.1	54,396	7.4	115,634	7.7	53.0	47.0
25-29	47,949	6.4	45,392	6.2	93,340	6.3	51.4	48.6
30-34	38,283	5.1	39,487	5.4	77,770	5.2	49.2	50.8
35-39	31,488	4.2	33,509	4.5	64,996	4.4	48.4	51.6
40-44	25,749	3.4	27,309	3.7	53,058	3.6	48.5	51.5
45-49	22,351	3.0	22,954	3.1	45,305	3.0	49.3	50.7
50-54	19,028	2.5	18,821	2.6	37,849	2.5	50.3	49.7
55-59	14,724	2.0	14,245	1.9	28,969	1.9	50.8	49.2
60-64	11,628	1.5	12,104	1.6	23,733	1.6	49.0	51.0
65-69	7,098	0.9	8,414	1.1	15,512	1.0	45.8	54.2
70-74	4,380	0.6	5,609	0.8	9,989	0.7	43.8	56.2
75-79	2,643	0.4	3,543	0.5	6,186	0.4	42.7	57.3

(3) AGE-SEX STRUCTURE IN 2000

AGE	MALE POPULATION		FEMALE POPULATION		TOTAL		SEX COMPONENT	
	POPULATION	%	POPULATION	%	POPULATION	%	MALE(%)	FEMALE(%)
0-4	197,333	21.3	189,166	21.2	386,499	21.2	51.1	48.9
5-9	153,327	16.6	147,487	16.5	300,814	16.5	51.0	49.0
10-14	122,662	13.2	118,598	13.3	241,259	13.3	50.8	49.2
15-19	98,296	10.6	91,676	10.3	189,972	10.4	51.7	48.3
20-24	72,633	7.8	68,332	7.6	140,966	7.7	51.5	48.5
25-29	60,590	6.5	53,217	6.0	113,806	6.3	53.2	46.8
30-34	49,380	5.3	45,525	5.1	94,905	5.2	52.0	48.0
35-39	39,096	4.2	40,159	4.5	79,255	4.4	49.3	50.7
40-44	31,314	3.4	33,361	3.7	64,675	3.6	48.4	51.6
45-49	26,867	2.9	28,263	3.2	55,130	3.0	48.7	51.3
50-54	22,698	2.5	23,344	2.6	46,042	2.5	49.3	50.7
55-59	17,788	1.9	17,530	2.0	35,318	1.9	50.4	49.6
60-64	14,638	1.6	14,310	1.6	28,948	1.6	50.6	49.4
65-69	9,172	1.0	9,749	1.1	18,921	1.0	48.5	51.5
70-74	5,559	0.6	6,708	0.8	12,267	0.7	45.3	54.7
75-79	3,243	0.4	4,293	0.5	7,536	0.4	43.0	57.0
80-84	1,390	0.2	2,057	0.2	3,447	0.2	40.3	59.7
85-	463	0.1	626	0.1	1,089	0.1	42.5	57.5
TOTAL	926,447	100.0	894,401	100.0	1,820,848	100.0	50.9	49.1

Table 5.4.2 Regional Population Structure in 1990, 1995 and 2000

(1) HUMAN RESOURCES (1990)

REGION	WILAYAT	VILLIGE	REGIONAL SHARES	POPU 1990	OMANI POPULATION	OMANI LABOUR	NON-OMANI LABOUR	TOTAL LABOUR
MUSCAT	2	139	0.2219	344,500	158,763	38,738	138,360	175,742
AL-JANUBIAH	1	64	0.1095	169,999	128,361	30,588	33,270	62,788
AL-DAKHILIAH	9	255	0.1267	196,702	183,345	44,736	9,950	53,120
AL-SHARQIAH	11	371	0.1452	225,423	203,505	49,580	16,261	64,202
AL-BATINAH	12	594	0.2905	451,001	406,202	99,113	33,375	129,019
AL-DHAHIRAH	5	302	0.0903	140,191	118,413	28,893	16,228	44,110
MUSANDAM	4	172	0.0159	24,685	22,654	5,528	1,485	6,819
TOTAL	44	1897	1.0000	1,552,500	1,218,343	297,276	248,929	535,800

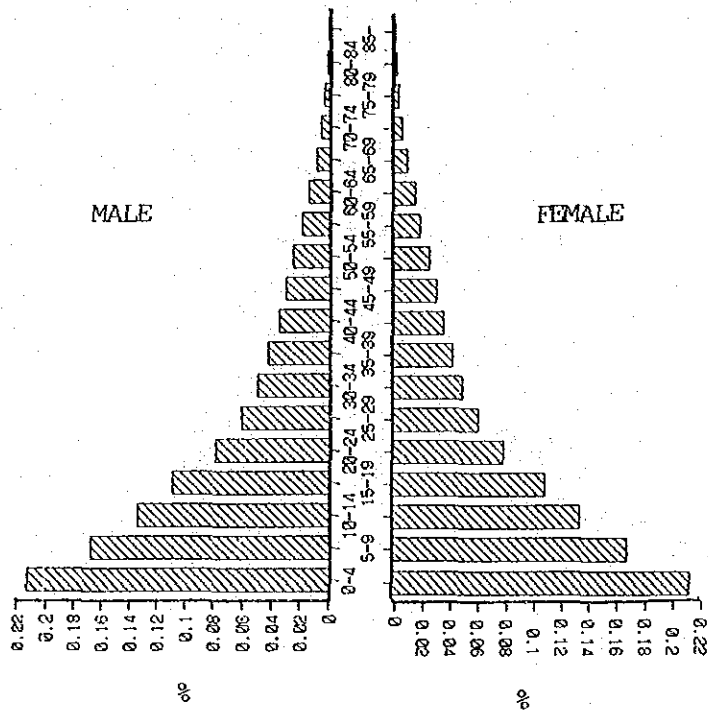
(2) HUMAN RESOURCES (1995)

REGION	WILAYAT	VILLIGE	REGIONAL SHARES	POPU 1995	OMANI POPULATION	OMANI LABOUR	NON-OMANI LABOUR	TOTAL LABOUR
MUSCAT	2	139	0.2219	409,266	214,057	52,230	145,416	195,818
AL-JANUBIAH	1	64	0.1095	201,959	155,045	37,831	34,967	71,474
AL-DAKHILIAH	9	255	0.1267	233,682	219,644	53,593	10,457	62,174
AL-SHARQIAH	11	371	0.1452	267,803	244,873	59,749	17,090	74,748
AL-BATINAH	12	594	0.2905	535,789	488,705	119,244	35,077	150,147
AL-DHAHIRAH	5	302	0.0903	155,547	143,658	35,053	17,056	50,882
MUSANDAM	4	172	0.0159	29,325	27,190	8,534	1,561	7,963
TOTAL	44	1897	1.0000	1,844,370	1,493,172	364,334	261,624	613,207

(3) HUMAN RESOURCES (2000)

REGION	WILAYAT	VILLIGE	REGIONAL SHARES	POPU 2000	OMANI POPULATION	OMANI LABOUR	NON-OMANI LABOUR	TOTAL LABOUR
MUSCAT	2	139	0.2219	485,036	280,872	68,533	152,832	218,966
AL-JANUBIAH	1	64	0.1095	239,714	190,407	46,459	36,750	81,583
AL-DAKHILIAH	9	255	0.1267	277,409	262,556	64,088	10,990	72,835
AL-SHARQIAH	11	371	0.1452	317,980	293,880	71,707	17,952	87,159
AL-BATINAH	12	594	0.2905	636,394	586,508	143,206	36,866	175,059
AL-DHAHIRAH	5	302	0.0903	197,687	173,631	42,366	17,926	58,809
MUSANDAM	4	172	0.0159	34,737	32,493	7,928	1,641	9,292
TOTAL	44	1897	1.0000	2,189,957	1,820,848	444,237	274,957	703,704

Figure 5.4.1 Population Pyramid by Sex and Age



5.4.3 Agricultural Labor Population

On the basis of estimates in the foregoing section, the regional agricultural labor population was estimated. The percentage that the agricultural labor population occupies in the total labor force is estimated as per below on a regional basis (based on data from the Planning Committee for Environment and Development in the Southern Region and MH).

Muscat	:	2.0%
Batinah	:	25.0%
Dakhliya	:	42.0%
Dhahira	:	45.0%
Sharqiya	:	40.0%
Janubiyah	:	11.0%
Musandam	:	45.0%

The above percentages are assumed not to change through to the year 2000. Also, non-Omanis are included in the above agricultural labor percentages and must be subtracted to compute the purely Omani agricultural labor force.

Computational results for regional agricultural labor are indicated in Table 5.4.3. According to these, the Omani agricultural labor population is estimated at 100,148 in 1990, and will increase to 117,721 by 1995. The 1990 figure closely corresponds to the estimate by the World Bank, and is considered appropriate.

5.4.4 Generation of Agricultural Employment in the 5-Year Agricultural Development Plan

The preliminary estimation of employment to be generated in the agricultural sector under the 5-year Agricultural Development Plan was made on the basis of the following criteria.

(1) Labor Demand

Table 5.4.3 Supply of Agricultural Labor in 1990, 1995 and 2000

(1) HUMAN RESOURCES (1990)

REGION	WILAYAT	VILLIGE	REGIONAL SHARES	POPU 1990	TOTAL LABOUR	AGRICULTURE SHARES	LABOUR'S LABOUR	NON OMANI	OMANI
MUSCAT	2	139	0.2219	344,500	175,742	0.02	3,515	1,518	1,997
AL-JANUBIAH	1	64	0.1095	169,999	52,788	0.11	6,969	1,507	5,462
AL-DAKHILIAH	9	255	0.1267	196,702	53,120	0.42	22,364	1,270	21,094
AL-SHARQIAH	11	371	0.1452	225,423	64,202	0.40	25,552	1,295	24,257
AL-BATINAH	12	594	0.2905	451,001	129,019	0.25	32,513	4,308	28,205
AL-DHAHIRAH	5	302	0.0903	140,191	44,110	0.45	19,938	3,768	16,170
MUSANDAM	4	172	0.0159	24,685	5,819	0.45	3,059	105	2,954
TOTAL	44	1897	1.0000	1,552,500	535,800		113,919	13,771	100,148

(2) HUMAN RESOURCES (1995)

REGION	WILAYAT	VILLIGE	REGIONAL SHARES	POPU 1995	TOTAL LABOUR	AGRICULTURE SHARES	LABOUR'S LABOUR	NON OMANI	OMANI
MUSCAT	2	139	0.2219	409,266	195,818	0.02	3,916	1,595	2,321
AL-JANUBIAH	1	64	0.1095	201,959	71,474	0.11	7,934	1,584	6,350
AL-DAKHILIAH	9	255	0.1267	233,682	62,174	0.42	26,175	1,335	24,840
AL-SHARQIAH	11	371	0.1452	267,803	74,748	0.40	29,750	1,361	28,389
AL-BATINAH	12	594	0.2905	535,789	150,147	0.25	37,837	4,528	33,309
AL-DHAHIRAH	5	302	0.0903	166,547	50,882	0.45	22,999	3,960	19,039
MUSANDAM	4	172	0.0159	29,325	7,963	0.45	3,583	110	3,473
TOTAL	44	1897	1.0000	1,844,370	613,207		132,194	14,473	117,721

(3) HUMAN RESOURCES (2000)

REGION	WILAYAT	VILLIGE	REGIONAL SHARES	POPU 2000	TOTAL LABOUR	AGRICULTURE SHARES	LABOUR'S LABOUR	NON OMANI	OMANI
MUSCAT	2	139	0.2219	486,036	218,966	0.02	4,379	1,576	2,703
AL-JANUBIAH	1	64	0.1095	239,714	81,583	0.11	9,056	1,665	7,391
AL-DAKHILIAH	9	255	0.1267	277,409	72,835	0.42	30,654	1,403	29,251
AL-SHARQIAH	11	371	0.1452	317,980	87,159	0.40	34,689	1,430	33,259
AL-BATINAH	12	594	0.2905	636,394	175,059	0.25	44,115	4,759	39,356
AL-DHAHIRAH	5	302	0.0903	197,687	58,809	0.45	26,582	4,162	22,420
MUSANDAM	4	172	0.0159	34,737	9,292	0.45	4,181	116	4,065
TOTAL	44	1897	1.0000	2,189,957	703,704		153,566	15,211	138,455

Unit labor input necessary to produce 1 ton of farm produce is estimated as follows:

- Feed crops	0.05	man-year/ton
- Fruit	0.30	man-year/ton
- Field crops	0.25	man-year/ton
- Vegetables	0.35	man-year/ton
- Milk	0.05	man-year/ton
- Mutton	2.00	man-year/ton
- Beef	1.00	man-year/ton
- Chicken	0.30	man-year/ton
- Table eggs	0.30	man-year/ton

(2) Correction Coefficient

Labor productivity increases with time. The correction coefficient for the base year 1988 is assumed to be 0.75, which is subsequently factored by 0.9 for 1995 and 2000 to yield correction coefficients of 0.67 and 0.60, respectively to be applied to the unit labor inputs in (1). The correction coefficient 0.75 for 1990 has been determined to correlate with the agricultural labor population as estimated for 1990 in section 5.4.3 above.

(3) Agricultural Labor Demand

To compute demand for agricultural labor, estimated farm productions for 1988, 1995 and 2000 are multiplied by the corrected unit labor inputs. Details of the forecast for agricultural production increases resulting in the 10-year Master Plan are continued in volume 5, chapter 2, "Prospects for Demand and Production of Agricultural Products".

Computational results for the above are indicated in Table 5.4.4. According to these, increased agricultural production will create labor demand in 1995 for 143,158 workers. Of this, 127,484 are estimated to be Omani. As a result, it can be seen that the agricultural labor market

Table 5.4.4 Demand for Agricultural Labor in 5-Year Plan

Product	Value Man/t			Weight			Coef.			Production			Labor Demand		
	1988	1995	2000	1988	1995	2000	1988	1995	2000	1988	1995	2000	1988	1995	2000
Feed	0.05	0.75	0.60	0.67	0.04	0.03	0.03	0.03	0.03	488,352	686,221	884,090	18,191	23,806	26,675
Fruit	0.30	0.75	0.60	0.67	0.22	0.20	0.18	0.20	0.18	186,432	248,769	286,516	41,674	50,840	51,869
Field	0.25	0.75	0.60	0.67	0.19	0.17	0.15	0.15	0.15	702	1,020	1,320	131	171	199
Vegetable	0.35	0.75	0.60	0.67	0.26	0.23	0.21	0.21	0.21	139,244	202,620	235,053	36,308	47,550	49,645
Milk	0.05	0.75	0.60	0.67	0.04	0.03	0.03	0.03	0.03	41,638	44,562	51,151	1,551	1,494	1,543
Mutton	2.00	0.75	0.60	0.67	1.49	1.34	1.21	1.21	1.21	3,799	7,391	14,275	5,661	9,911	17,228
Beef	1.00	0.75	0.60	0.67	0.75	0.67	0.60	0.60	0.60	2,750	4,957	5,134	2,049	3,324	3,098
Chicken	0.30	0.75	0.60	0.67	0.22	0.20	0.18	0.18	0.18	1,520	27,294	43,827	353	5,490	7,934
Egg	0.30	0.75	0.60	0.67	0.22	0.20	0.18	0.18	0.18	1,950	10,800	16,000	436	2,172	2,897
Total										866,477	1,233,634	1,537,366	106,353	143,158	161,293
Omani													93,437	127,434	145,144
Foreigner													12,856	15,873	15,946

will readily be able to absorb, in 1995, the estimated agricultural labor population at the time of 117,721.

In order to achieve the goals under the 5-year Agricultural Development Plan, human resources must be deployed in a variety of sectors, including agriculture, livestock, irrigation and dams, etc. This will generate labor demand in addition to that discussed above. In particular, specialists will be needed to strengthen research and extension, agricultural statistics surveys, livestock health and disease control, plant quarantine, etc. Specialists will include various engineers, experts, veterinarians, and government technocrats. PAMAP staff will need to be reinforced to promote the expansion of the farm product distribution system and the establishment of wholesale markets. Management personnel and labor will also be needed in the area of processing of agricultural products.

Demand for the specialists and experts mentioned above can be broken down as follows:

(1) Irrigation and Dam Sector

(a) Irrigation engineers: increase of 59 (10 at the Irrigation Systems Section of the Directorate General of Agriculture, 30 for the centrally-controlled water-distribution system and 19 for hydrological monitoring)

(2) Agricultural Sector

(a) Agricultural research: increase of 219 (51 research experts, 85 assistants, 83 technicians)

(b) Extension: increase of 368 (20 extension supervisors, 89 extension officers, 215 officer assistants, 44 subject matter specialists)

(c) Development Support increase of 30 (3 experts, 19 engineers,

- Communication Center 8 technicians)
- (d) Statistical: increase of 70 (14 statisticians, 56 enumerators)
- (e) Plant Quarantine: increase of 45 (20 engineers, 2 assistants, 23 technicians)
- (3) Livestock Sector
- (a) Extension: increase of 201 (41 subject matter specialists, 40 extension officers, 120 assistants)
- (b) Livestock Health and Disease Control: increase of 123 (21 veterinarians, 46 assistants, 56 nurses)
- (c) Animal quarantine: increase of 41 (17 doctors, 7 assistants, 17 nurses)
- (d) Animal Health and Disease Control Project: increase of 205 (15 specialists, 142 assistants, 2 veterinarians)
- (e) Livestock Marketing Improvement Project: increase of 25 (18 specialists, 5 assistants, 2 veterinarians)
- (f) Livestock Input Company: increase of 41 (22 specialists, 17 assistants)
- (4) Agricultural Produce Distribution Sector
- (a) PAMAP: increase of 462 (9 special grade, 73 first grade, 18 second grade, 362 third grade)
- (5) Agricultural Produce Processing Sector
- (a) increase of more than 300 (including labor)

(6) Inter-sectoral Projects

- (a) Integrated Agricultural Development for Nejd Region: 18 (experts in agriculture, irrigation, extension, etc.)

Region:

Total increase in MAF related professional jobs is 1,379 (excluding distribution and produce processing sectors as well as livestock marketing and Livestock Input Company). In addition, various support staff such as experimental farm workers, drivers, secretaries, etc. will be increased.

5.4.5 Upgrading Human Resources

In order to achieve the high priority policy of Omanization, training of the Omani labor force is necessary. An outline of the training program envisaged under the 5-year Agricultural Development Plan is as follows:

(1) Farmer Training

In addition to training to be provided by the Agricultural Technology Information Units to be attached to each extension office, a practical introduction of agricultural practices will be performed at the demonstration fields of the key farmers. Audio-visual teaching media to be developed at the Development Support Communication Center, will also be utilized. 3,000 key farmers are targeted for the 5-year period.

Extension officers will be deployed at a ratio of 1:250 farmers for the 5-year period.

In the case of livestock holders, training aimed at 4,500 farmers will be conducted through a combination of subsidy (Small Holder Poultry Production Project and Intensive Livestock Production Project) and extension through demonstration units. Through the Grazing Control Project, 500 livestock holders in the Jabal Region will be instructed in rangeland management techniques.

(2) Staff Training

Research, extension and statistical survey staff will be trained at the training centers to be established at Rumais and Salalah. Selected extension officers will also receive training outside Oman. During the first 5-year period of the agricultural development plan, 50 research staff, 1,000 extension staff, and 250 statistical staff would be expected to receive training through the above training centers. Also, the 40 extension officers would be dispatched to overseas to study.

The 1,000 extension officers in the livestock sector would receive training in modern livestock husbandry techniques, including health and disease control, artificial insemination, rangeland management guidance, effective feeding methods, etc. This would also be performed at the centers at Rumais and Salalah.

CHAPTER 6

DESCRIPTION OF PROJECT/PROGRAM

BY SECTOR

CHAPTER 6 DESCRIPTION OF PROJECT/PROGRAM BY SECTOR

6.1 Irrigation and Dam

[NW-1] Improvement of Irrigation System and Centrally-Controlled Water-Distribution System

Objective:

The aims and goals of the project are to identify and promote irrigation technologies and water-saving rules in order to achieve water conservation, eliminate water wastage, and to optimize the agricultural revenue from each cubic meter of irrigation water.

Description:

(1) Present State of Irrigation

Thousands of aflaj and wells were dug or drilled in the past and are pumped for irrigation. Even if the drilling of new wells is restricted, the access to groundwater is not controlled as farmers pump freely from existing wells and the discharges are only limited by the aquifer characteristics.

Consequently, in many places water extraction is today higher than the renewable water resources. Groundwater levels in the aquifers are being lowered. This leads to the drying up of wells and aflaj in the Interior Regions during the dry years and to sea- and deep-salt groundwater encroachment in the coastal areas and salinization of soils and pumped water.

(2) The Present Actions of the Ministry of Agriculture and Fisheries in the Improvement of the Mobilization and Use of Water Resources

The Ministry of Agriculture and Fisheries has embarked on an ambitious program of construction of recharge dams which aims to recover for agriculture the volumes of water which were previously lost to the

desert or the sea during floods. This is an important first step in water-resources mobilization.

The second step is to optimize the revenue to be expected from the use of groundwater which is a national wealth. This can be done by:

- proposing cropping patterns and irrigation practices which are well-adapted to the soils and water qualities, and
- controlling the farmers' pumping rates and the water allocation to the farms.

In order to determine the parameters of this optimization, the Ministry of Agriculture and Fisheries has a pilot project study underway in south Batinah. The Barka-Rumais area was selected for this study due to the heavy pumpings there which are causing a rapid deterioration of the agricultural soils and groundwater quality. The pilot project will:

- identify the present agricultural conditions and drawbacks,
- analyze the soil and water conditions,
- design new irrigation systems,
- prepare agricultural policy rules.

This will be done in close cooperation between the MAF/FAO team, the selected consultant, and the Ministry of Water Resources.

(3) The First 5-year Project -- 16 Project Areas

The Ministry of Agriculture and Fisheries has identified 16 areas in the Sultanate where new systems of controlled irrigation are to be studied and implemented.

The projects are based on the principle that the present free access to water resources should be modified in such a way that the delivery of

water to the farms is scientifically determined by a central organization on the basis of maximum revenue and water-resource conservation both at the farm and national level.

The 16 selected areas are mainly located in areas using traditional irrigation systems. The aims, goals and means of the project are the following:

- to evaluate the potential interest among farmers and land owners and ability to manage modern farms;
- to have in each agricultural zone in the country a sizeable, modern, irrigated perimeter to demonstrate the interest and the benefit to be expected from modern technologies;
- to experiment with various irrigation systems corresponding to cropping patterns well-adapted to the soils and water quantities and qualities;
- to promote crops with the highest market potentials;
- subsequently to design the irrigation systems including well fields, conveyance systems and farm distribution networks with reference to the existing land ownership; and
- to propose project-management procedures including crop pattern, water allocation and eventually, if decided so, metering and billing of the consumed water.

For each of the 16 projects, the water-resource conservation and the revenue of the farmers will be analyzed and optimized considering the possibility of application of the procedures to irrigated land in other places.

It is worth mentioning that even if the 16 projects are located mainly in pumped-well-irrigated areas, the aflaj-irrigated palm groves will also be considered in order to propose new systems of water

allocation adapted to modern irrigation to optimize the use of water during the dry and wet years without any losses to the present owners of water rights.

The project sites to be expected in each region under this Master Plan are as follows.

Batinah ; Six projects. One project in six Wilayats. Total 3000 ha.

Sharqiya ; Three projects in areas like Al-Kamil, Al-Wasil and Al-Ghabbi. Total 250 ha.

Dakhliya ; Three projects in areas like Tanuf, Firq, Wadi Quriyat. Total 800 ha.

Dhahira ; Three projects in areas like Al Buraimi, Suwaidai Al Maa, and Buzayli. Total 500 ha.

Al Janubiya ; One project in the Salalah Plain. 500 ha.

(4) Cost-Sharing Method of the Program

The construction cost of the project is thoroughly financed by MAF under this Plan. Detailed cost-sharing methods for operation and maintenance and percentages of the cost to be shared between the consumer (through water billing) and the Ministry should be considered in a study under the next Five-year Development Plan, paying attention to farmers' income in the project area. The water-billing system will require institutional and legislative establishment. This should be considered in connection with the formulation of appropriate organizations which will decide irrigation rotation in accordance with the cropping patterns to be introduced, operate the irrigation system, provide necessary maintenance, and finally collect water charges from farmers. Some scenarios regarding the establishment of the organizations to be considered in the study are as follows.

(a) Officers of MAF fully control the irrigation system.

- (b) Private companies assume responsibility.
- (c) A farmers' organization is in charge.
- (d) Combination of the above three.

Each case has advantages and disadvantages. In case(a) an agricultural policy and water-use policy of MAF will be easily directed at farmers. Experienced irrigation engineers and technicians will be able to control the irrigation network well. 18 irrigation engineers and technicians will be required for operation and maintenance. In addition, 12 accountants and officers (2 persons/project) will be necessary to introduce the water-billing system. These costs must be financed by MAF or by the farmers.

In case(b), it might be a solution to encourage the participation of private sectors in the agricultural sector. However the total cost of case(b) may be higher than that of case(a) because they must earn profits.

The success of case(c) is dependent on the quality of farmers. Their agricultural management is generally poor at present. However, this method will nurture their self-reliance and turn their attention to agricultural management. Furthermore, this is the least expensive option.

An example of case(d) is a combination of case(a) and case(c). The government officers will control the whole system at the initial stage and transfer their roles to the farmers' organization in due course. Taking into account the present situation of Omani agriculture the most realistic approach is case(d).

Timing :

Timing of these projects is shown in Table 6.1.1.

Table 6.1.1 Schedule of Improvement of Irrigation System and Centrally-Controlled Water-Distribution System Project

NO	PROJECT	REGION	QTY. (ha)	SCHEDULE				
				1991	1992	1993	1994	1995
1	Saham	Batinah	500					*****
2	Sohar	Batinah	500					
3	Shinas	Batinah	500					
4	Al-Khabourah	Batinah	500					
5	Al-Ma'awil	Batinah	500			*****		
6	Barka	Batinah	500			*****		
7	Al-Kamil(1)	Sharqiya	100					
8	Al-Kamil(2)	Sharqiya	50	*****				
9	Al-Wasil & Al Ghabbi	Sharqiya	100				*****	
10	Tanuf	Dakhliya	100					
11	Firq	Dakhliya	200				*****	
12	Wadi-Qurayat	Dakhliya	500					
13	Al Buraimi	Dhahira	300					
14	Al Maa	Dhahira	100					*****
15	Buzayli	Dhahira	100			*****		
16	Salalah	Janubiya	500					*****

Note; ----- Study, ***** Construction.

Budget :

The total budget of the projects is R.O. 19,800,000. The annual budget of each project is shown in Table 6.1.2.

Table 6.1.2 Annual Budget of Improvement of Irrigation System and Centrally-Controlled Water-Distribution System Project

Study Phase

(1000 RQ)

NO	PROJECT	REGION	TOTAL BUDGET	ANNUAL BUDGET										1991 - 1995	1996 - 2000	
				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000			
1	Saham	Batinah	120		60	60									120	
2	Sohar	Batinah	120			60	60								120	
3	Shinas	Batinah	120				60	60							120	
4	Al-Khabourah	Batinah	120					60	60						60	60
5	A' Suweiq	Batinah	120						60	60						120
6	Al-Ma' awil	Batinah	120	60	60										120	
7	Al-Masna' ah	Batinah	120							60	60					120
8	Barka	Batinah	120	60	60										120	
9	Al-Kamil(1)	Sharqiya	120			60	60								120	
10	Al-Kamil(2)	Sharqiya														
11	Al-Wasil & Al Ghabbi	Sharqiya	120	60	60										120	
12	Al Batha	Sharqiya	120							60	60					120
13	Tanuf	Dakhliya	120		60	60									120	
14	Firq	Dakhliya	120	60	60										120	
15	Mannah(1)	Dakhliya	120									60	60			120
16	Mannah(2)	Dakhliya	120							60	60					120
17	Wadi-Qurayat	Dakhliya	120					60	60						60	60
18	Al Buraimi	Dhahira	120				60	60							120	
19	Al Maa	Dhahira	120		60	60									120	
20	Dubaishy	Dhahira	120						60	60						120
21	Buzayli	Dhahira	20	20											20	
22	Salalah	Janubiya	120	60	60										120	
	Total		2,420	320	480	300	240	240	240	240	180	120	60		1,580	840

Construction Phase

NO	PROJECT	REGION	TOTAL BUDGET	ANNUAL BUDGET										1991 - 1995	1996 - 2000	
				1991	1992	1993	1994	1995	1996	1997	1998	1999	2000			
1	Saham	Batinah	4,500					1,500	1,500	1,500					1,500	3,000
2	Sohar	Batinah	4,500						1,500	1,500	1,500					4,500
3	Shinas	Batinah	4,500							1,500	1,500	1,500				4,500
4	Al-Khabourah	Batinah	4,500								1,500	1,500	1,500			4,500
5	A' Suweiq	Batinah														
6	Al-Ma' awil	Batinah	4,500			1,500	1,500	1,500							4,500	
7	Al-Masna' ah	Batinah				1,500	1,500	1,500							4,500	
8	Barka	Batinah	4,500			1,500	1,500	1,500							4,500	
9	Al-Kamil(1)	Sharqiya	900									450	450		900	
10	Al-Kamil(2)	Sharqiya	300	300											300	
11	Al-Wasil & Al Ghabbi	Sharqiya	900				450	450							900	
12	Al Batha	Sharqiya	600									600				600
13	Tanuf	Dakhliya	900									450	450			900
14	Firq	Dakhliya	1,800				900	900							1,800	
15	Mannah(1)	Dakhliya														
16	Mannah(2)	Dakhliya	600										600			600
17	Wadi-Qurayat	Dakhliya														
18	Al Buraimi	Dhahira														
19	Al Maa	Dhahira	900					450	450						450	450
20	Dubaishy	Dhahira														
21	Buzayli	Dhahira	1,270		500	500	270								1,270	
22	Salalah	Janubiya	4,500				1,500	1,500	1,500						3,000	1,500
	Total		39,670	300	500	3,500	6,120	7,800	4,950	4,500	4,500	4,500	3,000		18,220	21,450

Grand Total (Study + Construction)	42,090	620	980	3,800	6,360	8,040	5,190	4,740	4,680	4,620	3,060	19,800	22,290
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[NW-2] Subsidy for New Irrigation System Project for 30,000 ha

Objective:

The objective of the project is to improve the general state of the agricultural production infrastructure in Oman and to increase agricultural investment efficiency in the future by encouraging farmers to introduce new irrigation methods.

Description:

The project is a subsidy program for capital expenditure incurred by farmers when they introduce new methods such as sprinkler, bubbler and drip irrigation.

The prevailing irrigation method in Oman is flood irrigation. Only small areas have introduced water-saving irrigation methods, performance of which is as high as 20 to 40 percent more than the flood-irrigation method. However, it takes a long time for farmers to accustom themselves to such new facilities and for them to realize the water-saving effects, even though such effects will have the largest impact on farming.

Therefore it is important to provide farmers with incentives for the promotion of new irrigation schemes in the form of subsidies.

In connection with this project, extension officers will give intensive guidance to farmers in close co-operation with researchers. Also, some kind of input subsidy should be given to selected farmers participating in this project to encourage them to practice highly productive farming with integrated modern techniques.

With respect to aflaj, it may be difficult to introduce these new facilities unless the existing water-distribution system is improved. Accordingly, the introduction of new irrigation facilities is proposed for areas where the major water sources are wells, such as the Batinah coast, the Salalah Plain and some areas in other regions.

The target area to be developed in such a manner over 10 years is 30,000 ha, of which 13,000 ha will be implemented over the first 5 years.

Responsibility:

Either a coordination committee between the D.G. of Agriculture Research, the D.G. of Irrigation and Dam and the D.G. of Agriculture and Livestock, or a new entity set up specifically to execute the project should be established in order to achieve smooth implementation and follow-up. The new irrigation section would be established in the D.G of Agriculture and Livestock for execution and supervision of this project. The staff requirement is shown in Table 6.1.3.

Source of Finance:

A portion of the modern irrigation facilities cost -- an average of 50 % -- will be subsidized by the government and the remaining investment cost would be financed by OBAF. Self-financing by farmers and/or finance from commercial banks are possible for the remaining investment cost.

Subsidy Rate:

The subsidy rate of the project is the same as the present subsidy ratio applied to the modern irrigation project in Batinah, which is financed by H.M. Sultan Qaboos. It is as follows;

Class	Size of farm (acre)	Rate %
1	5 - 10	75
2	10 - 50	50
3	50 - 100	30

In addition to the above, the following subsidy conditions should be established.

- (1) Farmers to receive subsidy must install a flow meter.

- (2) Farmers must report monthly water consumption, with kinds of crops and cultivation area to an agricultural extension center or extension officer.

Timing:

The project will be implemented throughout the first 5-year period of the Master Plan.

Budget:

The total budget of the project is R.O. 16,250,000. Staff requirements and capital expenditure needed for the establishment of the Irrigation Section, which are recurrent budget, are shown in Table 6.1.3.

Table 6.1.3 Staff Requirements and Capital Expenditure for Establishment of the Irrigation section

ITEMS	NUMBERS	UNIT PRICE (R.O.)	TOTAL COST (R.O.)
1. STAFF			
(1) DIRECTOR OF THE SECTION	1 NOS.	5,832	5,832
(2) IRRIGATION ENGINEER	2 NOS.	7,284	14,568
	3 NOS.	6,552	19,656
(3) SURVEY ENGINEER	1 NOS.	6,552	6,552
(4) IRRIGATION SYSTEM MAINTENANCE TECHNICIAN	2 NOS.	2,820	5,640
(5) OTHER SUPPORTING STAFF	1 NOS.	3,360	3,360
TOTAL	10 NOS.		55,608
2. CAPITAL EXPENDITURE	1 SET	40,000	40,000
GRAND TOTAL			95,608

[NW-3] Legal Framework for Agricultural Water Use

Objective:

The objective of the study is to establish an appropriate nationwide legal framework for agricultural water use which will be imposed on farmers. Optimizing agricultural water use is an important factor determining agricultural production and securing socio-economic, environmental profitability to be returned to the people.

Description:

Agriculture consumes more than 90 % of total water requirements in Oman. Legislation of laws and/or regulations which restrict the agricultural water use would be unavoidable in the preparation of a legal framework by the government in order to conserve scarce water resources. The National Water Resources Master Plan is being undertaken by MWR, of which one main objective is to formulate such a legal framework. MAF is conducting a study entitled "New Organization of Irrigation in View of the Conservation of Water Resources and Optimization of Their Use in Barka-Rumais". Some sort of measures to control use of water in the area through laws, regulations etc. will be considered in the study.

MAF is in the best position to instruct farmers on effective agricultural water use. MAF extension officers are fully in charge of providing farmers with necessary and appropriate advice regarding agricultural techniques such as water management, cultivation methods, etc. It is essential for these officers to confirm actual water consumption, water quality, soil condition and kinds of crops cultivated in each farm in order to recommend to farmers the proper agricultural farming techniques.

To maintain consistency with the legal framework to be formulated by MWR and taking into consideration results of the study by MAF, the action program to be taken by MAF will be worked out under this study. The following items are to be given careful attention.

- (1) Establishment of institutional and organizational responsibilities for collection of data regarding agricultural water consumption on farms in each region under MAF, and the processing of this data with other relevant agricultural farming data for feedback to the farmers.
- (2) Determination of water requirements of major crops based on research. The D.G. of Agricultural Research will be in charge of this important research subject.
- (3) Assessment of irrigation efficiency based on results of above (1) and (2).
- (4) Establishment of necessary legal framework in cooperation with MWR.

Timing:

1992-1993 ; The study on formulation of an overall action program.
1995 ; Review of the action program.

Budget:

1992-1993	;	R.O.	90,000
1995	;	R.O.	80,000
<hr/>			
Total			170,000

[NW-4] Recharge Dams

Objective:

The objective of the projects is to increase agricultural production and stabilize farmers' income by improving the agricultural production infrastructure by constructing recharge dams on the main wadis to retain flood flows that would otherwise be lost to the sea or the desert.

Description:

A recharge dam is a retention dam to retain flood flows and recharge the stored waters to the aquifer via the wadi channels. MAF had already completed 6 recharge dams as of 1989 and records of observations of wells established around the constructed recharge dams have been kept continuously. The recharge dams program consists of four projects as follows:

- (1) NW-4-1 Groundwater-Recharge Scheme
- (2) NW-4-2 Maintenance and Improvement of Existing and Newly Constructed Dams
- (3) NW-4-3 Study on a Recharged Water Effective Use Pilot Project
- (4) NW-4-4 Identification of New Groundwater-Recharge Schemes

The Groundwater-Recharge Scheme comprises the study and construction of recharge dams. As preparatory work, 53 recharge dam projects have been selected on the basis of results of preliminary and feasibility studies conducted by MAF. Taking into account economic factors such as internal rate of return and water cost of these projects, and a well-balanced regional allocation of the projects, 39 promising recharge dam projects have been further selected from the above for the 10-year Master Plan. 25 recharge dam projects will be implemented in the first 5 years as shown in Table 6.1.4. Total construction cost of such projects is estimated to be R.O. 38,200 thousand. The F/S and D/D studies for those projects will cost R.O. 3,750 thousand.

The operation and maintenance cost of existing recharge dams and newly constructed dams will be included in the program of the Maintenance and Improvement of Existing and Newly Constructed Dams. The cost is estimated at R.O. 25,000/Dam/year shown in Table 6.1.6.

Irrigation projects which utilize the recharged water must be implemented in parallel with the construction of recharge dams in order to improve investment efficiency. The objective of the study on the Effective Use of Recharged Water is to work out an appropriate irrigation plan paying strict attention to water balance in and around the project area. This project will be in the form of a case study, to evaluate the effectiveness of the selected recharge dams as well. The data accumulated by observing and monitoring wells around the recharge dams will be useful for this study.

The reconnaissance studies conducted by MAF on the identification of recharge dam sites have not covered the entire country. The reconnaissance investigations for new schemes will be conducted over the first 5 years.

Timing:

The implementation schedule of the Groundwater-Recharge Scheme is shown in Table 6.1.5. The Maintenance and Improvement of Existing and Newly Constructed Dams program, the study on a Recharged Water Effective Use Pilot Project and the Identification of New Groundwater-Recharge Schemes will be implemented from 1991 to 1995.

Budget:

Total budget of the projects is as follows.

NAME OF PROJECT	COST (R.O.)
NW-4-1 Groundwater-Recharge Scheme;	41,950,000
Study Phase	3,750,000
Construction Phase	38,200,000
NW-4-2 Maintenance and Improvement of Existing and Newly Constructed Dams;	2,325,000
NW-4-3 Recharged Water Effective Use Pilot Project	250,000
NW-4-4 Identification of New Groundwater Recharge Schemes	3,500,000
<hr/>	
Total	48,025,000

Table 6.1.4 25 Recharge Dam Projects for the First 5-Year Agricultural Development Plan

No.	Scheme Name	Wadi	Region	Budget (R.O.)	Addit. Water (MCM)	New Land (ha)	Total Benefit (R.O./cu.m)	Water Cost (R.O./cu.m)	I R R (%)	Remarks
1	Shinas	Hatta	Batinah	3,300,000	4.00	147.37	728,000	0.548	28.25	F/S is on-going
2	Shinas	Fayd	Batinah		0.30	11.05	54,800	3.007	2.51	
3	Saham-Sohar	Ahin	Batinah	2,800,000	5.00	184.21	910,000	0.270	52.53	F/S is on-going
4	Saham-Sohar	Sakin	Batinah	1,000,000	0.50	18.42	91,000	2.964	2.64	F/S is on-going. Project site will be changed.
5	Saham-Sohar	Sarami	Batinah	1,900,000	1.30	47.89	236,600	0.941	18.75	F/S is on-going
6	Saham-Sohar	Shafan	Batinah	1,300,000	1.10	40.53	200,200	1.135	13.70	F/S is on-going
7	Al Khaburah	Bani Umar	Batinah	1,200,000	1.60	58.95	291,200	0.585	26.57	F/S is on-going
8	Al Khaburah	Hawasinah	Batinah	1,600,000	1.20	44.21	218,400	0.672	23.33	F/S is on-going
9	Rustaq	Fer	Batinah	1,300,000	2.13	56.05	244,950	0.329	29.61	D/D is on-going
10	Baraka-Rumais	Bani Kharus	Batinah	3,100,000	1.20	75.45	337,480	2.679	8.04	F/S is completed
11	Baraka-Rumais	Rubkneh	Batinah	3,300,000	1.40	88.02	391,810	1.289	18.83	F/S is completed
12	Baraka-Rumais	Taww	Batinah		0.50	31.44	153,537	2.422	10.55	F/S is completed
13	Yanqul	Dank	Dhahirah	600,000	0.59	21.74	48,994	0.541	11.06	P/S is completed
14	Arid	Al Arid	Dhahirah	400,000	0.36	13.26	30,595	0.540	10.23	P/S is completed
15	Dariz	Kebir	Dhahirah	1,200,000	1.07	39.42	90,668	0.650	8.31	P/S is completed
16	Buraimi	One main wadi	Dhahirah	2,000,000						P/S is on-going
17	Jabal Akhdar	6 main wadis	Dekhliya	1,800,000						F/S/D/D is on-going
18	Jabal Akhdar	64 sites	Dekhliya	3,200,000						P/S is completed
19	Al Gharaf	Sayfam	Dekhliya	700,000	0.63	16.80	38,745	0.942	1.99	P/S is completed
20	Izki	Hal fayn	Dekhliya	1,500,000	0.38	10.13	23,370	1.071	0.58	P/S is completed
21	Sud Qadim	Hal fayn	Dekhliya		0.88	23.47	54,120	0.997	1.59	P/S is completed
22	Sudayrah	Samad	Sharciya	2,000,000	1.47	56.38	94,262	1.327	0.48	P/S is completed
23	Masirah	One main wadi	Sharciya	1,000,000						R/S is on-going
24	Darbat	Darbat	Al Janubiya	1,000,000						R/S is on-going
25	Musandam	One wadi	Musandam	2,000,000						P/S is on-going
	Total			38,200,000						

Note: JICA team estimated budget, based on the results of preliminary and feasibility studies conducted by the government. Water cost and IRR include both values adopted from government sources, and values calculated by the JICA team on the basis of its own survey.

Table 6.1.5 Implementation Schedule of the Groundwater-Recharge Schemes

(Unit: 1000 R.O.)

No	Project	Wadi	Region	Budget	'91	'92	'93	'94	'95
1	Shinas	Hatze	Batinah	3,300					3,300
2	Shinas	Fayd	Batinah						
3	Seham/Sohar	Ahin	Batinah	2,600	1,300	1,500			
4	Seham/Sohar	Sakhin	Batinah	1,000					1,000
5	Seham/Sohar	Sarami	Batinah	1,900	900	1,000			
6	Seham/Sohar	Shafan	Batinah	1,300	600	700			
7	Khaburah	Bani Umar	Batinah	1,200			1,200		
8	Khaburah	Hawasinah	Batinah	1,600			1,600		
9	Rustaq	Far	Batinah	1,300				600	700
10	Baraka/Rumais	Bani Kharus	Batinah	3,100	1,900	1,200			
11	Baraka/Rumais	Rubkha	Batinah	3,300	1,900	1,400			
12	Baraka/Rumais	Taww	Batinah						
13	Yanqul	Dank	Dhahirah	600					600
14	Arid	Al Arid	Dhahirah	400					400
15	Dariz	Kabir	Dhahirah	1,200			1,200		
16	Buraiji	One main wadi	Dhahirah	2,000				2,000	
17	Jabal Akhdar	6 main wadis	Dakhlia	1,800			900	900	
18	Jabal Akhdar	64 sites	Dakhlia	3,200		1,600	1,600		
19	Al Ghatat	Sayfam	Dakhlia	700				700	
20	Izki	Halfayn	Dakhlia	1,500			1,000	500	
21	Sud Qadin	Halfayn	Dakhlia						
22	Sucayrah	Sams	Sharqia	2,000				800	1,200
23	Masirah	One wadi	Sharqia	1,000					1,000
24	Darbat	Darbat	Al Janubiya	1,000					1,000
25	Musandam	One wadi	Musandam	2,000				1,000	1,000
		Total		38,200	6,600	7,400	7,500	7,500	9,200

[NW-5] Sub-surface (Underground) dams

Objective:

The objective of the underground dams is to increase agricultural production and improve its economic profitability by restricting essential groundwater outflow to the sea and into the desert.

Description:

Every year, even if there is no rain, large quantities of essential groundwater flow out to the sea and into the desert. Artificially recharged groundwater might also be escaping.

A sub-surface dam (underground dam) is an effective method for retaining essential groundwater outflow. It can dam groundwater and store it behind a cut-off wall which extends down from near the ground surface to the basement, provided an appropriate underground valley fenced by an impermeable basement stratum is identified.

On the other hand, low-height sub-surface dams could be considered along the coast if the impermeable basement is so deep that construction of high sub-surface dams is not economical. If they are used in combination with recharge dams, this will further increase their effect. Sub-surface dams, the bottom of which, the cut-off walls, are sealed to the basement have already been constructed and made excellent use of in Japan.

The underground dams provide irrigation water necessary for improving agricultural productivity by restricting discharge and are, in some cases, expected to be more effective than recharge dams. However, the area for the construction of the underground dam is not only limited by geological conditions but also requires a longer period of investigation. Therefore, a pilot project with observation and monitoring system should be established in order to evaluate the technical and economical viability of construction.

By using available but as yet incomplete data and the results of a few site surveys, some expected locations are preliminary identified as follows;

- (1) Wadi Muaydin
About 1km upstream from Birkat Al Mawz
- (2) Wadi Al Kabir
Tawi Qarn al Kabsh, about 8 km upstream from Dariz
- (3) Wadi Al Arid
About 2 km upstream from Al Arid
- (4) Wadi Bahla
About 2 km northeast of Jabrin
- (5) Wadi Sahtan
Exit of Sahtan bowl
- (6) Wadi Mistral
Just downstream of Ghubrah
- (7) Wadi Abyad
About 3 km downstream of Awabi
- (8) Wadi Manzariyah
Manzariyah
- (9) Wadi Samad
About 5 km northwest from Lizq
- (10) Wadi Andam
Rubkah
- (11) Zarub Gap
Buraimi

(12) Batinah coast

(13) Salalah plain

An outline of the studies is as follows.

(1) Reconnaissance study

(a) Site surveys and electric resistivity surveys at about twenty places.

(b) Computer analysis in order to assess roughly dam size at one representative location where geological data is available in the Batinah Coast or the Salalah Plain.

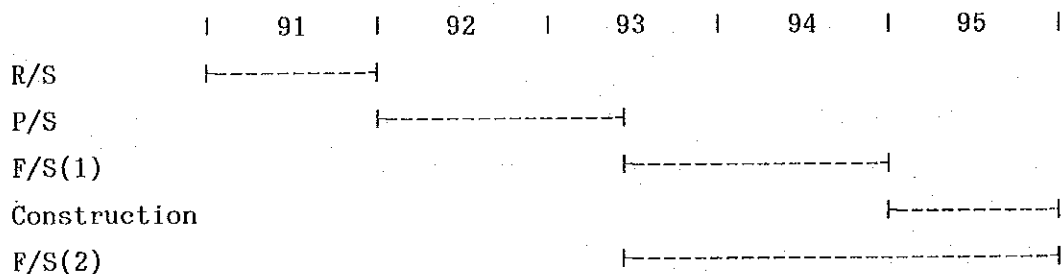
(2) Preliminary study

Five borings and seismic surveys(3 km) on the Batinah coast, and four borings at three places in the other regions.

(3) Feasibility study

Five drilling wells, thirty borings, seismic surveys(5 km), pumping tests, dam design and cost estimate, etc.

Timing:



Budget:

The budget of the sub-surface dam is as follows.

NAME OF PROJECT	QUANTITY	COST (R.O.)
Reconnaissance study	1 Set	75,000
Preliminary study	1 Set	150,000
Feasibility study(1)	1 Set	100,000
Feasibility study(2)	1 Set	200,000
Construction	1 Set	1,900,000
Observation and Monitoring	1 Set	75,000
Total		2,500,000

[NW-6] Aflaj

Objective:

The objective of the Aflaj program is to conserve the traditional agricultural society by maintaining aflaj which continuously provide the oases in rural areas with irrigation water and domestic water.

Description:

The program comprises the following three projects.

(1) [NW-6-1] Repair and Maintenance of Falaj

Aflaj are part of the indispensable infrastructure which maintains rural society in Oman, and must be maintained in good condition. Accordingly, the aflaj maintenance and rehabilitation program shall be continued following the Third Five-year Development Plan. Although the accurate total number of aflaj is unknown, it is estimated by MAF that there are more than 4,000. The target number of aflaj for repair and maintenance under the Master Plan is 1,600, of which many will need repair and maintenance more than two times over the 10-year period of the Master Plan. 800 aflaj will be repaired for the first 5-year period.

(2) [NW-6-2] Distribution System Improvement Pilot Project in Oases
(Study)

One of major constraints of a aflaj is the deficiency of a water-distribution system in the oasis. Without any improvement of the system, an increase of agricultural productivity in oases cannot be expected. The JICA team has proposed an idea accompanied with a reasonable and fair institutional change of the water distribution system in oases. There are also other ideas proposed to improve the aflaj systems. This study evaluates these possibilities to enhance the physical and institutional efficiency of aflaj systems and

proposes the most appropriate and implementable falaj-improvement plan. Five studies will be conducted over the five years.

(3) [NW-6-3] Improvement and Maintenance of Major Aflaj

The Improvement and Maintenance of Major Aflaj Project aims at the complete repair of one or two major aflaj in each willayat in order to reduce maintenance costs and preserve continuous flow. One of the major problems of aflaj is a shortage of labor for maintenance work. Without complete repair work, the demand under the Repair and Maintenance of Falaj Project will increase in the future. Major aflaj will be selected according to criteria of agricultural area, number of beneficiaries, falaj condition, etc. Eight projects will be implemented for the five years.

Timing:

The Repair and Maintenance of Falaj Project, and the Distribution-System Improvement Project in Oases will be continuously implemented over the five years. The studies on the Improvement and Maintenance of Major Aflaj will start in 1991, and construction will commence in 1992.

Budget:

Total budget of the projects is as follows.

	NAME OF PROJECT	QUANTITY	COST (R.O.)
NW-6-1	Repair and Maintenance of Falaj;	800 Projects	24,000,000
NW-6-2	Distribution System Improvement Pilot Project in Oases;	5 Studies	750,000
NW-6-3	Improvement and Maintenance of Major Aflaj;	8 Aflaj	4,920,000
Total			29,670,000

[NW-7] Wells

Objective:

The objective of the Wells program is to secure stable agricultural production and to reduce farmers' expenditure for repair of hand-dug wells by giving subsidies and providing running aflaj with supplementary water by drilling new wells.

Description:

The program comprises the following two projects;

- (1) [NW-7-1] Subsidy for Repair of Existing Open Wells
- (2) [NW-7-2] Assistant Wells for Aflaj

Taking into account the importance of the hand-dug wells, which, together with the aflaj, are indispensable facilities for maintaining agricultural production and rural society in Oman, a constant effort should be made to maintain them. Following the intentions of the Third Five-year Development Plan, the subsidy for repair of existing open wells is incorporated into this Master Plan.

Under the project for building assistant wells for aflaj, new wells will be drilled in order to provide running aflaj with supplemental water, especially in the dry season. The possibility of further dropping of groundwater, which adversely affects the aflaj, should be carefully assessed in implementing the project. This project will require close co-operation with MWR.

Timing:

The well program will be implemented continuously throughout the first 5-year period of the Master Plan.

Budget:

The budget of the program is as follows.

NAME OF PROJECT	QUANTITY	COST (R.O.)
NW-7-1 Subsidy for Repair of Existing Open Wells	3,000 wells	3,000,000
NW-7-2 Assistant Wells for Aflaj	150 wells	6,000,000
Total		9,000,000

[NW-8] Springs

Objective:

The objective of the spring program is to secure drinking water for animals in the Jabal and to provide maintenance costs for springs and spring facilities.

Description:

This program is specific to the Southern Region. The program consists of following two projects;

- (1) [NW-8-1] Improvement of Springs
- (2) [NW-8-2] Annual Maintenance of Open Channels for Springs

The Improvement of Springs project preserves drinking water facilities for livestock in the Jabal by improving the spring facilities. There are about 400 springs in the Jabal, 300 of which are targeted under the Master Plan. 100 springs will be improved for the first 5-year period of the Master Plan.

The project for the Annual Maintenance of Open Channels for Springs provides annual cleaning and maintenance cost for two large springs, Jarsis and Sahalnawt, and the other 99 small springs which are expected to be completed by the end of 1990 under the project for the Improvement of Springs. The maintenance costs are expected to be incurred every year in the case of large springs and every 5 years for small springs.

Timing:

The two projects under this program will be continuously implemented from 1991 to 1995.

Budget:

The budget of the projects is as follows.

NAME OF PROJECT	QUANTITY	COST (R.O.)
NW-8-1 Improvement of Springs	100 Springs	1,750,000
NW-8-2 Annual Maintenance of Open Channels for Springs	1 Item	219,000
Total		1,969,000

[NW-9] Erosion Control and Protection of Agricultural Land against Flood

Objective:

The objective of the project is to protect the plantations, arable land and farmers' property from damage and soil erosion caused by flash floods in wadis.

Description:

The flood flow of wadis in Oman is characterized by the high flood peak discharge. The flood erosion risks are different in the mountains and in the plains. In mountainous areas the palm groves along narrow valleys are under permanent flood risks. On the other hand newly developed farms and new buildings encroaching on the wadi beds in the plains are facing risks of heavy losses from occasional floods.

MAF has a plan to formulate a master plan for erosion control and flood protection for agricultural land against floods.

The detailed design of the erosion control and flood protection project in four areas has been already worked out by MAF. In addition to the four projects, the other fifteen projects that will be identified by the MAF plan to be conducted are included in this Master Plan.

Timing:

The up-dating of the four detailed designs will be carried out in 1991. The other detailed designs will be conducted from 1991 to 1995. The construction of facilities will be implemented from 1992 to 1995.

Budget:

The budget for the study and construction under the project over the 5 years is R.O. 270,000 and R.O. 3,600,000, respectively.

[NW-10] Survey and Monitoring

[NW-10-1] Long-term Plan for Aerial Photography and Orthophoto Mapping

Objective:

The primary objective of the project is to provide basic data detected from orthomaps for the Repair and Maintenance of Aflaj project.

Description:

The continuous activity of surveying in order to collect basic data is essential, because it provides vital information for planning. Aerial photography is a tool for data collection and resource appraisal. Ground-controlled coordinated maps provide a basis for compiling collected data.

This aerial photography and orthophoto mapping project should be continuously implemented step by step now that the first of four stages has been completed. In the meantime, efforts should be made to use the existing aerial photographs as much as possible to minimize the expenses for survey.

Timing:

The project period is from 1991 to 1995.

Budget:

Total budget of the project is R.O. 1,118,000 including necessary costs, R.O. 44,000, for equipment.

[NW-10-2] Establishment and Operation of Hydrological Monitoring Network
for Recharge Dam

Objective:

The objective of this program is to collect data in and around the recharge dam sites, and evaluate the effectiveness of the structures and improve on their performance.

Description:

The current MAF hydrological monitoring and evaluation unit has been collecting and monitoring data from the aquifer recharge sites. Data collected will be used to assess the effectiveness of individual recharge facilities and to evaluate and plan the overall direction of the MAF aquifer recharge program. The proposed pilot project for effective use of recharged water in the Master Plan will be conducted in close connection with this hydrological monitoring network program.

The components of the project are as follows.

- (1) Improvement of network coverage, installation of necessary equipments and operation.
- (2) Collection and analysis of data such as rainfall, surface flow, falaj flow, consumptive use and aquifer parameter.
- (3) On the job and abroad training for Omani technical staff.
- (4) Employment of technical assistance staff, Omani engineers and field technicians.

Timing:

The project will be implemented over the five years from 1991 to 1995.

Budget:

The total budget of the project for the five years is R.O. 3,146,000. The cost of improvement of network coverage and installation of necessary equipment is to be decided according to the number of recharge dams to be constructed.

The necessary recurrent budget for employment of new staff is estimated at R.O. 309,050. Six Omani engineers (two engineers in each year over three years from 1991 to 1993) will be employed. Eleven Omani field technicians (ten in 1991 and one in 1993) will be employed.

Table 6.1.6 Unit Price for Cost Estimation

UNIT PRICE

NW-1

(Study)

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Well drilling	Well	4.0	10,000	40,000
Electric resistivity, Pumping test, Water quality test etc.	Site	50.0	400	20,000
F/S,D/D	Set	1.0	60,000	60,000
Total				120,000

The cost estimations assume the study area is about 500 ha where farmland is concentrated in the study area and access to the site is easy, like the Batinah coast. The study cost per ha of study area of less than 500 ha in other regions seems to be higher than that in the Batinah coast because of the dispersal of farm lands, difficulty of access to the study site, shortage of existing data and the need for supplementary study. Under such circumstances, the costs necessary for all studies were assumed equal except for the studies for which the feasibility studies have been already completed.

(Construction)

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Production wells	Well	25.0	7,000	175,000
Pumping plant	Set	25.0	9,000	225,000
Main water storage	Set	2.0	160,000	320,000
Branch water storage	Set	20.0	70,000	1,400,000
Transmission pipeline	Unit	1.0	800,000	800,000
Main pipeline	M	10,000.0	40	400,000
Branch pipeline	M	40,000.0	15	600,000
Electricity supply	Unit	1.0	100,000.0	100,000
Water superintendent's office	Unit	1.0	10,000	10,000
Sub-total				4,030,000
Preliminaries & contingencies	%	15.0	4,030,000	604,500
Total	ha	500.0		4,630,000
			Cost/ha	9,000

(Al-Kamil(2))

The construction cost, RO 300,000, is based on the result of the F/S.

Table 6.1.6 (continued)

(Buzayli project)				
ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Rehabilitation of the conveyance section	M	6,100	45	274,500
Storage tank	Unit	1	40,000	40,000
Booster	Unit	1	170,000	170,000
MV power cable	M	4,000	11	44,000
Transformer and generator set	Unit	1	14,000	14,000
Pipeline	M	4,600	14	64,400
Irrigation hydrants	Unit	21	1,000	21,000
Irrigation equipment (Drip & sprinkler)	Farm	42	4,600	193,200
Land levelling	ha	125	400	50,000
Access road	M	8,500	2	13,600
		2,600	11	28,600
Fence	M	19,500	10	195,000
				1,108,300
Preliminaries & contingencies	%	15		166,245
Total				1,274,545
			Round	1,270,000

NW-2

The cost of a new irrigation system depends on its irrigation methods such as sprinkler, bubbler and drip. The cost varies from 1,500 RO/ha to 3,600 RO/ha. 2,500 RO/ha is used as an average unit cost per hectare.

NW-3

(Study(Phase 1))

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	14.0	5,000	70,000
Other charges	%	25.0	70,000	17,500
Sub-total				87,500
Contingencies	%	5.0	87,500	4,375
Total				91,875
			Round	90,000

(Study(Phase 2 & 3))

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	12.5	5,000	62,500
Other charges	%	25.0	62,500	15,625
Sub-total				78,125
Contingencies	%	5.0	78,125	3,906
Total				82,031
			Round	80,000

Table 6.1.6 (continued)

NW-4-1

(Study Phase)

10% of the construction cost is allocated for the F/S and D/D

(Construction Phase)

The construction cost is based on the results of the P/S and the on-going F/S.

NW-4-2

Maintenance cost is an average cost of the following projects which are representative projects in future in each region.

Name of the project	Wadi	Maintenance cost
Shinas	Hatta	21,317 RO
Barka-Rumais	Bani Kharus	33,840
Dariz	Kabir	23,225
Suq Qadium	Halfan	14,720
Al Ghulaji	Al Batha	17,500
Total		110,602
	Average	22,120
Contingencies	15 %	3,318
Total		25,438
	Round	25,000

NW-4-3

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	19.5	5,000	97,500
Other charges	%	25.0	97,500	24,375
Sub-total				121,875
Contingencies	%	5.0	121,875	6,094
Total				127,969
			Cost/Project for 5 years	Round 125,000

NW-5

(Reconnaissance study)

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	12.0	5,000	60,000
Other charges	%	25.0	60,000	15,000
Sub-total				75,000
Contingencies	%	5.0	75,000	3,750
Total				78,750
			Round	75,000

Table 6.1.6 (continued)

(Preliminary study)

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	23.0	5,000	115,000
Other charges	%	25.0	115,000	28,750
Sub-total				143,750
Contingencies	%	5.0	143,750	7,188
Total			Round	150,938
				150,000

(Feasibility study(1))

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	15.5	5,000	77,500
Other charges	%	25.0	77,500	19,375
Sub-total				96,875
Contingencies	%	5.0	96,875	4,844
Total			Round	101,719
				100,000

(Feasibility study(2))

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	31.0	5,000	155,000
Other charges	%	25.0	155,000	38,750
Sub-total				193,750
Contingencies	%	5.0	193,750	9,688
Total			Round	203,438
				200,000

(Observation & monitoring)

ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Hydrogeologist	Person	1.0	45,000	45,000
Monitoring well recorder	Set	25.0	1,200	30,000
Total				75,000

NW-6-1

Repair and maintenance cost (RO/Falaj)				30,000
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Table 6.1.6 (continued)

<u>NW-6-2</u>				
ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	23.0	5,000	115,000
Other charges	%	25.0	115,000	28,750
Sub-total				143,750
Contingencies	%	5.0	143,750	7,188
Total				150,938
			Round	150,000

<u>NW-6-3</u> (Preliminary study)				
ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	12.5	5,000	62,500
Other charges	%	25.0	62,500	15,625
Sub-total				78,125
Contingencies	%	5.0	78,125	3,906
Total				82,031
			Round	80,000

(Feasibility study)				
ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Expert manpower and supporting staff	M/M	6.5	5,000	32,500
Other charges	%	25.0	32,500	8,125
Sub-total				40,625
Contingencies	%	5.0	40,625	2,031
Total				42,656
			Round	40,000

(Construction)				
ITEM	UNIT	QUANT.	UNIT PRICE	COST (RO)
Collecting section	M	1,000.0	50	50,000
Transport section	M	4,000.0	50	200,000
Open channel	M	10,000.0	15	150,000
Storage tank	Unit	1.0	40,000	40,000
Preliminaries & contingencies	%	15.0	440,000	66,000
Total				506,000
			Round	500,000

<u>NW-7-1</u>	
Well owned by one person	RO 1,000
Well owned by more than two persons	RO 2,000

Table 6.1.6 (continued)

NW-10-1(For 10-year period)

ITEM	UNIT	QUANT.	UNIT PRICE	COST (R0)
Contribution to MD	Unit	1.0	2,156,119	2,156,119
Equipment(Plotter, Computer-aided designs & mapping system)	Unit	1.0	44,000	44,000
Total				2,200,119
			Round	2,200,000

NW-10-2(For 10-year period)

ITEM	UNIT	QUANT.	UNIT PRICE	COST (R0)
Senior Hydrologist	Person	1.0	367,000	367,000
Staff Hydrogeologist	Person	1.0	308,000	308,000
Supplemental wells	Well	330.0	7,000	2,310,000
Monitoring well recorder	Set	330.0	1,200	396,000
Vehicle		6.0	7,000	42,000
Technical training				
Engineer	Person	6.0	32,400	194,400
Field technician	Person	16.0	8,100	129,600
Total				3,747,000
			Round	3,740,000

6.2 Agriculture

[NAR-1] Support for Agricultural Research Stations

Objective:

To support research through the upgrading and expansion of research facilities and provision of materials and equipment for research activities.

Description:

Due to a present shortage in Oman of trained research management staff and research experts, further aggravated by insufficient facilities and equipment, the agricultural research sector in general -- although achieving some partial success in the development of practical innovations -- has not been able to achieve results commensurate with requirements and expectations at the farmer level.

In the case of the Rumais Agricultural Research Center, the main research building has been completed but the annex wing and procurement of research equipment and materials remain to be completed. It is expected that this institution will continue to carry out broad, basic research which affects the entire country. In addition to intensively providing the latest, most sophisticated equipment to the center, it will also be necessary to support its activities in the initial stages with expatriate experts.

Only the field workshop has been completed at the Jimmah Agricultural Research Station. A research building, as well as research equipment are still required. These should be provided as promptly as feasible given the importance of the Interior Region for Omani agriculture, as well as the uniquely wide range of natural conditions it encompasses from Jabal to the arid interior plain.

At the Salalah Agricultural Research Station, the research and administration building and equipment should be urgently strengthened to keep pace with research requirements which have rapidly increased in

recent years.

The Rumais Agricultural Research Center is not capable of completely meeting the research requirements of the Batinah Region, important because it accounts for over half of Oman's agricultural production as well as because its weather and soil conditions differ from those in the north and south. Accordingly, the present Sohar Experimental Farm in northern Batinah should be upgraded to research station status, particularly with a view to accelerating research in vegetable and fruit cultivation important to the area.

Additionally, establishment of agricultural research stations at Sharqiya, which exhibit unique regional conditions as well would make an effective contribution to improving Omani agricultural technology. A part of this facilities would be established in the first 5-year period.

Necessary costs estimated for establishing the above are shown in Table 6.2.1. Establishing and operating costs for the above, as well as staff expected to be deployed to the facilities are shown in Tables from 6.2.7 to 6.2.14.

Table 6.2.1 Cost Estimation of NAR-1 Project

PROJECT NUMBER	NAME OF PROJECT/PROGRAME	NUMBERS	UNIT PRICE	TOTAL COST
			(1,000RO)	(1,000RO)
NAR-1	SUPPORT FOR AGRICULTURAL RESEARCH STATIONS		2,710	2,710
NAR-1-1	AGRICULTURAL RESEARCH FACILITIES AT RUMAIS		600	600
	(1) LABORATORIES EQUIPMENT AND INSTRUMENTS	1 SET	175	175
	(2) FIELD EQUIPMENT, INSTRUMENTS AND IRRIGATION SYSTEMS	1 SET	200	200
	(3) RESEARCH GREENHOUSES	1 SET	50	50
	(4) SCREENHOUSES	1 SET	10	10
	(5) FIELD WORKSHOP	1 SET	40	40
	(6) RESEARCH INPUT REQUIREMENTS	1 SET	125	125
NAR-1-2	AGRICULTURAL RESEARCH FACILITIES AT JEMMAH		600	600
	(1) BUILDING AND LABORATORIES	1 SET	350	350
	ADMINISTRATION & FINANCE OFFICES, LIBRARY, COMPUTER ROOM, MEETING ROOM, SOIL LAB., PLANT PATHOLOGY LAB., ENTOMOLOGY LAB, PLANT LAB., MECHANICAL WORKSHOP, GREENHOUSES, COLD STORAGE, PLANT SHADE AREA, CAR & MACHINERY PARK			
	(2) LABORATORIES EQUIPMENT AND INSTRUMENTS	1 SET	100	100
	(3) FIELD EQUIPMENT, INSTRUMENTS AND IRRIGATION SYSTEMS	1 SET	75	75
	(4) RESEARCH INPUT REQUIREMENTS	1 SET	75	75
NAR-1-3	AGRICULTURAL RESEARCH FACILITIES AT SALALAH		675	675
	(1) BUILDING AND LABORATORIES	1 SET	350	350
	ADMINISTRATION & FINANCE OFFICES, LIBRARY, COMPUTER ROOM, MEETING ROOM, SOIL LAB., PLANT PATHOLOGY LAB., ENTOMOLOGY LAB, PLANT LAB., MECHANICAL WORKSHOP, GREENHOUSES, COLD STORAGE, PLANT SHADE AREA, CAR & MACHINERY PARK			
	(2) LABORATORIES EQUIPMENT AND INSTRUMENTS	1 SET	100	100
	(3) FIELD EQUIPMENT, INSTRUMENTS AND IRRIGATION SYSTEMS	1 SET	150	150
	(4) RESEARCH INPUT REQUIREMENTS	1 SET	75	75
NAR-1-4	AGRICULTURAL RESEARCH FACILITIES AT SOHAR		600	600
	(1) BUILDING AND LABORATORIES	1 SET	300	300
	ADMINISTRATION & FINANCE OFFICES, LIBRARY, COMPUTER ROOM, MEETING ROOM, SOIL LAB., PLANT PATHOLOGY LAB., ENTOMOLOGY LAB, PLANT LAB., MECHANICAL WORKSHOP, GREENHOUSES, COLD STORAGE, PLANT SHADE AREA, CAR & MACHINERY PARK			
	(2) LABORATORIES EQUIPMENT AND INSTRUMENTS	1 SET	100	100
	(3) FIELD EQUIPMENT, INSTRUMENTS AND IRRIGATION SYSTEMS	1 SET	150	150
	(4) RESEARCH INPUT REQUIREMENTS	1 SET	50	50
NAR-1-5	AGRICULTURAL RESEARCH FACILITIES AT SHARQIYA		235	235
	(1) BUILDING AND LABORATORIES	1 SET	75	75
	ADMINISTRATION & FINANCE OFFICES, LIBRARY, COMPUTER ROOM, MEETING ROOM, SOIL LAB., PLANT PATHOLOGY LAB., ENTOMOLOGY LAB, PLANT LAB., MECHANICAL WORKSHOP, GREENHOUSES, COLD STORAGE, PLANT SHADE AREA, CAR & MACHINERY PARK			
	(2) FIELD EQUIPMENT, INSTRUMENTS AND IRRIGATION SYSTEMS	1 SET	125	125
	(3) RESEARCH INPUT REQUIREMENTS	1 SET	35	35

[NAR-2] Establishment of New Research Units and Laboratories

Objective:

To establish new research units and laboratories for urgent development of technology tailored to the needs of Omani farming and future agricultural development.

Description:

In line with the direction of agricultural production development, research units and laboratories will be established to address research requirements in new fields. Basic research with impact for the entire nation will be centralized at the Rumais Agricultural Research Center. As the research program progresses, it is anticipated that practical field experimentation tailored to the requirements of specific regions will become necessary. Regional sites for such research units and laboratories will be determined at a future date. Research specific to conditions of particular regions would be carried out as well as units and laboratories to be established at agricultural stations in these regions.

Research units and laboratories to be provided under the project are:

(1) Agricultural Machinery Research Unit (Rumais)

MAF considers farm mechanization to be a central issue to improvement of farm management. Unfortunately, there has been little study in this regard in Oman to date. Accordingly, various experiments are considered necessary for selection and improvement of type, model and size of agricultural machinery best-suited to the crops, natural conditions and cropping methods in Oman. Such experiments would also explore the durability and maintenance problems affecting candidate equipment. Study of the "soft" aspect of farm mechanization, including economical methods for machinery use would also be carried out.

(2) Toxicology Laboratory (Rumais)

In recent years, the types of agricultural chemicals have increased and methods of application have become more complicated. Also, most of the conventional plant diseases have become possible to control. Unfortunately, plant diseases which had not been a problem until now are occurring more frequently. In the future still more types of agricultural chemicals are expected to be used.

Increasing importance must also be attributed to studies on toxicity and residual duration of agricultural chemicals, from the standpoint of their environmental and health impact.

The toxicology laboratory will be established at Rumais to carry out the above research. This laboratory is expected to work in line with the regulation of agricultural chemicals which will be introduced in the near future.

(3) Seed and Tuber Production Research Unit (Rumais)

Research at this unit will include introduction and selection of existing varieties bred in countries outside Oman where conditions are similar, collection and selection of traditional Omani varieties, cross-breeding of genetically superior foreign and domestic varieties, and bio-technological breeding. Considering that the gestation period is long in the case of biotechnological breeding methods other than tissue culture, such would, for the time being, be excluded from consideration. Nevertheless, well-organized combinations should be made from among the above-mentioned methods.

Maximum application of existing traditional Omani varieties of fruit trees, feed crop, etc., which have been confirmed as having superior genetic characteristics well-suited to the Omani environment, should be emphasized.

Seed production requires a higher technological ability than general cultivation, and the development and transfer to Omani farmers of appropriate techniques should be pursued. Crops to be considered for seed production include vegetables (carrots, onions, chilli peppers), wheat and barley in the Interior, and potatoes in

the Southern Region and Jabal Akhdar. Seed production of other vegetables such as radishes, gourds, spinach and okra should be considered in the future.

A part of this unit would be established in the first 5-year period.

(4) Central Soil, Plant and Water Analysis Laboratory (Rumais)

As with pest, disease and weed control, fertilizer application technology in Oman is at a low level of development. For this reason improvement and expanded application of fertilizer is expected to greatly increase agricultural productivity. Along with research on plant physiology, research towards development and improvement of fertilizer application technology responsive to plant type, planting season, and cropping method is important.

Also, in line with the above, the establishment of facilities properly equipped for soil analysis, including systematic data-processing are necessary to identify soil characteristics in areas already under cultivation as a basis for developing fertilizer application methods best-suited to such soil conditions. Water analysis for irrigation would also be carried out.

(5) Library and Documentation Center (Rumais)

Establishment of a library and documentation center for collection, compilation and collation of documents relevant to agricultural research is recommended. The library would have the two-fold function of (a) pooling information from outside Oman relevant to its conditions which would help in avoiding redundancy of research efforts inside the country, as well as serve as a data base for development of new technologies practical for Oman, and (b) raising the academic standards of, and providing intellectual stimulus for research staff. It would be effective to equip the library with a computerized information-processing system, connected on-line with databases outside Oman for ready transfer of information.

(6) Plant Water Requirement Determination Unit (Salalah)

Effective use of limited water resources is the most critical issue in terms of increasing agricultural productivity in the Sultanate. Efforts to alleviate this heaviest of constraints will require research on crop-wise water requirements, appropriate irrigation methods, and feasibility of irrigation using brackish water.

This unit will be established at Salalah Agricultural Research Station to carry out the above research.

(7) Disease and Pest Forecasting Unit (Rumais)

Some research on use of biological methods for pest control such as application of sex pheromones, natural enemies, etc. has begun. However, intensification of these efforts would be carried out at this unit. Also, research on pest physiology and ecology would be pursued towards development of a disease and pest forecasting system.

(8) Salt-Tolerant Plants and Halophytes Research Unit

In order to maintain long-term, stable agriculture in an arid region such as Oman, comprehensive research on prevention of and counter-measures for salinization of soil, salt-tolerant crops and varieties, etc. is necessary. These subjects relate to a wide spectrum of technical fields including agricultural engineering, horticulture, plant breeding, pedology, plant physiology, etc. Research in this regard would be carried out at this unit.

A part of this unit would be established in the first 5-year period. Pilot projects would be initiated in the next 5-year period.

(9) Honey Bee Research Unit

To date, bee keeping in Oman has been principally carried out in Rustaq, Nizwa and Salalah by the traditional method. Bee keeping under such practice is of low productivity.

Nevertheless, domestic demand for Omani honey is higher than that for imported honey. Modernization of this industry will provide a valuable income source for bee-keeping farmers.

A bee-keeping research laboratory or units should be established at Rumais, Jimmah and Salalah for development of bee-keeping technology best-suited to conditions in the Sultanate.

In particular, research would be conducted on the following items.

- (a) Survey, diagnosis and prevention of infectious disease among bees (this activity to be principally carried out at Rumais)
- (b) Development and raising of new species
- (c) Research on effective management and use of bee-keeping resources
- (d) Development of bee-keeping practices best-suited to conditions in Oman

In addition to permanent staff at the centers, foreign experts would be periodically invited to advise and participate in this research.

(10) Date Palm Research Unit

Most fruit trees in Oman are date palms. The important research subjects concerning date palms are utilization of the spaces under date palms and thinning and replacing of old date palms. When the old trees, the productivity of which has become relatively low, are gradually thinned out, there are two possibilities. One is replacing these with superior new varieties by application of tissue culture, etc. The other is utilization of the space under these trees through modern agricultural production techniques. These subjects need to be investigated in the future, from the viewpoint of

farm economy and from the viewpoint of crop science. Also, it is important to develop technology for processing date by-products.

In relation to the above, the following subjects should be studied in the future: improvement of irrigation systems for date cultivation; development of intercropping system under date palms which includes mechanization; crop cultivation under the shelter of trees in summer; development of simple tunnel cultivation methods using plastic material; and development of processed foodstuffs which have added value and will serve to stimulate demand for dates, etc.

Establishment of most facilities and development of most equipment, as well as a part of pilot project for by-products processing would be initiated in the first 5-year period.

Necessary costs estimated for establishing the above laboratory and units are shown in Table 6.2.2. Personnel and operating costs necessary for the above are also shown in Tables from 6.2.15 to 6.2.23.

Table 6.2.2 Cost Estimation of NAR-2 Project

PROJECT NUMBER	NAME OF PROJECT/PROGRAME	NUMBERS	UNIT PRICE	TOTAL COST
			(1,000RO)	(1,000RO)
NAR-2	ESTABLISHMENT OF NEW RESEARCH UNITS AND LABORATORIES		3,065	3,075
NAR-2-1	AGRICULTURAL MACHINERY RESEARCH UNIT AT RUMAIS		475	475
	(1)MACHINERY WORKSHOP	1 SET	100	100
	(2)IRRIGATION WORKSHOP	1 SET	50	50
	(3)EQUIPMENT AND MACHINERY	1 SET	250	250
	(4)ELECTRICAL, ELECTRONIC, WELDING, DICING, TESTING EQUIPMENT	1 SET	75	75
NAR-2-2	TOXICOLOGY LABORATORY (RUMAIS)		235	235
	(1)BUILDING OF THE LABORATORY	1 SET	75	75
	(2)EQUIPMENT AND INSTRUMENTS	1 SET	120	120
	(3)LABORATORY INPUT REQUIREMENTS	1 SET	40	40
NAR-2-3	SEED AND TUBER PRODUCTION RESEARCH UNIT (RUMAIS)		70	70
	(1)PLANT BREEDING EQUIPMENT AND INSTRUMENTS	1 SET	50	50
	(2)SURVEY AND COLLECTION OF GERM PLASM	1 SET	20	20
NAR-2-4	CENTRAL SOIL, PLANT AND WATER ANALYSIS LABORATORY (RUMAIS)		600	600
	(1)BUILDING OF THE LABORATORY	1 SET	300	300
	(2)EQUIPMENT AND INSTRUMENTS	1 SET	200	200
	(3)LABORATORY INPUT REQUIREMENTS	1 SET	100	100
NAR-2-5	LIBRARY AND DOCUMENTATION CENTER (RUMAIS)		240	240
	(1)BUILDING OF THE LIBRARY	1 SET	160	160
	(2)EQUIPMENT AND INSTRUMENTS	1 SET	60	60
	(3)LIBRARY INPUT REQUIREMENTS	1 SET	20	20
NAR-2-6	PLANT WATER REQUIREMENT DETERMINATION UNIT (SALALAH)		100	100
	EQUIPMENT AND INSTRUMENTS	1 SET	100	100
NAR-2-7	DISEASE AND PEST FORECASTING UNIT (RUMAIS)		100	100
	BIOTRON	1 SET	100	100
NAR-2-8	SALT-TOLERANT PLANTS AND HALOPHYTES RESEARCH UNITS (RUMAIS)	1 SET	200	200
	EQUIPMENT AND INSTRUMENTS	1 SET	200	200
NAR-2-9	HONEY BEE LABORATORY (RUMAIS)		140	140
	(1)BUILDING	1 SET	75	75
	(2)BEE KEEPING AREAS	1 SET	15	15
	(3)EQUIPMENT, INSTRUMENTS AND INPUT REQUIREMENTS	1 SET	50	50
NAR-2-10	HONEY BEE RESEARCH UNIT (SALALAH)		65	65
	(1)BUILDING OF SMALL LAB., STORE AND WORKING AREA	1 SET	25	25
	(2)BEE KEEPING AREAS	1 SET	15	15
	(3)EQUIPMENT, INSTRUMENTS AND INPUT REQUIREMENTS	1 SET	25	25
NAR-2-11	HONEY BEE RESEARCH UNIT (JEMMAH)		50	50
	(1)BEE KEEPING AREA	1 SET	25	25
	(2)EQUIPMENT, INSTRUMENTS AND INPUT REQUIREMENTS	1 SET	25	25
NAR-2-12	DATE PALM RESEARCH UNIT (RUMAIS)		800	800
	(1)BUILDING AND LABORATORIES	1 SET	200	200
	BIOLOGICAL LAB., CHEMICAL LAB., DATE PALM PATHOLOGY LAB., DATE PALM ENTOMOLOGY LAB., DATE PROCESSING LAB., DATE PALM FIELD WORKSHOP, OFFICES, STORES			
	(2)EQUIPMENT AND INSTRUMENTS FOR LABORATORIES	1 SET	200	200
	(3)FIELD EQUIPMENT AND INSTRUMENTS	1 SET	75	75
	(4)RESEARCH INPUT REQUIREMENTS	1 SET	125	125
	(5)DATE PALM PILOT PROJECT	1 SET	200	200

[NAR-3] Development and Establishment of Experimental Farms and Nurseries

Objective:

To develop and establish experimental farms and nurseries to improve efficiency in research and extension of new varieties and provide a stable supply for sound, superior seedlings.

Description:

New experimental farms and nurseries will be established, and existing ones upgraded.

(1) Experimental Farm

- (a) Arabic Coffee Experimental Farm (Janubiya)(new)
- (b) Wadi Quriyat (existing)
- (c) Musandam (new)

(2) Nurseries (existing facilities)

- (a) Rumais and Barka (Central Nursery) (mangoes, citrus, etc.)
- (b) Sohar (mangoes, limes, etc.)
- (c) Interior (date palms, citrus, grapes, pomegranates, etc.)
- (d) Southern Region (coconuts, papayas, etc.)

Necessary costs estimated for these farms and nurseries are shown in Table 6.2.3.

Table 6.2.3 Cost Estimation of NAR-3 Project

PROJECT NUMBER	NAME OF PROJECT/PROGRAME	NUMBERS	UNIT PRICE	TOTAL COST
			(1,000RO)	(1,000RO)
NAR-3	DEVELOPMENT AND ESTABLISHMENT OF EXPERIMENTAL FARM AND NURSERIES		1,040	1,040
NAR-3-1	DEVELOPMENT OF ARABIC COFFEE EXPERIMENTAL FARM IN SALALAH		135	135
	(1)OFFICE, STORES, FIELD WORKSHOP, PLANT SHADE AREAS	1 SET	25	25
	(2)IRRIGATION SYSTEM	1 SET	25	25
	(3)EQUIPMENT	1 SET	40	40
	(4)INPUTS REQUIREMENTS	1 SET	45	45
NAR-3-2	DEVELOPMENT OF NURSERIES AT RUMAIS AND BARKA		220	220
	(1)OFFICE, STORES, FIELD WORKSHOP, NURSERIES	1 SET	100	100
	(2)IRRIGATION SYSTEM	1 SET	20	20
	(3)EQUIPMENT	1 SET	50	50
	(4)INPUTS REQUIREMENTS	1 SET	50	50
NAR-3-3	DEVELOPMENT OF NURSERIES AT SOHAR		100	100
	(1)OFFICE, STORES, FIELD WORKSHOP, NURSERIES	1 SET	25	25
	(2)IRRIGATION SYSTEM	1 SET	15	15
	(3)EQUIPMENT	1 SET	30	30
	(4)INPUTS REQUIREMENTS	1 SET	30	30
NAR-3-4	DEVELOPMENT OF NURSERIES IN INTERIOR		300	300
	(1)OFFICE, STORES, FIELD WORKSHOP, NURSERIES	1 SET	100	100
	(2)IRRIGATION SYSTEM	1 SET	90	90
	(3)EQUIPMENT	1 SET	60	60
	(4)INPUTS REQUIREMENTS	1 SET	50	50
NAR-3-5	DEVELOPMENT OF NURSERIES IN SOUTHERN REGION		100	100
	(1)OFFICE, STORES, FIELD WORKSHOP, NURSERIES	1 SET	25	25
	(2)IRRIGATION SYSTEM	1 SET	15	15
	(3)EQUIPMENT	1 SET	30	30
	(4)INPUTS REQUIREMENTS	1 SET	30	30
NAR-3-6	DEVELOPMENT OF EXPERIMENTAL FARM AT WADI QURIYAT		115	115
	(1)OFFICE, STORES, FIELD WORKSHOP, NURSERIES	1 SET	50	50
	(2)IRRIGATION SYSTEM	1 SET	15	15
	(3)EQUIPMENT	1 SET	30	30
	(4)INPUTS REQUIREMENTS	1 SET	20	20
NAR-3-7	DEVELOPMENT OF EXPERIMENTAL FARM AT MUSANDAM		70	70
	(1)FIELD WORKSHOP, NURSERIES	1 SET	20	20
	(2)IRRIGATION SYSTEM	1 SET	10	10
	(3)EQUIPMENT	1 SET	25	25
	(4)INPUTS REQUIREMENTS	1 SET	15	15