

2.5.9 Subsidy Institution

2.5.9.1 Present Situation

(1) General Situation of Agricultural Finance in the Sultanate

Reflecting the high level of economic growth in the first half of the 1980s, followed by the moderate economic growth in the second half of the decade in Oman, the financial sector also, especially in the area of credit, has been developing and has an outstanding growth rate. As shown in Table 2.5.22, the average growth rate, of the total lending amount during the nine years between 1980 and 1988, is 15.3 %. The main sectors which obtained financing are trade and construction. The agricultural sector received only a small portion (less than 1.0 % of the total). The agricultural sector's share, despite its small size, has increased from 0.29 %, the lowest level in 1982 to 0.83% in 1988. Figure 2.5.10 shows the agricultural sector's share of total bank lending.

The main institutions which offer financial services to the agricultural sector are the Oman Development Bank (ODB) and the Oman Bank for Agriculture and Fisheries (OBAF). The share of financing for the agricultural sector from ODB was relatively low because the bank was established as a promoter for industrial development projects. Thus, the major amount of financing from ODB was delivered to the manufacturing sector.

On the contrary, OBAF was established to contribute to the development of the agricultural sector and to be its principal lending institution. That is why the problems and projects relating to agricultural finance are regarded almost equally as those of OBAF.

The functions and activities of both OBAF and ODB are described in the following sections.

(2) OBAF

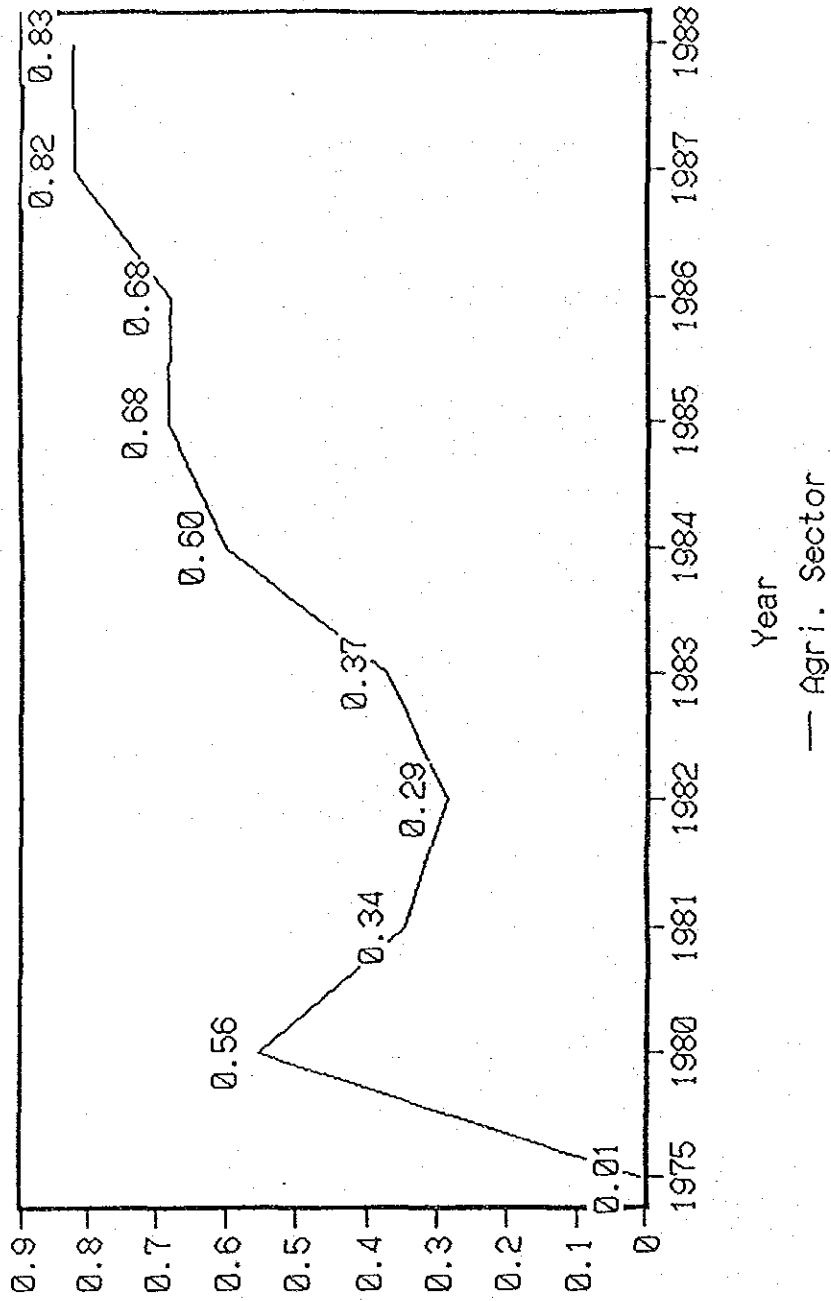
OBAF was created by Royal Decree 50/81 published on May 19, 1981. The

Table 2.5.22 Bank Lending by Economic Sector

Sector	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988
Trade	48,926	156,365	190,239	214,502	238,152	275,501	305,288	280,597	293,789	314,382
Mining & Quarrying	1,389	2,754	3,653	9,476	8,161	11,371	10,914	14,515	13,332	14,866
Construction	17,112	55,280	55,893	65,363	68,433	83,383	127,327	139,358	116,899	120,145
Manufacture	706	5,468	5,124	6,189	22,007	19,332	26,854	23,957	26,705	28,124
Electricity, Gas, & Water	1,025	546	746	464	682	3,447	4,899	4,457	4,731	3,944
Transport & Communication	820	5,397	5,078	10,669	11,360	6,981	13,814	11,720	6,749	5,493
Financial Institutions	19	2,435	2,805	2,548	5,923	7,433	5,709	6,699	7,861	5,306
Services	1,777	6,104	5,364	11,924	16,319	17,835	21,835	22,135	20,544	34,183
Government(1)	63,853	4,097	1,129	4,470	9,831	13,884	62,312	51,552	57,511	25,808
Personal Loans	10,257	36,986	51,767	62,809	97,050	122,812	142,440	136,894	147,563	183,842
Agriculture & Allied Activities	10	1,634	1,192	1,161	1,884	3,558	5,173	5,832	6,182	6,586
Others	2,017	17,069	23,377	17,830	28,196	25,855	31,572	41,883	41,146	56,396
Total	147,031	294,135	346,367	406,525	507,998	589,712	756,637	738,817	752,012	797,495
Percentage of Agri. Sector	0.01	0.56	0.34	0.29	0.37	0.60	0.68	0.68	0.82	0.83

Note(1): Excludes Government Loans from CBO
Source: Statistical Yearbook 1989

Figure 2.5.10 Percentage of Agricultural Sector in Bank Lending



formal operation of the bank commenced in April, 1982. Simultaneously, the first loans were granted. Identified as one of the major projects of the Second Five-year Development Plan of the nation, OBAF was meeting the dual objectives of bringing credit facilities and fostering the development of two sectors, the agricultural and fishery sectors.

The lending criteria, therefore, were determined as follows.

(a) Range of loan

Private project, small-scale farmers, etc. in the field of agriculture and fisheries or related fields.

(b) Eligibility

All Omani individuals and companies involved with agriculture and fisheries are eligible for loans. and

(c) Requirements

- (i) Provision of feasibility study in the case of large projects or investments,
- (ii) The project should prove its feasibility,
- (iii) Provision of related documents such as land documents, fishing license or fishing boat registration.

In the beginning, the loans awarded were classified into three categories.

(a) General Development Loans

Financing for the improvement of existing farms, establishing new farms, mechanization, livestock, fisheries.

(b) Loans complementary to subsidies

Complement the financing of water pumps distributed within the Water-Pump-Subsidy Program. and

(c) Loans to agro-industries and related activities

The loans for promoting agro-industries and small-scale agribusiness, etc.

Category (b) was eliminated in 1986 because of a change in governmental policy and disproportionately high costs of collecting the related payments from borrowers in comparison with the low number of actual loans.

The practical contents of OBAF loans are:

(a) Farm Improvement

includes various types of improvement activities from traditional management and facilities to modern ones, such as well, irrigation, etc.;

(b) New Farm

includes all expenses to establish new farms (newly established farm on the land obtained from the state) defined as modern farms having the standard scale of 10 feddans, such as land reclamation, land leveling, fencing, housing for laborers, modern irrigation systems, wells, pumps, tractors, etc.;

(c) Farm Mechanization

includes various machines used for agriculture depending on the project, though water pumps and tractors are dominant;

(d) Agro-Industries, Marketing and Related Activities

includes farm-level small marketing facilities like freezing storage, finance for small trading equities, moderate or small facilities like greenhouses, etc.; and

(e) Large Projects

includes all expenses necessary for the completion of large projects, which are ambiguously regarded as having a scale more than 100 feddans and/or a total cost of more than R.O. 100,000.

The lending conditions are as follows:

(a) The range of financing

farmers: lending for 90% of project cost
non-farmers: lending for 80% of project cost
companies: lending for between 40 and 60% of project cost.

(b) Interest rate

farmers: 2% per annum
non-farmers: 3 to 5% per annum (normally 4%)
companies: 4 to 6% per annum (normally 6%).

(c) Loan period

mechanization: normally two years for water pumps, four years
for tractors, including replacements
large projects: variable depending on the project life
others: variable within the maximum 12 years depending on the
project life.

(d) Grace period

variable according to analysis.

(e) Maximum amount

depends on total investment but within the financial ability of
the bank.

(f) Mortgage

other items besides large projects: land mortgage, personal
property, equipment.
large projects: additional security besides the minimum
stipulated above is required.

The trend of the annual loan amount for OBAF from the inauguration year to 1988 is shown in Figure 2.5.11. There is a steep fall in loans in 1985 and 1986. The bank points out the reasons below.

(a) The problem of land title as mortgage

Traditionally, sheiks gave their farmers a certificate called the "sheria" court which proved the ownership of the land. But, the certificate inadequately described the name of the owner, the

Figure 2.5.11 Trend of OBAF Loan
(Million R.O. & Number)

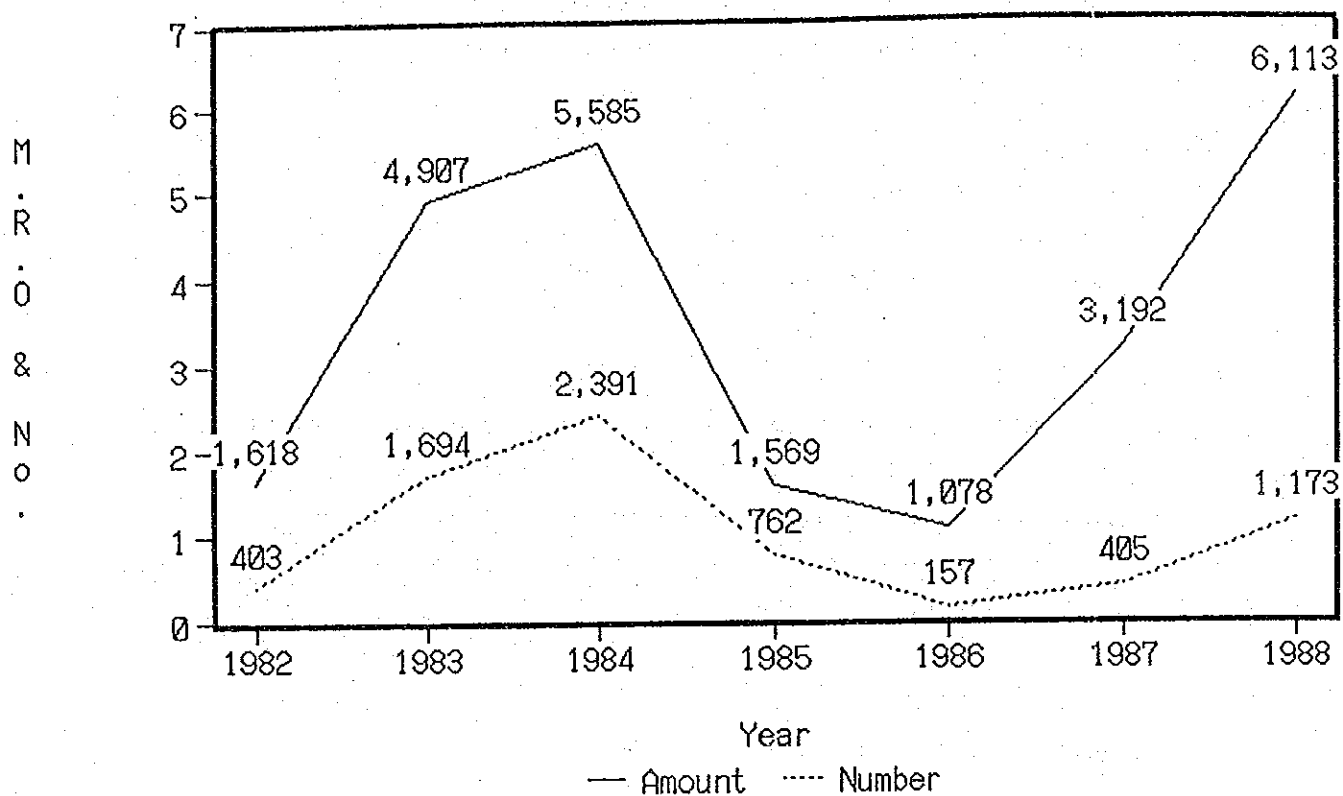
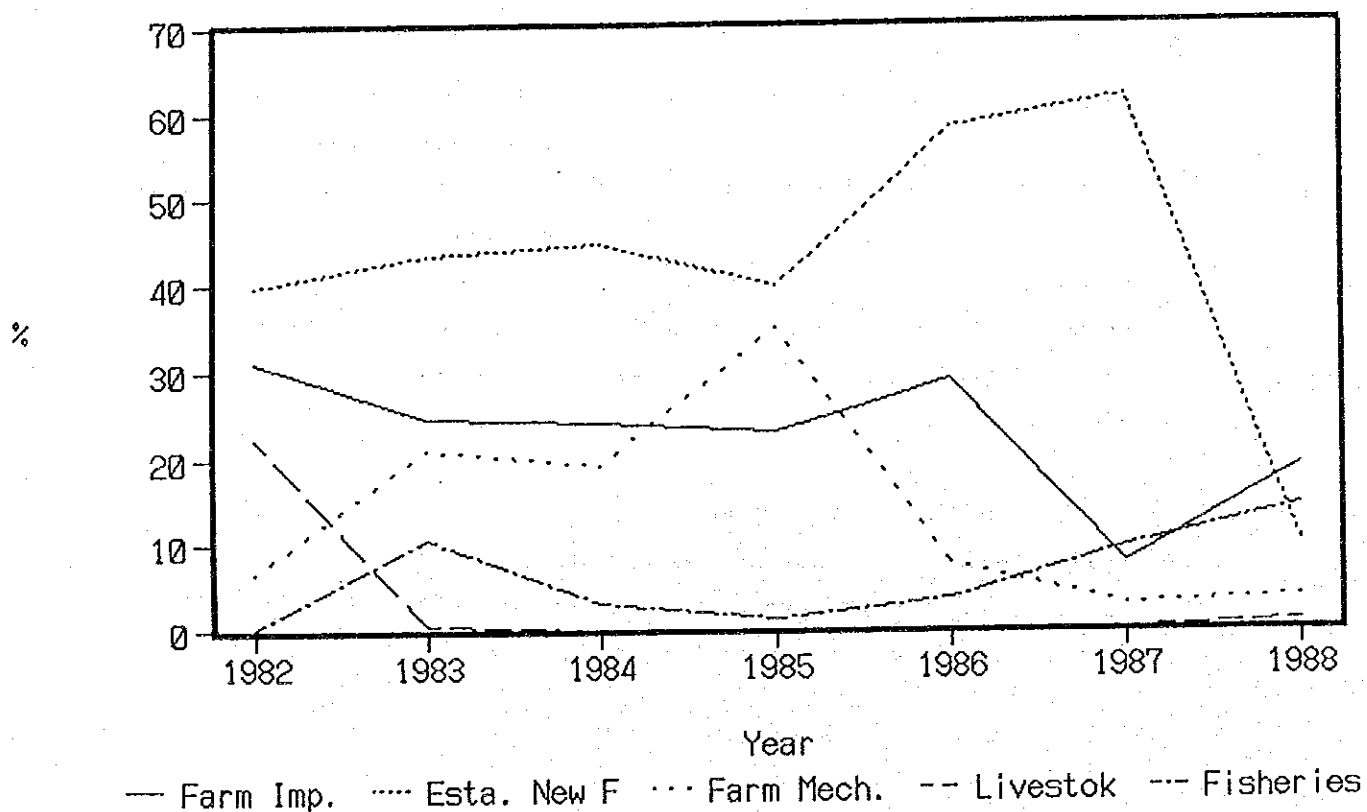


Figure 2.5.12 Percentage of OBAF Loan by Purpose



location, the direction, etc. After the establishment of the Ministry of Housing (MH), this organization assumed responsibility for giving title to farmers through necessary procedures, which included farmers' requests, simple land surveys, drawing sketches of lands area, and calculations by MH officials. Since the bank cannot provide financing without a legally-recognized mortgage, the farmers who want loans must obtain land titles. Unfortunately, formal procedures being troublesome, MH tended to delay issuing land titles. This means that financing by the bank was also frequently hindered. 1985 and 1986 were peak periods for such delays. In order to cope with the problem, MH, MAF and OBAF agreed on the resolution illustrated below.

(i) The farmers who are actually cultivating can get a "lease certificate" from MH soon after its simple surveying. This lease certificate is regarded as a legal title deed necessary for the bank loan. By this means the farmer will spend only four months to get a legal document. If the farmer continues to farm at least 75% of the land for the succeeding three years, he can get a formal land title.

(ii) In the case of uncultivated land (state-owned land), the farmer requesting a land title must pass formal procedures which requires one to two years.

(b) The salinization problem on the Batinah coast

In 1985, the concern over incidences of aquifer salinization on the Batinah coast increased, probably due to high rates of water extraction caused by the rapid increase in farm settlement in this region. In 1986, a study of natural water resources was commissioned. Until the completion of this study, the government prohibited the new installation of water pumps. However, the water-saving modern irrigation systems were recommended in the study report and the bank re-opened loan applications to the irrigation sector in 1987.

(c) Cessation of government subsidy

The fact mentioned in (b) caused the cessation of the Water-

Pump-Subsidy Program and other mechanization programs which subsidized 50% of the farmer's purchases. Accompanying this cessation, bank loans decreased because the rest of the cost was covered by bank loans, e.g. in the case of tractors: 50% subsidy, 40% bank loan and 10% self-finance.

(d) Financial situation of the nation

The unexpected fall of international crude oil prices in 1986 caused the deterioration of the Omani economy and simultaneously resulted in a decrease in loan amounts.

After the resolution (in 1987), the bank was executing loan procedures smoothly. Taking a turn for the better in 1987, the total financing in 1988 increased to a maximum in the bank's history.

40% of farmers at present are said to be retainers of land certificates or lease certificates.

OBAF loans, by purpose, are indicated in Figure 2.5.12, from which the fact that the construction of new farms is the main purpose of the bank, is easily recognized. In 1988, however, the share of new farm development decreased sharply. The control of land title distribution by MH, who feared unruly development, was likely one reason for the phenomenon. The outstanding items are the sustained share expansion of the fisheries sector and the declining trend of farm mechanization owing to the termination of the subsidy policy.

The OBAF staff is different from other banks and consists of 28 agronomists, agro-economists and assistant engineers out of a total of 134 employees. When the loan request inspection and examination are executed, the staff specializing in agriculture gives potential borrowers adequate advice and instructions relating to crop selection, land use, construction methods, contractors, etc.

(3) Future Strategy of OBAF

The present problems facing OBAF:

- (a) OBAF capital is set at R.O. 19 million, while R.O. 13 million was already paid by the government in 1989. Because of its small-scale capital and financial resources, the position of the bank is not deemed strong.
- (b) The average interest rate of the bank is set extremely low compared to the opportunity cost of capital in Oman (10 to 10.5 %), because the bank loans mainly target the individual farmer. The Ministry of Finance and Economy pays a subsidy to help cover part of the difference in the interest rate - a maximum 6 %. The recent stagnant economy in the Sultanate resulted in the declination and fluctuation of government contributions, which also made the bank's operations unstable.
- (c) The repayment rate remains at a low level of 70 to 75 % of the amount due. This exacerbated the financial situation of the Bank. The high cost to collect payments from borrowers, especially living in remote areas should be taken into consideration.

The future strategy of the bank should be as follows:

- (a) To fortify its financial status by receiving external loans with preferential interest rate.
- (b) To settle the role of the bank in general agriculture policy and projects of MAF, in order to distribute appropriate amounts of the budget to the bank. and
- (c) To raise the repayment rate of borrowers by using various methods such as periodical campaigns, enlightenment of farmers through village committees, etc.

(4) ODB

The Oman Development Bank was set up by a Royal Decree in 1976 and began its operations in 1979. The main purpose of ODB is to help achieve

development in the industrial sector in which private entities play a leading role. The bank concentrates on the following operations.

- (a) To advance or guarantee medium and long term loans to licensed projects, provided the credit is required for the purpose of financing investment in the sectors of industry, agriculture and fisheries.
- (b) To offer technical assistance and consulting to Omani companies by way of preparing economic and technical feasibility studies.

The bank's lending criteria and conditions are as follows:

(a) Criteria

Registered companies related to the agro-industry will be financed if their economic viability is clarified during the appraisal of the relevant market, managerial, technical, and economic factors, as well as the analysis of proposed financial statements, cash flow, and sensitivity to revenue decrease or cost increase.

(b) Lending conditions

- (i) Range of finance: The bank finances 50% of the project cost. Where the total cost of the project is below R.O. 100,000 and it is promoted under the self-employment scheme, the bank may finance up to 80% of the project cost. It should be noted that only fixed assets are considered for ODB financing.
- (ii) Interest rate: 6% in Muscat, 4% elsewhere in Oman
- (iii) Loan period: 5 to 10 years
- (iv) Grace period: 1-1/2 years
- (v) Maximum amount: up to 10% of the bank's reserves
- (vi) Mortgage: all fixed assets and vehicles
- (vii) Total time for loan approval: 2 months, provided documentation is completed. Lending and implementation need 6 months.

The bank places importance on the projects related to the food sector, in line with the national policy to pursue self-reliance. The bank mostly participates in three main food products which are imported

i.e. poultry, eggs and milk.

(5) Outline of Subsidies

The subsidy policy for agriculture in Oman is classified into two sectors: production input and production, and output.

With respect to the output, PAMAP, which purchases vegetables and fruits from farmers at the support price (normally a 20 % discount from the wholesale price) plays a major part in the policy.

It is not difficult to understand why the Omani government adopted the agricultural product protection policy against external competition, imposing heavy tariffs and quotas on food imports and little or no tariffs on domestic materials. Oman has comparative disadvantages in the agriculture sector both in price and quality. The protection could also be regarded as an indirect subsidy.

On the other hand, subsidies for production input are divided into three parts: recurrent input, durable input, and government service. The contents of these are as follows:

(a) Recurrent input

Supported by government subsidies, most of the recurrent input is supplied to farmers at a cheaper price than market price.

(b) Durable input

Although durable input -- tractors, sprayers and pumps -- is also subsidized, farmers could obtain preferentially low interest loans from OBAF to purchase them. and

(c) Government service

The government offers various services to farmers which include not only extension, but spraying and tractor hire services in free of charge.

Tables 2.5.23 - 2.5.27 show input subsidies.

(6) Details of Subsidies for Each Item

(a) Seeds

Of the total seed imports, MAF took about 30% in 1986. The majority of seed stocks used domestically are purchased on an international tender by MAF, and supplied to the small farmers, who are given priority over commercial farmers for allocation of these supplies. Varieties are selected for purchase by a combination of various tests at the Rumais Agricultural Research Center and feedback from extension services on farmers' preferences.

Until the relevant GCC body has framed the forthcoming pan-regional regulations, there will continue to be no established Omani law governing seed quality, seed phyto-sanitary regulations, or selection and testing procedures. Consequently, the private sector is free to import any seed variety supplied by reputable, international seed producers, for distribution and sale through the free market.

(b) Pesticides

MAF's share in agro-chemical imports was small (around 3 %) in 1986. With the same terms and conditions as seeds, pesticides are supplied to the government through the international tenders. After establishing a contract, imported chemicals are delivered to the MAF warehouse located in the capital. They are distributed to the main MAF regional- and satellite-centers for eventual sale to farmers. These MAF centers, along with the commercial outlets, constitute the major part of the supply network in the country.

Pesticides are informally controlled by a system of performance trial testing at the Rumais Agricultural Research Center where products submitted by manufacturers undergo comparative performance trials over two or three seasons. To qualify for tender purchase,

agro-chemical products must also be supported by proof of registration within the manufacturing country.

As with seeds, the importing or the use of pesticides in Oman remains unregulated. The GCC legal instruments currently being prepared are also intended to be adopted as Omani legislation. In the meantime, the private sector is free to import and sell any agro-chemical product, regardless of quality or safety.

(c) Fertilizers

MAF currently supports the subsidized supply of only two types of inorganic fertilizers, compound NPK (20:10:10) and ammonium sulphate, and one organic fertilizer, produced locally from decomposed domestic refuse by the Oman Organic Fertilizer Company. All inorganic fertilizers are tendered by MAF, and imported annually by one or two main suppliers who dominate the market.

(d) Spraying Equipment

MAF provides free spraying services to farmers through regional extension centers (only the crop chemical is charged for). It is believed that a surprisingly large number of farmers in some areas, particularly in the hinterland regions, do not own spraying equipment and tend to rely on the MAF spray teams. In the past, MAF has also distributed very small numbers (usually about 200 per year) of subsidized manual sprayers. Subsidies on sprayers were withdrawn at the beginning of 1988.

Motorized, pressure sprayers which are certainly the most effective for spraying tall or dense tree crops should be made more widely available.

In order to increase land productivity and quality, timely, frequent and adequate application of crop protection agents are indispensable. The ownership of sprayers, therefore, should be strongly promoted because the dependence of crop protection on third

parties is risky, especially for those growing annual field crops like vegetables.

(e) Tractors and Agricultural Machinery

The tractor hire scheme operated by MAF is now inadequate to meet demand, which is estimated to be several times higher than can be satisfied with the present levels of staff, machinery and financial resources.

The agricultural machinery business in Oman is small and predominantly an adjunct of the motor trade-related businesses of larger Omani trading houses. The supply of equipment and spares to the MAF tractor hire service resulted in a diminishing proportion of revenue to the trading houses. While there is a small, steady market for medium to large horsepower machinery, the large number of small farms of 10 feddans or less establishes the small tractor or powered tiller market as best suited to the operational and financial circumstances of the average small farmer.

Ownership of tractors of any sort is uncommon amongst small farmers, partly due to the small farm sizes and low incomes, and the influence of the tractor hire scheme.

(f) Water Pumps and Irrigation Equipment

Prior to 1982, water pumps were supplied to farmers free of charge, under the terms of a Royal Decree. This arrangement was terminated in 1982 and replaced with a subsidy scheme which was terminated in 1986 when responsibility for pump-funding was handed over entirely to OBAF. Since the elimination of MAF subsidy, installed pumps have declined considerably.

The supply and installation of irrigation equipment, conversely, is currently one of the greater growth areas of the supply input industry, following general recognition of the critical need to improve the efficiency with which Oman's finite water resources are

used. This requires a move away from the traditional flood irrigation methods of the falaj system, towards the more water conservative techniques of modern sprinkler and drip irrigation systems. The MAF policy in this respect centers on several schemes supported by loans from OBAF. The largest of these plans, to intensify production on 2,500 established farms by installing drip or sprinkler irrigation, is on-going.

It is intended that between 400 and 500 farms will be improved each year, depending on the availability of sufficient manpower resources within MAF.

(g) Animal Feed

All animal feed consumed in Oman is formulated in the country, either at the Oman Flour Mills plant in Muttrah, or at the Dhofar Cattle Feeds plant in Salalah. In both cases, all feed stock material is imported, with the exception of one component, mineral limestone, which is produced locally. Both plants run efficiently, below capacity in both cases, and consistently meet national demand for all classes of animal feed required in the Sultanate. Feed products are sold at full, commercial, unsubsidized prices through a large network (Oman Flour Mills has 40 outlets) of local distributors and are protected from external competition by import tariffs. Though feed is not subsidized by MAF, it is supplied free to livestock farmers in years when seasonal jabal pastures fail due to severe drought.

The largest single consumer of ruminant feedstock in northern Oman is Oman Sun Farms in Sohar. The main market, however, is the livestock farmers on the southern jabal, to whom most production from both Oman Flour Mills and Dhofar Cattle Feeds, is sold. Demand is likely to increase substantially, since a new enterprise, Modern Poultry Farms, was established.

Veterinary services are also provided almost entirely by MAF.

2.5.9.2 Development Potential

Agricultural finance should be included in the government subsidy program, since a subsidized low interest rate is the focal point of its operation. The subsidies relating to agriculture policies are classified as follows:

- (1) Government purchase of agricultural products in line with the supporting price (output subsidy).
- (2) Subsidy for production input (input subsidy).
- (3) Agricultural development projects directly implemented by the government (government project).
- (4) Subsidy or government shareholding for private projects relating to agriculture (government-shared project).
- (5) Research and extension services for farmers (government service), and
- (6) Agricultural finance with favorable conditions (preferential finance).

The government subsidizes all the items mentioned above to varying degrees. The major contents of subsidies allocated for agriculture are as follows:

(1) Output subsidy

Purchase of products from farmers through PAMAP. It should be noted that, strictly speaking, no purchasing price is subsidized, because it is set 20% lower than the market price.

(2) Input subsidy

Subsidy for agricultural input, e.g. seeds, pesticides, fertilizers, etc., allocated from the development expenditure of MAF.

(3) Government project

Government projects such as improvement of aflaj, construction of recharge dams and agro-industry (date-processing factory) allocated from development expenditure of MAF.

(4) Government shared project

Capital sharing or supply of subsidized raw materials by MIC for enterprises relating to agro-industry and so forth.

(5) Government service

Direct implementation of agricultural research and extension services by MAF for the development of agriculture and the increase of farmers' income.

(6) Preferential finance

Favorable loans, by OBAF for farmers and commercial farms as well as the ODB loans for agro-industry, etc.

The evaluation of the effect of those subsidies has not yet been completed sufficiently by the government. The response to the subsidies from farmers, in which commercial farms are included, is more favorable for direct ones than indirect ones. Accordingly, indirect programs like input subsidies and extension services are not be considered to have benefits corresponding to cost, due to the complicated procedures for getting permission, the delay of service, and the infrequency of services rendered to farmers. In the future, the government should aim at more direct subsidies, for which demand from producers will increase. Subsidies for output in the form of purchasing agricultural produce at the supporting price is adequately direct and considerable effect can be expected.

Table 2.5.23 Actual Subsidies for Plant Sector (in 1989)

I T E M	SUBSIDY (%)
1- Seeds	50%
2- Insecticides	50%
3- Chemical fertilizers	25%
4- Organic fertilizer	25%
5- Aerial spraying	100%
6- Ploughing (Tractor hire)	80%
7- Spraying	100%
8- Potato tubers	50%
9- Modern irrigation systems	R.O. 3 million being a Sultanate grant for introduction of subsidized irrigation system in Batinah (1990 - 1992)
10- Wheat seeds	100%
11- Bee hives	-
12- Mechanization	-
13- Extension services	free
14- Maintenance of falaj systems	100%
15- Maintenance of wells & springs	100%

Source: MAF

Table 2.5.24 Actual Subsidies for Animal Sector (in 1989)

S U B J E C T	SUBSIDY (%)
1- National vaccination scheme, vet. treatment, and extension	100%
2- Construction of pens and distribution facilities of livestock	100%
3- Purchase of beef from herdsmen	100% (in remote areas only)
4- Animal feed	-
5- Preparation of feasibility studies for animal production projects	free

Source: MAF

Table 2.5.25 Actual Subsidies for Fisheries Sector (in 1989)

S U B J E C T	SUBSIDY (%)
1- Fisherman fund	
i) modern fishing gear (boats and moving engines)	66.6%
ii) fishing boxes for shrimp	100%
2- Marine workshops (repair & maintenance of fishing boats) and engines)	100%
3- Fisheries research fund	under implementation

Source: MAF

Table 2.5.26 Proposed Distribution of the Farmer Subsidy Program
Allocation for the Years 1988 and 1989

I T E M	AMT. PROPOSED	AMT. ALLCATED
	FOR 1989 IN R.O.	FOR 1988 IN R.O.
1. Insecticides	330,000	430,000
2. Sprayers	20,000	140,000
3. Aerial spraying	170,000	140,000
4. Vegetable seeds	100,000	92,000
5. Potato tubers	60,000	40,000
6. Plants	30,000	260,000
7. Chemical fertilizers	100,000	100,000
8. Organic fertilizers	50,000	40,000
9. Ploughs, threshers and implements	60,000	80,000
10. Subsidy for modern irrigation system	218,000	168,000
11. Propagation of wheat seed	160,000	20,000
12. Promotion of garlic cultivation	20,000	10,000
13. Control of coconut disease	30,000	10,000
14. Apiary inputs	50,000	40,000
15. Animal feed	10,000	30,000
16. Nurseries inputs and production farm	100,000	180,000
17. Agricultural exhibition/competition	100,000	180,000
18. Control of citrus disease	160,000	-
19. Production farms input	(included in 16 above)	600,000
T O T A L	1,600,000	2,500,000

Source: MAF

Table 2.5.27 Proposed Distribution of the Farmer's Subsidy Program
Allocation for the Year 1990

SERIAL NUMBER	I T E M	PROPOSED AMT. IN R.O.
1.	Pesticides	250,000
2.	Aerial spraying against dubas bug	170,000
3.	Promotion of garlic cultivation	15,000
4.	Control of coconut diseases	10,000
5.	Vegetable seeds	100,000
6.	Chemical fertilizers	115,000
7.	Organic fertilizers (manure pit)	20,000
8.	Potato tubers	60,000
9.	Extension services programs	35,000
10.	Control of citrus disease	20,000
11.	Propagation of wheat	15,000
12.	Honey bee inputs	20,000
13.	Nursery inputs	50,000
14.	Subsidy for modern irrigation system	60,000
15.	Plants	15,000
16.	Irrigation systems subsidy in 100 sheep farms	70,000
17.	Establishment of 55 enclosures for goats	170,000
18.	Veterinary medicine	100,000
19.	Spray machines	26,847
20.	Cutting and baling machines	25,000
21.	Tractors subsidy	50,000
22.	Grass cutting machines	40,000
23.	Date palm trees cutter	153
24.	Date palm pollination machines	6,000
25.	Wheat threshers	7,000
T O T A L		1,550,000

Source: MAF

2.6 Progress of the Third Five-Year Development Plan

The long-term development strategies in Oman which were established in February, 1975 were reflected in the First Five-year Development Plan (1976-1980), carried over to the Second Five-year Development Plan (1981-1985), and then to the Third Five-year Development Plan (1986-1990). The main contents of the strategies are as follows:

- (1) To diversify the resources of national income by developing new resources to augment and to eventually replace oil resources.
- (2) To increase the ratio of investment directed to income-generating projects particularly in activities of manufacturing, mining, agriculture and fisheries. and
- (3) Fair distribution of national investment among geographic regions with a view to spreading progress and prosperity to all districts of the Sultanate. Special priority is assigned to the less-developed areas in order to reduce differences in the standard of living among regions.

In addition to the above, the strategies include commitments to the support of regions in order to slow urbanization and to conserve the environment, the development of water resources, the development of human resources by enhancing education programs, the improvement of infrastructures, the promotion of commercial activities and private enterprises, raising the efficiency of the government's administration system, intensifying regional economic cooperation among GCC countries, etc.

In order to accomplish these long-term strategies, short-term targets and policies were sanctioned for the Third Five-year Development Plan in December 1985 in accordance with Royal Decree No. 103/85. The short-term targets concerning agriculture are set out below:

- (1) To achieve an average growth rate of 4% in national income, estimated in current prices.
- (2) To give priority to the development of natural resources and to

income-generating projects in such sectors as agriculture, fisheries, manufacturing, mining, and natural gas.

- (3) To expand regional development in the field of social services such as education, health, vocational training and subsidized housing, and
- (4) To give due attention to the completion of public infrastructures, as permitted by the available resources, and to attach high priority to sanitary drainage projects, drinking water services, electricity, means of communication and establishment of local markets.

Soon after the sanction of Royal Decree for the Third Five-year Development Plan, oil prices started to decline. They reached US\$ 8 per barrel in July, 1986, the lowest level since 1983. Although the price recovered somewhat, the revenues of the Sultanate were reduced by almost half. The Sultanate tried to minimize the effects of reduced national income and decided to reduce government expenditure in the Third Five-year Development Plan by 10 %, as well as to devalue the Omani Rial against the US\$ by 10.2 %. As a result, the targets of the short-term policies of the Third Five-year Development Plan have been reformulated. The main factors to be considered are:

- (1) To stabilize the economy and assist private and government sectors to cope with the new environment.
- (2) To tackle the deficit in the national budget.
- (3) To concentrate on increasing the value of products in non-oil producing sectors so as to compensate for the reduction in revenues, and
- (4) To maintain the development of the social and health services, vocational training and subsidized housing.

In accordance with these policies, the total amount of R.O. 1,483 million which was originally allocated for development expenditures was finally reduced by 8.7 % to R.O. 1,354 million. The plan was then amended

by the Council of Financial Affairs in its session held on October 19th, 1986.

Examining the trend of actual government revenues and expenditures during three years (1986-88) of the Third Five-year Development Plan, the deficit has reached over R.O. 1.0 billion, despite cutbacks in expenditures. Most of this deficit was financed by the country's reserves, which were built up by the government in previous years, withdrawals from SGRF (State General Reserve Fund) and external borrowing.

In contrast to the original Third Five-year Development Plan, the amended plan was almost completely accomplished due to the relatively stabilized oil prices after the fall in 1986; the actual achievements during those three years are illustrated in Table 2.6.1. The three-year total achievement rate shows revenue of 78.1 % and that of expenditure of 91.8 %. If the contents of expenditures are examined, the achievement of development expenditure and support for the private sector is obviously hindered, as indicated by the three year achievement rates of 78.3 % and 53.0 %, respectively, because of the budget reductions made in the amended Third Five-year Development Plan.

With respect to the development budget for MAF, the total development budget allocated in the Third Five-year Development Plan is R.O. 132 million and the difference between planned and actual budget, R.O.119 million, is R.O. 13 million. If the indicated budget for 1990 is halved because the amount is the requested to the Development Council, the total actual development budget for MAF will be approximately R.O. 107 million. The sector-wise distribution of the MAF development budget is shown in Table 2.6.2. The largest share of 43 % in the budget is distributed to irrigation and dam sector, followed by agriculture and livestock sector 29 % and fisheries sector 19 %.

The MAF share in national civil development expenditure is 3.7 % on an average, in spite of fluctuating within the range of 2.5 - 4.8 % as shown in Table 2.6.3. From the view point of its importance in both work force and rural economy, the share should be raised to an appropriate level.

Table 2.6.1 Actual and Planned Public Finance

Actual and Planned Public Finance (Million R.O., %)

Items	Actual			Planned (3rd 5 Year Development Plan)			Achievement Rate (Actual/Planned)				
	1986	1987	1988 Total	1986	1987	1988 Total	1986	1987	1988 3Y. Total		
Revenues											
Oil Revenue	928.9	1,194.9	993.6	3,117.4	1,409.0	1,399.0	1,466.0	4,273.0	65.9	85.5	67.8
Gas Revenue	37.9	39.0	44.2	121.1	31.0	34.0	39.0	104.0	122.3	114.7	113.3
Custom Duties	37.8	26.9	23.6	93.5							
Corporate Income Tax	25.6	21.2	23.4	78.2							
Interest from Investments	133.5	30.5	8.5	84.1	213.0	222.0	235.0	670.8	62.7	75.1	68.2
Other Revenue	32.8	32.7	6.8	72.3	13.0	18.0	19.8	58.0	252.3	181.7	35.8
Repayment of Loans to the Government											
Total Revenue	1,220.8	1,512.0	1,247.6	3,980.4	1,666.0	1,672.0	1,759.0	5,097.0	73.3	98.4	78.1
Expenditures											
Defence & Security	665.4	533.5	589.2	1,938.2	601.0	604.0	609.0	1,814.0	110.7	86.6	86.7
Civil Recurrent	648.2	848.5	681.9	1,978.6	650.0	789.0	756.0	2,115.0	89.7	91.5	98.2
All Ministries	500.0	599.1	535.2	1,544.3	512.0	547.0	585.0	1,644.0	97.7	93.1	91.5
Interest on Government Loan	75.9	72.9	84.0	232.8	65.0	82.0	85.0	232.0	116.3	88.9	88.8
Gov. Share in Operating expenditure of PDO	72.3	66.5	62.7	201.5	73.0	80.0	86.8	239.0	99.0	83.1	72.9
Development Expenditure	532.4	328.8	288.2	1,141.4	547.0	490.0	421.0	1,458.0	97.3	67.1	68.6
All Ministries	363.1	238.0	203.8	798.9	488.0	358.0	278.0	1,028.0	98.8	65.7	73.3
Gov. Share in Operating expenditure of PDO	169.3	90.8	84.4	342.5	141.0	132.0	136.0	411.0	115.8	87.5	51.2
Support to Private Sector	6.0	0.3	6.8	21.1	6.0	6.0	7.0	19.0	100.0	138.3	97.1
Industrial Sector	10.7	11.0	15.9	37.6	23.0	24.0	24.0	71.0	46.5	45.8	66.3
International, Regional & Local Organization	0.0	0.0	0.5	0.5	10.0	10.0	10.0	30.0	0.0	0.0	5.0
Oman Housing Bank	1.3	0.7	12.1	14.1							
Oman Development Bank	7.1	7.0	2.8	16.1	7.0	7.0	7.0	21.0	181.4	108.0	28.6
Oman Bank for A.F. in Gov. Loans & Participation in Local & Foreign Enterprises	2.0	2.1	1.3	5.4	2.0	3.0	3.0	8.0	100.0	70.8	43.3
Local Expenditures	0.3	1.2	0.0	1.5	4.0	4.0	4.0	12.0	7.5	38.0	0.0
Total Expenditures	38.1	37.2	0.0	87.3	20.0	20.0	20.0	60.0	158.5	166.0	8.0
Total Expenditures	1,886.8	1,609.1	1,567.2	5,093.1	1,841.0	1,847.0	1,830.0	5,518.0	102.5	87.1	85.6
Balance	-666.0	-97.1	-318.6	-1,982.7	-175.0	-175.0	-71.0	-421.0			

Source: Statistical Yearbook 1989
The Third Five-Year Development Plan

Table 2.6.2 Sector-wise Development Budget in MAF

Sector	Adjusted Total	Total till 1989	1990	Balance
Agriculture & Livestock	38,620	26,456	9,455	2,709
General	18,285	10,183	5,450	2,652
Support to Farmers	20,335	16,273	4,005	57
Irrigation & Dam	56,282	41,175	9,100	6,007
Fisheries	25,475	16,695	4,221	4,558
General	20,329	13,141	3,306	3,883
Support to Fishermen	5,145	3,555	916	675
Housing	2,227	2,199	28	
Administration (building, furnitures)	2,869	2,665	204	
General Consultancy Studies	6,380	5,652	711	17
Total	131,853	94,842	23,720	13,291

Table 2.6.3 Development Expenditure by Ministries and Governmental Organizations (R.O. Million)

Ministries	1985	1986	1987	1988
Diwan of Royal Court	94.1	38.9	41.2	63.8
Health	25.9	31.2	10.6	3.8
Education and Youth	16.2	18.1	16.5	11.9
Communication	68.4	54.4	27.4	18.2
Electricity and Water	41.6	41.4	28.5	24.0
Agriculture and Fisheries	25.4	17.5	8.3	10.9
Petroleum and Minerals	13.8	13.5	3.0	14.9
Social Affairs and Labor	10.1	1.2	1.3	1.5
Sultan Qaboos University	38.7	42.7	29.9	19.5
Others	199.5	273.6	162.1	111.7
Total	533.7	532.5	328.8	280.2
Share of MAF (%)	4.8	3.3	2.5	3.9

Source: Statistic Yearbook 1989, Development Council

Note: This Table does not include capital expenditures of civil nature carried out by Defence and National Security

CHAPTER 3

FUTURE SOCIO-ECONOMIC

CHARACTERISTICS

CHAPTER 3 FUTURE SOCIO-ECONOMIC CHARACTERISTICS

Since His Majesty Sultan Qaboos ascended the throne in 1970, basic social infrastructures, such as road networks, transportation, electrification, and telecommunication have been developed, using funds provided by national oil revenues. As a result, the basic framework for infrastructure has been completed.

Along with this, the social structure of Oman is shifting from a closed tribal community system to a new open society as economic development progresses. This tendency is expected to continue as long as the social situation and economy of the country continue to develop.

It is believed that in the future, the national economy will be greatly influenced by the price tendencies of oil. Since oil reserves are estimated at 20 years, the government is making an effort to depend less on oil and to diversify sources of national income.

It is very important for the Fourth Five-year Development Plan to develop industries other than oil and to make an effective attempt at the diversification of national income sources, using the stable oil revenues to do so.

The population growth rate in Oman is expected to be 3.5 % per annum. This is one of the factors which limits the growth of the national income per capita. However, symbolized by the first graduation ceremony of the Qaboos University in 1990, the investment made by the Omani government for development of human resources through education is expected to yield impact in the 1990's, promoting the important policy of Omanization.

The purpose of the 10-year Agricultural Development Plan is to present a realistic yet ambitious program to promote Omani

agriculture, which will form a foundation for the stable development of the economy and society of the Sultanate.

CHAPTER 4

*PROSPECTS FOR DEMAND FOR
AGRICULTURAL PRODUCTS*

CHAPTER 4 PROSPECTS FOR DEMAND FOR AGRICULTURAL PRODUCTS

Further increases in the demand for food are predicted in Oman, in response to rising population. In addition, alterations in the varieties of food are forecast as a result of changes in consumption trends and characteristics. These prospects have been prepared on the basis of the following considerations.

- (1) The target year of these prospects is 2000, the final year of this Master Plan. The year used for comparison is 1988.
- (2) The demand forecast has been prepared on the basis of the following data and analysis:
 - amount of domestic production and imports vs. exports for the last seven years
 - trend of per capita food availability, obtained from analysis based on the above amounts
 - trend of per capita calorie- supply per day analyzed on the basis of the above trend
 - per capita food availability in neighboring countries
- (3) A certain latitude should be allowed in interpreting the figures estimated.

These should, however, be reviewed from time to time on the basis of updated statistical data, analytical methods of statistics and supply and demand of food.

4.1 Trend and Prospects for Demand of Each Product

It is likely that the Omani diet is nearly at a peak now. This is

evidenced by the fact that per capita calorie supply exceeds 2,800 kcal per day.

In the future the diet will shift, little by little, from sheer calorie intake to the consumption of a wider variety of foods. As a result, per capita calorie supply is forecasted to reach 3,000 kcal per day by the year 2000, while maintaining the "Omani-type diet" described in Sub-section 4.2. The trend of supply of each food and annual food supplies per capita in various countries are presented in Tables 4.1.1 and 4.1.2. Prospects for demand of food are shown in Table 4.1.3.

(1) Cereals

Recently, rice consumption has increased rapidly and surpassed wheat consumption, which has remained stable. The gross consumption of cereals indicates a gradual increase as demonstrated by the increase in rice consumption.

This recent change in the relationship of rice and wheat will remain the same in the future, judging from current Omani tastes. Per capita gross supply of cereals will also stabilize in the future.

(2) Vegetables

The recent trend of per capita vegetable consumption in Oman represents a rapid increase and indicates that consumption is higher than most OECD countries in those terms, and at the same level as neighboring countries.

In the future, it is estimated that vegetable consumption will increase slightly along with the diversification of the Omani diet.

(3) Fruit

The total consumption each of dates, limes, lemons, and

Table 4.1.1 Trend of Supply of Food in Oman

NO.	ITEMS	SUPPLIES FOR DOMESTIC CONSUMPTION (ton)						
		1982	1983	1984	1985	1986	1987	1988
1	CEREALS	198,373	156,907	170,220	154,978	198,363	138,754	191,765
2	VEGETABLES	87,744	98,040	112,954	111,999	131,851	162,066	209,599
3	TUBERS	2,438	2,626	2,800	3,626	3,726	14,873	17,016
4	BEANS,NUTS	700	844	754	613	562	509	2,279
5	FRUITS	157,675	180,812	171,549	180,553	185,771	176,343	179,390
	DATES	74,739	76,569	75,706	81,320	83,367	89,311	95,195
	OTHERS	82,936	104,243	95,843	99,232	102,403	87,032	84,195
6	SUGAR	17,666	25,292	37,730	22,007	24,771	28,254	38,322
7	OIL	9,154	12,818	14,538	18,089	15,127	19,244	20,541
8	SAUCE,SPICES	5,915	6,923	6,748	7,412	7,523	9,299	8,689
9	BEVERAGES	32,146	39,132	51,693	43,299	33,938	20,856	8,971
10	OTHER FOODS	3,528	4,504	-1,320	9,212	8,935	10,048	9,516
11	FISH	77,914	95,360	88,414	82,856	79,120	100,220	82,770
12	ANIMAL PRODUCTS	154,151	164,377	183,615	187,633	223,849	207,960	199,139
	MILK PRODUCTS	114,165	117,599	127,224	128,515	160,764	151,720	139,437
	RED MEAT	18,636	19,528	22,166	23,363	25,135	22,198	22,885
	CHICKEN	16,600	20,000	26,000	26,500	27,400	24,495	26,443
	EGG	4,750	7,250	8,225	9,255	10,550	9,547	10,374
	TOTAL							

Table 4.1.1 (continued)

NO.	ITEMS	SUPPLIES OF GROSS FOOD PER CAPITA(kg/year)							SUPPLIES OF NET FOOD PER CAPITA (kg/year)						
		1982	1983	1984	1985	1986	1987	1988	1982	1983	1984	1985	1986	1987	1988
1	CEREALS	179.5	135.7	140.7	122.4	149.8	100.2	132.4	161.5	122.1	126.6	110.2	134.9	90.2	119.1
2	VEGETABLES	58.3	61.9	68.4	62.7	71.7	86.3	109.3	47.4	50.4	56.2	51.4	59.1	70.6	91.4
3	TUBERS	2.5	5.7	-3.5	11.7	8.8	9.7	10.7	2.3	5.1	-3.1	10.5	7.9	8.7	9.6
4	BEANS,NUTS	0.6	0.7	0.6	0.5	0.4	0.4	1.6	0.6	0.7	0.6	0.5	0.4	0.4	1.6
5	FRUITS	116.4	128.2	115.3	115.8	113.9	103.1	98.9	94.8	103.8	93.0	93.8	92.4	85.1	80.8
	DATES	53.2	52.2	48.7	50.0	49.2	50.5	51.3	50.6	49.6	46.3	47.5	46.7	48.0	48.7
	OTHERS	63.2	76.0	66.6	65.7	64.7	52.6	47.6	44.2	54.3	46.7	46.2	45.7	37.1	32.0
6	SUGAR	16.1	22.1	31.5	17.6	18.9	20.6	26.7	16.1	22.1	31.5	17.6	18.9	20.6	26.7
7	OIL	8.4	11.2	12.1	14.4	11.5	14.0	14.3	8.4	11.2	12.1	14.4	11.5	14.0	14.3
8	SAUCE,SPICES	4.8	5.3	4.9	5.1	4.9	5.8	5.1	4.8	5.3	4.9	5.1	4.9	5.8	5.1
9	BEVERAGES	29.4	34.2	43.2	34.6	25.9	15.2	6.3	29.4	34.2	43.2	34.6	25.9	15.2	6.3
10	OTHER FOODS	3.2	3.9	-1.1	7.4	6.8	7.3	6.6	2.7	3.3	-0.9	6.1	5.7	6.1	5.5
11	FISH	71.2	83.3	73.8	66.1	60.4	73.1	57.7	36.3	42.5	37.6	33.7	30.8	37.3	29.4
12	ANIMAL PRODUCTS	138.4	141.1	150.7	147.2	167.8	149.0	136.5	129.3	131.2	139.4	135.9	156.4	139.3	126.6
	MILK PRODUCTS	102.3	100.8	104.2	100.6	120.3	108.6	95.4	102.3	100.8	104.2	100.6	120.3	108.6	95.4
	RED MEAT	16.8	16.8	18.3	18.4	18.9	16.0	15.8	11.8	11.8	12.8	12.9	13.3	11.2	11.0
	CHICKEN	15.0	17.3	21.4	20.9	20.7	17.7	18.2	11.5	13.3	16.5	16.1	15.9	13.6	14.0
	EGG	4.3	6.2	6.7	7.2	7.9	6.8	7.1	3.7	5.4	5.9	6.3	6.9	5.9	6.2
	TOTAL														

Source: Estimate by JICA team.

Table 4.1.1 (continued)

NO.	ITEMS	DAILY CALORIE SUPPLIES PER CAPITA (kcal/day)						
		1982	1983	1984	1985	1986	1987	1988
1	CEREALS	1,596	1,213	1,257	1,094	1,342	890	1,181
2	VEGETABLES	37	38	42	38	45	54	68
3	TUBERS	5	11	-6	23	17	19	21
4	BEANS, NUTS	7	8	7	6	5	4	18
5	FRUITS	363	369	341	348	342	336	336
	DATES	295	289	270	277	273	280	284
	OTHERS	68	80	71	70	69	56	52
6	SUGAR	169	232	331	184	198	216	280
7	OIL	212	283	307	366	292	355	363
8	SAUCE, SPICES	23	25	20	21	18	25	19
9	BEVERAGES	0	0	0	0	0	0	0
10	OTHER FOODS	11	14	-4	26	24	26	23
11	FISH	133	155	138	123	113	136	108
12	ANIMAL PRODUCTS	435	435	453	458	482	429	411
	MILK PRODUCTS	287	270	264	268	289	264	244
	RED MEAT	77	77	84	85	87	73	73
	CHICKEN	55	64	79	77	76	65	67
	EGG	16	24	26	28	30	26	27
	TOTAL	2,992	2,784	2,886	2,686	2,879	2,491	2,828

Table 4.1.1 (continued)

NO.	ITEMS	DAILY PROTEIN SUPPLIES PER CAPITA (g/day)							DAILY FAT SUPPLIES PER CAPITA (g/day)						
		1982	1983	1984	1985	1986	1987	1988	1982	1983	1984	1985	1986	1987	1988
1	CEREALS	37.4	30.5	31.3	27.1	34.6	20.6	28.7	7.2	5.9	6.0	5.2	6.6	3.9	5.5
2	VEGETABLES	1.6	1.7	1.9	1.7	2.0	2.4	3.0	0.4	0.4	0.5	0.4	0.5	0.6	0.7
3	TUBERS	0.1	0.3	-0.2	0.6	0.4	0.5	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.1
4	BEANS, NUTS	0.5	0.6	0.5	0.4	0.3	0.3	1.3	0.4	0.4	0.4	0.3	0.2	0.2	0.9
5	FRUITS	3.4	3.5	3.2	3.2	3.2	3.1	3.0	0.4	0.5	0.5	0.5	0.4	0.4	0.3
	DATES	2.4	2.3	2.2	2.2	2.2	2.2	2.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	OTHERS	1.0	1.2	1.0	1.0	1.0	0.8	0.7	0.3	0.4	0.3	0.3	0.3	0.2	0.2
6	SUGAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	OIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.9	30.7	33.2	39.6	31.6	38.5	39.2
8	SAUCE, SPICES	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
9	BEVERAGES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	OTHER FOODS	0.9	1.1	-0.3	2.0	1.8	2.0	1.8	0.5	0.6	-0.2	1.1	1.0	1.0	1.0
11	FISH	18.6	21.8	19.3	17.3	15.8	19.1	15.1	5.8	6.7	6.0	5.4	4.9	5.9	4.7
12	ANIMAL PRODUCTS	21.8	23.4	26.2	25.9	27.8	23.9	23.2	32.1	31.3	31.7	32.6	33.3	30.0	29.0
	MILK PRODUCTS	8.6	8.7	9.1	8.8	10.4	9.1	8.2	22.2	20.5	19.4	20.2	20.6	19.1	18.1
	RED MEAT	5.8	5.8	6.3	6.3	6.5	5.5	5.4	5.6	5.6	6.1	6.1	6.3	5.3	5.3
	CHICKEN	6.2	7.1	8.8	8.6	8.5	7.3	7.5	3.1	3.6	4.5	4.4	4.3	3.7	3.8
	EGG	1.2	1.8	2.0	2.1	2.3	2.0	2.1	1.1	1.7	1.8	1.9	2.1	1.8	1.9
	TOTAL	84.7	83.2	82.2	78.5	86.3	72.2	77.0	69.9	76.8	78.3	85.3	78.9	80.8	81.7

Source: Estimate by JICA team.

Table 4.1.2 Annual Food Supplies per Capita in Various Countries

COUNTRY	YEAR	CEREALS	TUBERS	SUGARS	PULSES	VEGETA-	FRUITS	MEATS	EGGS	MILK	FISH	OILS
			STARCH			IBLES						
AUSTRALIA	1985	60.1	58.3	47.8	4.6	78.9	94.4	107.8	11.2	304.6	8.1	16.2
CANADA	1985	72.6	68.1	44.0	6.4	84.3	87.8	96.5	11.9	291.1	7.2	20.9
DENMARK	1985	74.1	64.9	36.2	2.9	72.8	52.8	83.1	16.3	331.0	45.6	28.1
FRANCE	1983	85.2	76.7	34.7	3.4	112.9	78.3	108.8	14.7	357.1	18.1	22.0
WEST GERMANY	1985	76.7	78.2	42.0	4.3	80.7	108.6	99.8	17.0	315.6	6.4	19.0
ITALY	1985	120.0	35.7	27.1	7.1	151.6	113.1	83.8	10.9	278.8	8.1	26.5
NETHERLANDS	1985	63.8	86.8	41.4	9.9	63.4	152.2	79.3	11.7	310.0	10.4	35.4
SPAIN	1985	83.0	111.1	33.6	9.0	131.2	150.0	74.6	16.5	194.8	25.4	26.3
SWEDEN	1985	76.2	70.3	43.4	3.0	46.6	71.9	53.9	11.9	391.3	17.4	31.9
SWITZERLAND	1985	69.1	46.5	38.5	6.3	90.6	111.2	86.0	12.4	422.4	7.0	14.6
UNITED KINGDOM	1985	86.6	110.2	37.3	3.4	96.4	51.0	74.3	13.5	294.5	15.0	29.3
U.S.A.	1985	63.8	31.0	70.1	6.9	98.6	69.6	117.5	15.1	261.3	7.1	31.2
JAPAN	1987	105.2	37.1	21.5	9.7	129.4	54.2	38.1	18.6	75.5	71.5	14.1
EGYPT	1979-81	228.1	23.5	59.1	7.2	145.4	46.8	15.3	1.8	20.9	4.9	16.5
KUWAIT	1979-81	154.2	18.0	49.7	5.9	150.0	106.9	79.2	13.6	166.9	10.3	16.2
SAUDI ARABIA	1979-81	149.4	10.2	29.0	3.2	111.6	158.6	48.6	3.6	116.4	9.2	13.0
U.A.E.	1979-81	120.2	14.7	41.7	5.7	195.2	137.9	68.8	16.5	138.2	24.7	24.4
OMAN	1988	119.1	10.7	26.7	1.6	109.3	98.9	34.0	7.1	95.4	57.7	14.3

source:

- 1) OECD 'Food Consumption Statistics'
- 2) Ministry of Agriculture, Forestry and Fisheries of JAPAN 'Food Balance Sheets, 1987'
- 3) FAO 'Food Balance Sheets, 1979-81 Average'
- 4) Royal Oman Police 'Foreign Trade Statistics, 1988'
- 5) MAF of OMAN, Department of Agricultural Statistics

explanatory notes:

- 1) Values for cereals, pulses and oils are those of net foods, others are those of gross foods
- 2) Milk includes butter and other food made from milk, and the amounts were converted into those of fresh milk
- 3) Values for EGYPT, KUWAIT, SAUDI ARABIA and U.A.E. are average values of '79, '80 and '81.

Table 4.1.3 Prospects for Demand for Foods in Oman

NO. ITEMS	DEMANDS FOR DOMESTIC CONSUMPTION (TON)				DEMANDS OF GROSS FOOD (TON)				DEMANDS OF GROSS FOOD PER CAPITA (kg/year)				DEMANDS OF NET FOOD PER CAPITA (kg/year)				CALORIES PER CAPITA (kcal/day)			
	1988	1995	2000		1988	1995	2000		1988	1995	2000		1988	1995	2000		1988	1995	2000	
1 CEREALS	191,765	264,455	314,077	189,843	262,075	311,250	132.4	142.1	142.1	119.1	127.9	127.9	1,181	1,267	1,267		1,181	1,267	2,000	
2 VEGETABLES	209,599	262,785	312,767	156,693	214,081	280,552	109.3	116.1	128.1	91.4	96.5	106.5	68	71	78		68	71	78	
3 TUBERS	17,016	19,382	22,754	15,342	17,513	21,434	10.7	9.5	9.8	9.6	8.5	8.8	21	19	19		21	19	19	
4 BEANS,NUTS	2,279	1,285	1,526	2,233	1,259	1,496	1.6	0.7	0.7	1.6	0.7	0.7	18	8	8		18	8	8	
5 FRUITS	179,390	245,227	284,346	141,868	203,435	239,872	98.9	110.3	109.5	80.8	90.6	90.3	336	345	344		336	345	344	
6 DATES	95,195	114,751	132,892	73,583	93,545	111,098	51.3	50.7	50.7	48.7	48.2	48.2	284	281	281		284	281	281	
7 OTHERS	84,195	130,476	151,454	68,284	109,890	128,775	47.6	59.6	58.8	32.0	42.4	42.1	52	63	62		52	63	62	
8 SUGAR	38,322	40,439	48,026	38,322	40,439	48,026	26.7	21.9	21.9	26.7	21.9	21.9	280	230	230		280	230	230	
9 OIL	20,541	32,340	42,406	20,541	32,340	42,406	14.3	17.5	19.4	14.3	17.5	19.4	363	444	490		363	444	490	
10 SAUCE,SPICES	8,689	11,667	14,041	7,335	10,356	12,981	5.1	5.6	5.9	5.1	5.6	5.9	19	18	18		19	18	18	
11 BEVERAGES	8,971	49,690	59,485	8,971	49,690	59,485	6.3	26.9	27.2	6.3	26.9	27.2	0	0	0		0	0	0	
12 OTHER FOODS	9,516	9,006	10,696	9,516	9,006	10,696	6.6	4.9	4.9	6.6	4.9	4.9	23	17	17		23	17	17	
13 FISHES	82,770	127,905	151,905	82,770	127,905	151,905	57.7	69.4	69.4	29.4	35.4	35.4	108	129	129		108	129	129	
14 ANIMAL PRODUCTS	199,139	277,221	329,626	195,714	272,452	323,918	136.5	147.8	147.9	126.6	136.8	136.8	411	425	420		411	425	420	
15 MILK PRODUCTS	139,437	192,698	228,107	136,801	189,010	223,727	95.4	102.5	102.2	95.4	102.5	102.2	244	240	233		244	240	233	
16 RED MEAT	22,885	34,172	41,692	22,610	33,799	41,234	15.8	18.3	18.8	11.0	12.8	13.2	73	84	87		73	84	87	
17 CHICKEN	26,443	36,901	43,827	26,126	36,437	43,274	18.2	19.8	19.8	14.0	15.2	15.2	67	73	73		67	73	73	
18 EGG	10,374	13,450	16,000	10,177	13,205	15,683	7.1	7.2	7.2	6.2	6.2	6.2	27	28	28		27	28	28	
TOTAL													2,828	2,973	3,022		2,828	2,973	3,022	

Source: Estimate by JICA team.

mangoes, is higher than in any of Oman's neighbors and has recently maintained a stable level. Banana and coconut consumption in the country is also higher than in neighboring countries, however, it has recently decreased gradually. The consumption of oranges, grapes and other fruits is still lower than most OECD countries but remains stable.

Accordingly, it is estimated that banana and coconut consumption will decrease slightly and other fruit consumption will remain the same.

(4) Livestock Products

(a) Dairy Products

(i) Liquid dairy products

In recent years, the per capita consumption of liquid dairy products has remained stable at 100 kg per annum. Among these products, however, fresh milk, the taste of which is highly favored, shows an increase in the ordinary consumption market.

A gradual increase in per capita fresh milk consumption is in evidence, and this tendency can be expected to continue in the future as well, though the per capita demand for liquid dairy products as a whole seems likely to remain stable in future.

A demand forecast has been made on the basis of the above demand trends and the following assumptions:

- a) The present per capita demand for liquid dairy products is set at 100 kg/year and will not change in the future.
- b) The local inhabitants (traditional Omani) mainly consume local milk at home, and occasionally consume reconstituted (skim) milk.

- c) For the purpose of simplification, the low income earners are assumed to consume reconstituted milk, the retail price of which is about one-half the price of fresh milk.
- d) For the same reason, the higher-priced fresh milk is assumed to be only consumed by the upper and middle class income earners, and high income earners are assumed to consume two times the amount of fresh milk consumed by the middle class income earners.
- e) The increasing rate of fresh milk consumption in the future is estimated at 2.85 percent per annum which is the same as it was in the past.
- f) The estimated population share of the low income earners in 1987 is accounted for in the future as well.

Figure 4.1.1 and Table 4.1.4 indicate the demand forecasts for liquid dairy products in 1995 and 2000, estimated on the basis of the above assumptions.

The demand for fresh milk in 2000 is estimated at 16 thousand tons, which corresponds to slightly more than double that in 1987.

(ii) Cheese and Butter

A part of the local milk produced in the rural area is generally processed into cheese and butter by the family themselves, for their own consumption. However, quantified data are not available. Furthermore, the cheese and butter available in the market are solely imported products.

Recently, the per capita consumption of cheese has been constant at 1.5 to 2.0 kg and that of butter gradually reduced by 2.5 percent per annum. The recent per capita daily calorie intake is estimated to exceed 2,800 kcal; therefore, in

Figure 4.1.1 Estimate of Per Capita Consumption of Fresh Milk

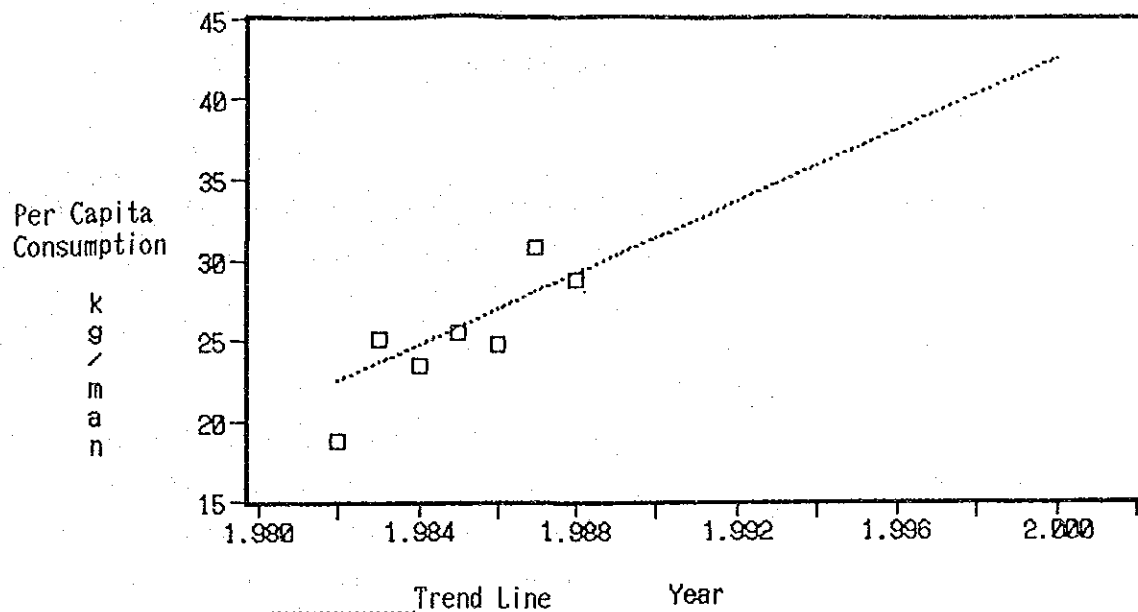


Table 4.1.4

Estimated Demand for fresh Milk

YEAR	HIGH INCOME GROUP			MIDDLE INCOME GROUP			TOTAL DEMAND (tonnes)
	POPULATION ('000)	CONSUMPTION PER CAPITA (kg/year)	TOTAL CONSUMPTION (tonnes)	POPULATION ('000)	CONSUMPTION PER CAPITA (kg/year)	TOTAL CONSUMPTION (tonnes)	
1987	78	46.4	3,603	160	23.2	3,708	7,310
1995	104	55.8	5,822	215	27.9	5,992	11,813
2000	124	64.2	7,959	255	32.1	8,191	16,151

accordance with a favorable diet, i.e. the reduction of the fat intake, butter consumption will continue to decrease for the time being.

Figure 4.1.2 and Table 4.1.5 show demand forecasts for cheese and butter under the following conditions:

- future per capita cheese consumption is estimated at a constant 1.76 kg; and
- per capita butter consumption reduces by 2.5 % per annum until 1995, and maintains a constant figure of 3.22 kg after that.

(b) Red Meat (Mutton and Beef)

In connection with the demand tendency for red meat in recent years, with respect to mutton, although the imports of live animals show an increase, per capita consumption has indicated decreases since 1986 (when peak consumption was recorded) due to reductions in imported cold and frozen meat. Regarding beef, imports have increased and the per capita consumption also shows a steadily increasing tendency.

The demand forecast has been made on the basis of the above trends and the following assumptions.

- (i) Per capita mutton consumption shows a tendency to decrease as described above, however, with respect to mutton, which appeals to the Omanis' taste, it should not be simply assumed that this tendency will continue in the future because domestic production is an assumed figure and not definite. Therefore, a constant value of 13.7 kg, which is the average of the past seven years has been adopted for per capita mutton consumption up until 2000.
- (ii) With respect to the consumption of beef, it can be predicted that the recent trends to increase will continue for the time

Figure 4.1.2 Transition and Estimate Per Capita Consumption Butter and Cheese

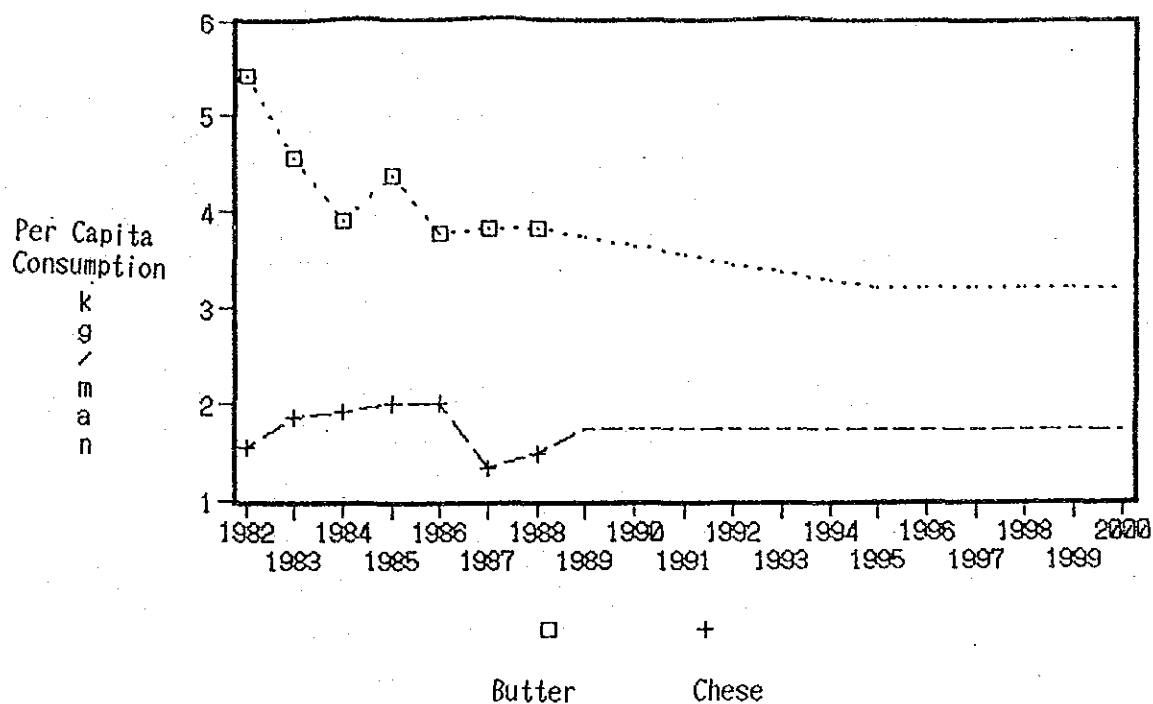


Table 4.1.5

Estimated Demand for Butter and Cheese

Year	Population (,000)	Butter		Cheese	
		Consumption PER CAPITA (kg/man)	Total Demand (tonnes)	Consumption PER CAPITA (kg/man)	Total Demand (tonnes)
1987	1,371	3.81	5,227	1.35	1,849
1995	1,844	3.22	5,929	1.76	3,246
2000	2,190	3.22	7,042	1.76	3,856

being. This increasing rate, however, is forecast to be slightly lower than the past ratio of, just 2.6 % per annum, due to the following reasons:

- the per capita daily caloric intake exceeds 2,800 kcal which is already considered sufficient,
- the per capita livestock products consumption will not decrease except for butter, as described above.

Consequently, the future increasing rate of beef consumption is estimated to be 2% per annum.

Figure 4.1.3 shows the past per capita mutton and beef consumption. On the basis of this figure, the proposed demands for mutton and beef are estimated for the years 1995 and 2000 and are exhibited in Table 4.1.6 and Figure 4.1.4.

As a result, the estimated demands are about 30,000 and 12,000 ton for mutton and beef, respectively, and the total demand for red meat in 2000 is estimated to be as high as 1.8 times the demand in 1988.

(c) Chicken and eggs

In recent years, per capita consumption has been stagnant at approximately 150 chickens and 20 kg of eggs per annum although the nation's gross demand indicates an increase in demand for both. Taking this situation into account, per capita demand for both chicken and eggs is estimated, assuming that the average per capita consumption during the last five years from 1984 to 1988 is applicable to the year 2000.

Thus, the predicted demands for chicken and eggs are shown in Table 4.1.7 and 4.1.8, respectively for the years after 1989. In accordance with an increase in the population, an increase of more than 50 percent in the demand for both chicken

Figure 4.1.3 Transition and Estimate Per Capita Consumption of Red Meat

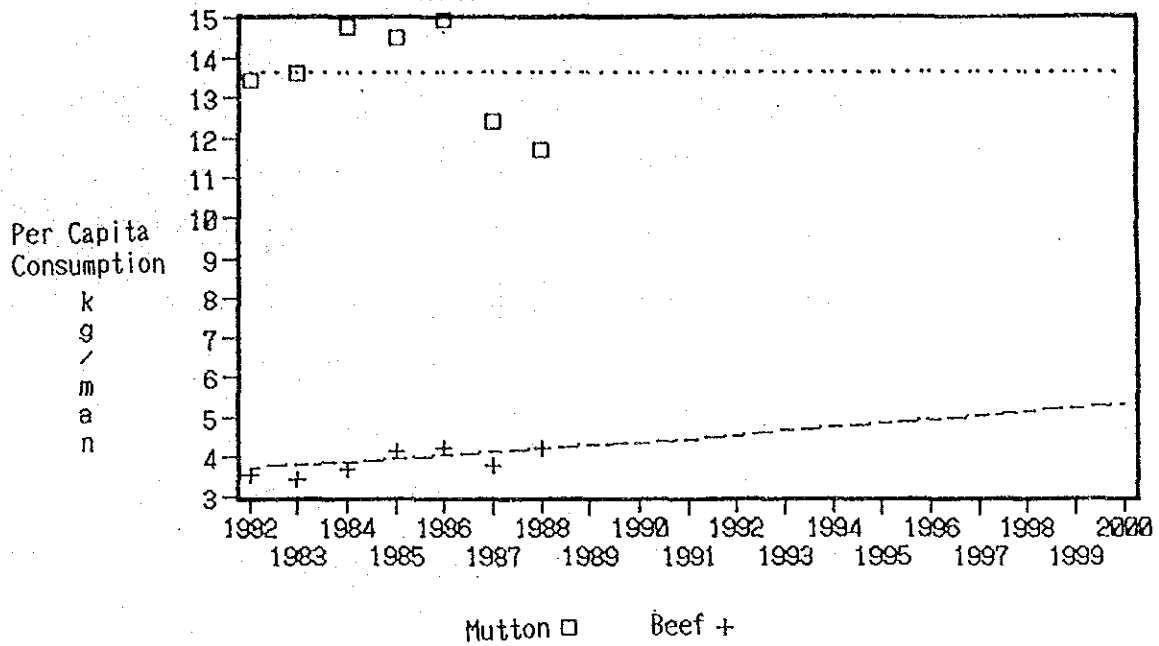


Figure 4.1.4 Transition and Estimate of Gross Demand for Red Meat

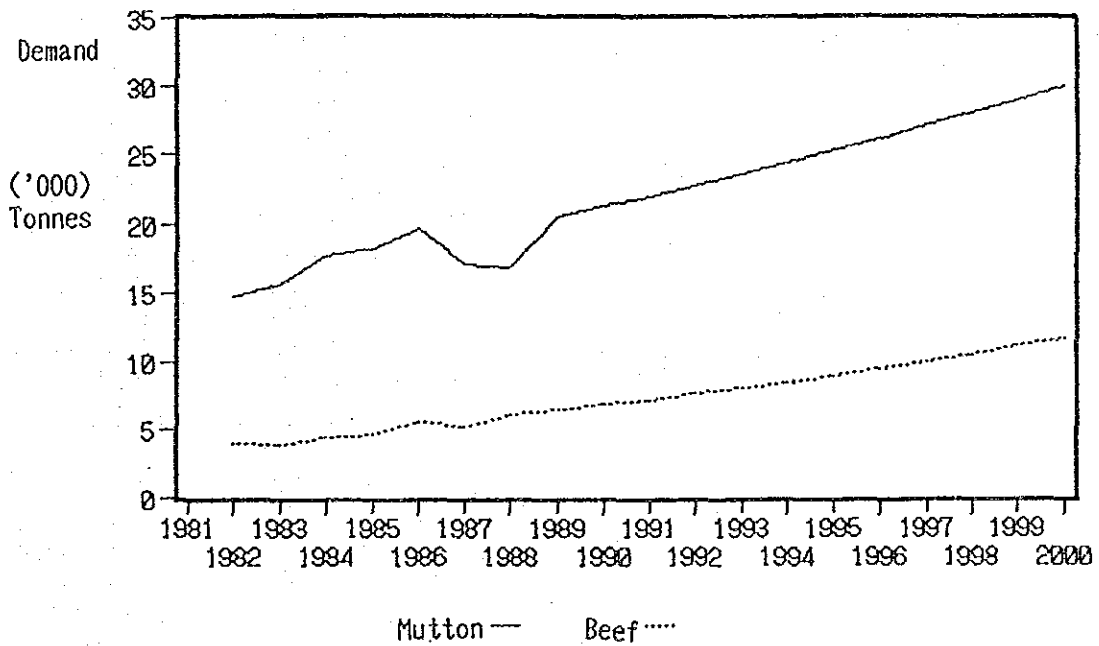


Table 4.1.6 Per Capita Consumption and Total Demand for Mutton and Beef during the Period 1988-2000

Year	Consumption (kg)			Population (Thousands)	Total Demand (ton)		
	Per Capita Mutton	Beef	Total		Mutton	Beef	Total
1988	11.7	4.2	16.0	1,434	16,828	6,057	22,885
1995	13.7	4.9	18.5	1,844	25,226	8,946	34,172
2000	13.7	5.4	19.0	2,190	29,961	11,731	41,692

Table 4.1.7 Estimated Demand for Poultry Meat
IN OMAN : 1988 - 2000

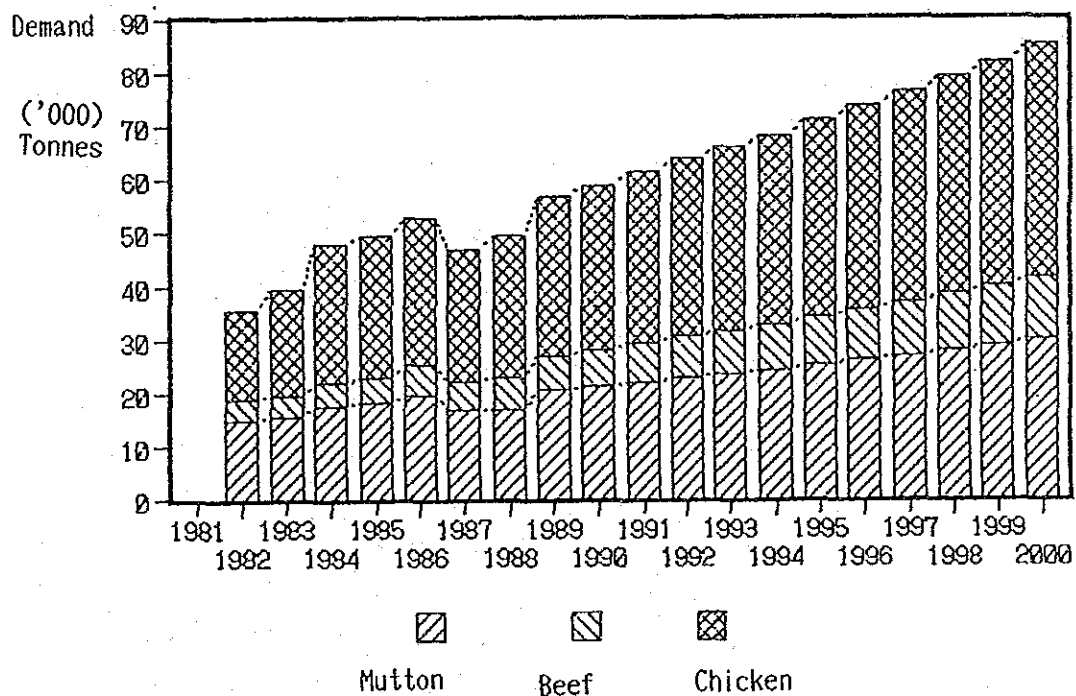
YEAR	PROJECTED POPULATION ('000)	TOTAL MEAT CONSUMPTION ('000kg)	PERCENTAGE CONTRIBUTED BY POULTRY	POULTRY CONSUMPTION ('000kg)	PER CAPITA CONSUMPTION OF POULTRY MEAT (kg)
1989	1,500	56,995	53	30,019	20.0
1990	1,553	59,123	53	31,070	20.0
1991	1,607	61,333	52	32,157	20.0
1992	1,663	63,628	52	33,283	20.0
1993	1,721	66,011	52	34,448	20.0
1994	1,782	68,487	52	35,654	20.0
1995	1,844	71,058	52	36,901	20.0
1996	1,908	73,730	52	38,193	20.0
1997	1,975	76,504	52	39,530	20.0
1998	2,044	79,387	52	40,913	20.0
1999	2,116	82,383	51	42,345	20.0
2000	2,190	85,495	51	43,827	20.0

Table 4.1.8

Estimated Demand for Table Eggs
in Oman 1989-2000

YEAR	PROJECTED POPULATION (‘000)	PER CAPITA CONSUMPTION (Nos)	TOTAL DEMAND (millions)
1989	1,500	146.0	219
1990	1,553	146.0	227
1991	1,607	146.0	235
1992	1,663	146.0	243
1993	1,721	146.0	251
1994	1,782	146.0	260
1995	1,844	146.0	269
1996	1,908	146.0	279
1997	1,975	146.0	288
1998	2,044	146.0	298
1999	2,116	146.0	309
2000	2,190	146.0	320

Figure 4.1.5 Transition and Estimate of Gross Demand for All Meat



and eggs is predicted for the year 2000, compared with that in 1988.

Figure 4.1.5 depicts the estimated and predicted demand for all meat, including red meat, for the period between 1982 to 2000.

(5) Others

Sugar consumption for the last seven years has been almost constant. Recently, oil and fat consumption have increased considerably. Accordingly, in the future, sugar consumption is expected to remain stable, while oil and fat consumption is expected to increase slightly considering future diet intentions, and the fact that present per capita calorie supply has already reached a higher level.

4.2 Trends and Prospects for Nutrition Supply Levels

The per capita calorie supply is estimated to exceed 2,800 kcal, as indicated in Table 4.1.1. Also, per capita protein supply has probably reached 80 grams per day, which is regarded as barely sufficient. The calorie supply consists of cereals such as rice and wheat which provide 40 to 50 percent of the total, other food such as meat, vegetables, fruits and seafood make up the rest. Therefore, on average, Omanis have a nutritionally well-balanced combination of food.

The estimated PFC balance in the calorie supply, namely, the proportions of protein, fat and carbohydrate, represents the appropriate proportion for maintaining health as shown in Figure 4.2.1 and Table 4.2.1. Except that the ratio of protein shows a slightly low figure, the Omani diet's proportions are almost within the range of the ideal PFC balance, which is also aimed for in Japan. It differs in this from the fat-biased proportions in western countries and from the carbohydrate-biased proportions in developing countries. Maintaining the present proportion in future is, therefore, essential for maintaining the health of the Omani people.

(%)

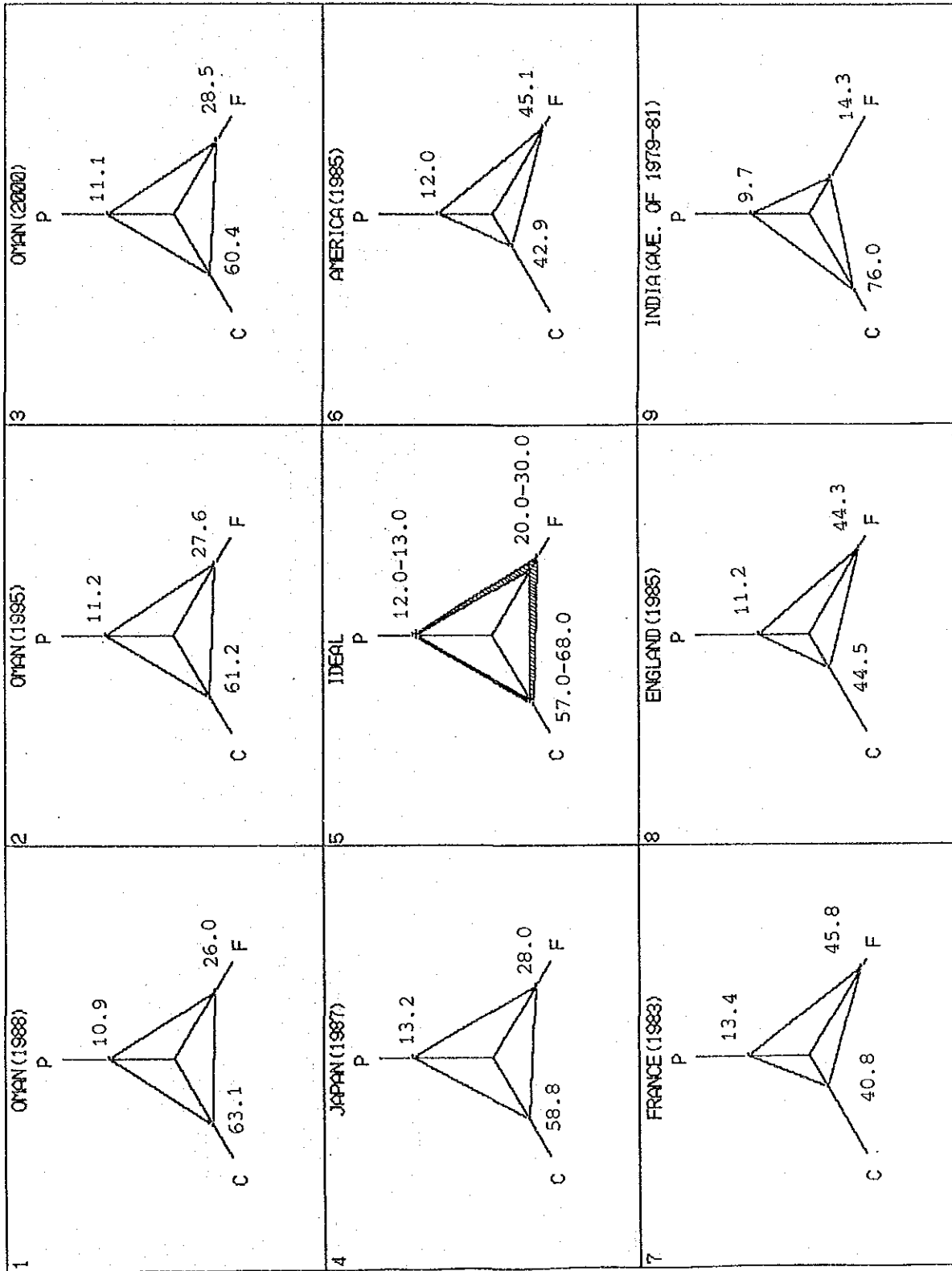


Figure 4.2.1 PFC Balance of Oman and Other Countries

(note) P, F and C represent Protein, Fat and Carbohydrates, respectively

Table 4.2.1 PFC Balance of Oman and Other Countries

	1982	1983	1984	1985	1986	1987	1988	1985	2000
(1) OMAN									
PROTEIN SUPPLIES (g/capita/day)	84.7	83.2	82.2	78.5	86.3	72.2	77.0	83.2	83.7
FAT SUPPLIES (g/capita/day)	69.9	76.8	78.3	85.3	78.9	80.8	81.7	91.2	95.6
CALORIE SUPPLIES TOTAL (kcal/capita/day)	2,992	2,784	2,886	2,686	2,879	2,491	2,828	2,973	3,022
PROTEIN	339	333	329	314	345	289	308	333	335
FAT	629	692	705	788	710	727	735	820	861
CARBOHYDRATE	2,023	1,760	1,852	1,604	1,824	1,475	1,785	1,820	1,826
PFC BALANCE (%)	11.3	12.0	11.4	11.7	12.0	11.6	10.9	11.2	11.1
FAT(F)	21.0	24.8	24.4	28.6	24.7	29.2	26.0	27.6	28.5
CARBOHYDRATE(C)	67.6	63.2	64.2	59.7	63.4	59.2	63.1	61.2	60.4

Source: Estimate by JICA team.

	JAPAN (1987)	AMERICA (1985)	FRANCE (1983)	ENGLAND (1985)	INDIA (AVE. OF 1979-81)	(cf.) IDEAL BALANCE	
						(MAX)	(MIN)
PFC BALANCE (%)	13.2	12.0	13.4	11.2	9.7	13.0	12.0
FAT(F)	28.0	45.1	45.8	44.3	14.3	30.0	20.0
CARBOHYDRATE(C)	58.8	42.9	40.8	44.5	76.0	68.0	57.0

(2) Other Countries

Source: 1) OECD "Food Consumption Statistics"
 2) Ministry of Agriculture, Forestry and Fisheries of JAPAN "Food Balance sheet, 1987"
 3) FAO "Food Balance Sheets, 1979-81"

CHAPTER 5

ESTABLISHMENT OF DEVELOPMENT TARGETS

CHAPTER 5 ESTABLISHMENT OF DEVELOPMENT TARGETS

Taking into account the tendencies of the socio-economy of the Sultanate of Oman and the present situation of agriculture, the overall targets of this Master Plan for Agricultural Development were established as follows.

- (1) Increase in food self-sufficiency
- (2) Promotion of agricultural productivity
- (3) Security of water resources and efficient utilization
- (4) Improvement of the agricultural structure
- (5) Stimulation of rural socio-economy through promotion of agriculture
- (6) Human resources development
- (7) Achievement of a 6.3 % annual average growth rate in the GDP

(1) Increase in Food Self-Sufficiency

The caloric supply per capita in Oman was estimated at 2,830 kcal in 1988, and is expected to be 3,000 kcal by the year 2000.

The Omani diet is characterized by a more appropriate PFC balance (the caloric proportions of the supply of protein, fat and carbohydrate) than is present in the diets of many other countries. Therefore, the expansion of agricultural production should be promoted, maintaining the "Omani type of diet".

Considering the natural conditions in Oman, it is not practical to expect full attainment of self-sufficiency in the entire agricultural production spectrum.

Therefore, it is essential to draw up a future plan for agricultural production with regards to various conditions such as the importance of each item of agricultural produce in terms of nutrition and agricultural production.

As a result, the goal for self-sufficiency is set at a rate of 55% for the year 2000, from the level of 44%, achieved in 1988 (Table 5.1.1 and 5.1.2).

(2) Promotion of Agricultural Productivity

The population in the country in the year 2000 is estimated at 2.2 million. This corresponds to a 46% increase against 1.5 million in 1989, at an increase rate of 3.5% per annum. Consequently, more cropping will be required to feed the population if the level of self-sufficiency is to be maintained up to and beyond the year 2000. However, as the potential water resources are restricted, the volume of water available for this may not be sufficient even if the crop planting area is enlarged horizontally. Therefore, vertical expansion, that is, the increase of agricultural productivity, will be required.

(3) Securing of Water Resources and Efficient Utilization

In arid areas like Oman, where rainfall is insufficient, the usable volume of water is a dominant limiting factor in agricultural production, as well as in the daily lives of the people.

As His Majesty Sultan Qaboos declared, water resources are considered national property and should be shared among the people of the country. Therefore, it is imperative that water resources be developed, managed and preserved from a national point of view.

Comprehensive efforts should be made to secure water resources and to use them effectively, and the following should be considered:

- Water conservation,
- Reinforcement of already-exploited aquifers,
- Exploitation of untapped aquifers, and
- Legal controls

Table 5.1.1 Trends and Prospects for Integrated Self-Sufficiency Rates of Edible Agricultural Products of OMAN
(1,000 R.O., %)

ITEM	YEAR	1982	1983	1984	1985	1986	1987	1988	1989	2000
import value	(1)	101,978	109,834	123,863	126,674	131,579	128,513	148,472	138,542	154,560
export value	(2)	6,254	8,115	9,574	11,453	11,026	12,882	15,963	4,347	4,896
net import value	(3)=(1)-(2)	95,724	101,719	114,289	115,221	120,553	115,631	132,509	134,195	149,664
crop products value	(4)	30,428	32,436	34,444	37,307	39,779	42,536	46,155	67,209	78,253
animal products value	(5)	41,707	47,410	52,186	54,167	56,411	55,566	56,321	69,075	102,532
total products value	(6)=(4)+(5)	72,135	79,846	86,630	91,474	96,190	98,102	102,476	136,284	180,785
self-sufficiency rate (%)		43.0	44.0	43.1	44.3	44.4	45.9	43.6	50.4	54.7
(7)=(6)*100/((3)+(6))										

explanatory notes:

- 1) Methods of estimating the figures of this table are explained in volume 5, section 2.4.(5).
- 2) Figures of (1) and (2) from 1982 - 1988 are derived from the Foreign Trade Statistics (1986 and 1988, Royal Oman Police). Edible agricultural products were selected and the values of those were summed up by the JICA team. The values of non-edible plant and animal products were excluded from these figures.
- 3) Figures of (4) and (5) from 1982 - 1988 were estimated by the JICA team, from Table 2.1.4 in volume 5.
- 4) Figures of prospects for 1995 and 2000 were estimated by the JICA team, from Table 2.1.7 in volume 5.

Table 5.1.2 Prospects for Supply of Agricultural Products of Oman

NO. ITEMS	IMPORT OR EXPORT (-) AMOUNT PROSPECTS (TON)				PRODUCTION AMOUNT PROSPECTS (TON)				CULTIVATION AREA PROSPECTS (ha)				DEMANDS FOR DOMESTIC CONSUMPTION (TON)			
	1988	1995	2000		1988	1995	2000		1988	1995	2000		1988	1995	2000	
1 CEREALS	191,021	263,435	312,757		744	1,020	1,320	468	500	550		191,765	264,455	314,077		
2 VEGETABLES	75,690	89,835	108,762		133,909	172,950	204,005	7,585	7,384	7,488		209,599	262,785	312,767		
3 TUBERS	11,116	0	-0		5,900	19,382	22,754	308	715	795		17,016	19,882	22,754		
4 BEANS,NUTS	2,279	1,285	1,526		0	0	0	0	0	0		2,279	1,285	1,526		
5 FRUITS	11,948	-3,540	-2,154		167,442	248,768	286,500	35,087	35,825	35,977		179,390	245,227	284,346		
DATES	-4,805	-11,899	-12,128		100,000	126,651	145,020	24,170	24,170	24,170		95,195	114,751	132,892		
OTHERS	16,753	8,359	9,974		67,442	122,117	141,480	10,917	11,655	11,807		16,531	36,824	43,253		
6 SUGAR	38,322	40,439	48,026		0	0	0					38,322	40,439	48,026		
7 OIL	20,541	32,340	42,406		0	0	0					20,541	32,340	42,406		
8 SAUCE,SPICES	3,136	3,733	4,264		5,553	7,934	9,777					8,689	11,667	14,041		
9 BEVERAGES	8,971	49,690	59,485		0	0	0					8,971	49,690	59,485		
10 OTHER FOODS	9,516	9,006	10,696		0	0	0					9,516	9,006	10,696		
11 FISH	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		82,770	127,905	151,905		
12 ANIMAL PRODUCTS	147,422	182,217	199,239		51,717	95,004	130,387					199,139	277,221	329,626		
MILK PRODUCTS	97,799	148,136	176,956		41,638	44,562	51,151					139,437	192,698	228,107		
RED MEAT	16,336	21,824	22,283		6,549	12,348	19,409					22,885	34,172	41,692		
CHICKEN	24,863	9,607	0		1,580	27,294	43,827					26,443	36,901	43,827		
EGG	8,424	2,650	0		1,950	10,800	16,000					10,374	13,450	16,000		
13 TOBACCO	-	-	-		-	-	-	409	409	409		-	-	-		
14 FEED CROPS	-	-	-		-	-	-	10,174	12,007	14,412		-	-	-		
TOTAL	-	-	-		-	-	-	54,641	57,441	60,241		-	-	-		

(4) Improvement of the Agricultural Structure

Agricultural management in Oman can be roughly classified into the following three types: large-scale commercial management; medium-scale management on new farms, etc, where mainly vegetables are cultivated on farms of about 10 feddan (4 ha); and small-scale traditional management where mainly dates are cultivated.

From the viewpoints of higher productivity and production increases, large-scale commercial management is recommended. On the other hand, from the viewpoint of creating new employment opportunities and increasing the living standard of the farmers, priority should be placed on medium- and small-scale management, even though these are less productive.

Under the Master Plan, first priority is given to management improvement of medium- and small-scale farms with an aim to creating employment opportunities and to increasing the income of the Omani farmer. However, large-scale commercial management should also be promoted in areas where the natural, social and economic conditions are suitable.

Small-scale traditional farmers may increase their productivity, but still be unable to subsist on the profits from agriculture alone. In this regard, expansion of agriculture-based livestock management is proposed under the Master Plan to establish self-sufficiency for such small-scale farmers.

(5) Stimulation of Rural Socio-economy through Promotion of Agriculture

Rural areas play a vital role in economic production, Omani culture, and relaxation and recreation. However, the rapid economic growth of Oman has increased urban-rural economic disparity, and stimulated migration of the younger generation to urban areas.

The creation of employment opportunities and the enhancement of living standards are essential in the rural areas for the well-balanced

development of the country and the orderly consumption of resources.

Because tradition and culture are preserved in rural areas, it is essential to make every effort to strengthen rural society by means of implementing comprehensive measures for rural development focused especially on the promotion of agriculture. This in turn will serve to invigorate the regional economy.

(6) Human Resources Development

Given the inherent nature of agriculture, wherein the farmer must struggle with the constraints imposed by the national environment, the level of a farmer's technical skill will be a determining factor in any attempt to improve agricultural productivity.

In order to achieve the targets under the 10-year Agricultural Development Plan, human resources development to train and expand the numbers of extension and research staff necessary to bring new and practical farm technologies to the farmer will be of the highest priority.

Also, a vigorous program of Omanization should be pursued to fill the new jobs to be created with Omani personnel to the absolute extent possible.

(7) Achievement of a 6.3% Annual Average Growth Rate in the GDP

The annual average growth rate in the GDP for the agricultural sector from 1990 to 2000 is forecast at 6.3 %, at constant prices from 1989. This is to be achieved through integrated implementation of those measures mentioned above in sub-sections (1) to (6).

CHAPTER 6

DEVELOPMENT STRATEGY

CHAPTER 6 DEVELOPMENT STRATEGY

6.1 Principles of Development Strategy

In order to attain the objectives of the agricultural development program described in the preceding chapter, development strategies have been formulated for each sector. In the formation of such a sectoral development strategy, particular attention has been paid to the preparation of effective plans which are consistent with each other, as well as to the following basic principles:

- (1) Maintain consistency throughout the Third Five-year Development Plan.
- (2) Provide maximum effect with minimum investment.
- (3) Use, to the fullest extent possible, the presently available resources.
- (4) Respect Omani society, cultures, customs and lifestyle. and
- (5) Focus on farmer self-reliance.

6.2 Basic Framework of Development Strategy

Agricultural policy formulation in Oman is an extremely difficult task under such severe natural conditions. The policy must achieve maximum production through efficient utilization of the limited water and human resources.

The outline of the sectoral development strategy, as well as policies for production, structure, price, distribution and subsidies for the agricultural development plan are discussed below to clarify the relationship between targets and strategy.

The vital role of the production policy is to establish the measures for achieving a production increase in agriculture through more efficient use of the limited water resources. The increase of land-use efficiency and crop intensity is also proposed, through the introduction of modern irrigation methods for water conservation.

As a result, productivity must increase in existing agricultural land through various comprehensive measures such as education of farmers, farm mechanization (appropriate to management scale), and extension of the new farming techniques endorsed by research on high-yielding varieties of crops. The expansion of selective crops is proposed for future agricultural production.

Structural policy includes the most difficult issues in formulating the agricultural development plan for Oman. In particular, the support efforts must be forced on small-scale farmers, who cultivate less than 1 ha.

The commercial farms and the new farms, the management scale of which is large- and medium-sized, respectively, are expected to increase productivity significantly. A small-scale farmer, on the other hand, may increase productivity, but still be unable to live on the profits of cultivation alone. Agriculture-based livestock farming shows a possibility to resolve this constraint.

The price policy should cover only the temporary declination of the farmer's income, which sometimes occurs as a result of excess production. According to the 1988 price data for imported and exported agricultural products, and for domestic products, a price sustenance policy is not needed for most crops. However, since the data are not adequate to propose a final conclusion, such information should first be collected and processed.

The distribution policy should be formulated so as to guarantee benefits for both producers and consumers, considering the relationship between PAMAP and the commercial trader, who supplement each other's role in the distribution process. For this purpose, a wholesale market should be established to determine the fairest price, based on supply and demand of agricultural products. In addition, the collection and distribution system (particularly at the terminal end) should be improved for smoother delivery to the wholesale market.

Agricultural input materials (fertilizer, seed, insecticide, agricultural machinery etc.) are subsidized under present policy, in order to maintain a suitable production cost. Since in Oman the producer's price is apt to be determined on the initiative of the wholesaler, the subsidy system should be continued in order to ensure the farmer's profit. On the other hand, in order to strengthen the producer's situation and to influence the price-decisions, it is strongly recommended to organize a farmers' association and to institute wholesale markets. Furthermore, which crops are to be subsidized should be determined under a policy referring to the forecast for supply and demand.

Consequently, the Master Plan is to be formulated in a manner that integrates these policies. Its accompanying measures should be implemented in an integrated fashion, so as to bring about the best results.

The development framework of the 10-year Agricultural Development Plan is shown in Figure 6.1. Rationale of agriculture farm development and livestock holding farm development are shown in Figures 6.2 and 6.3.

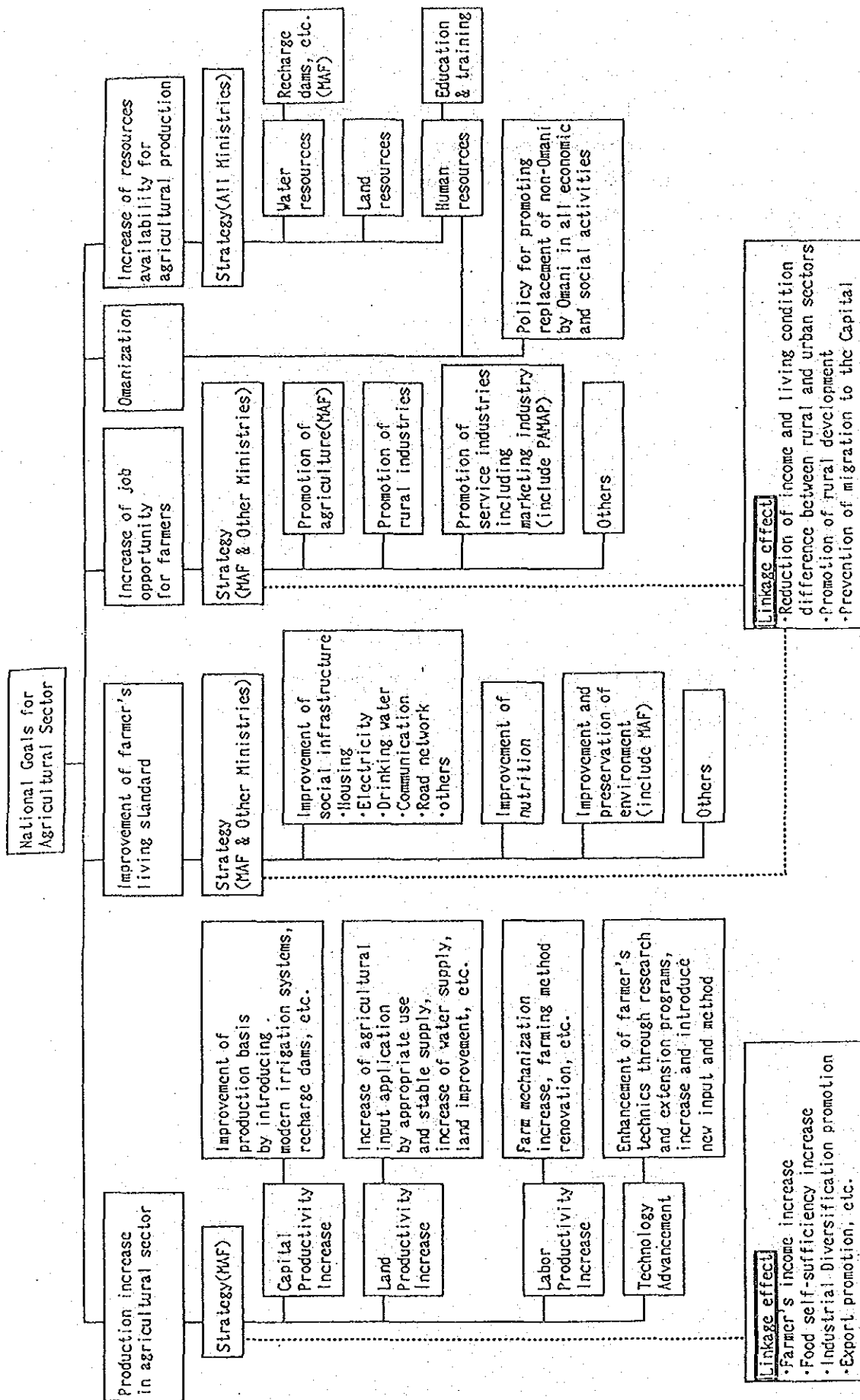


Figure 6.1 Framework of 10-Year Agricultural Development Plan

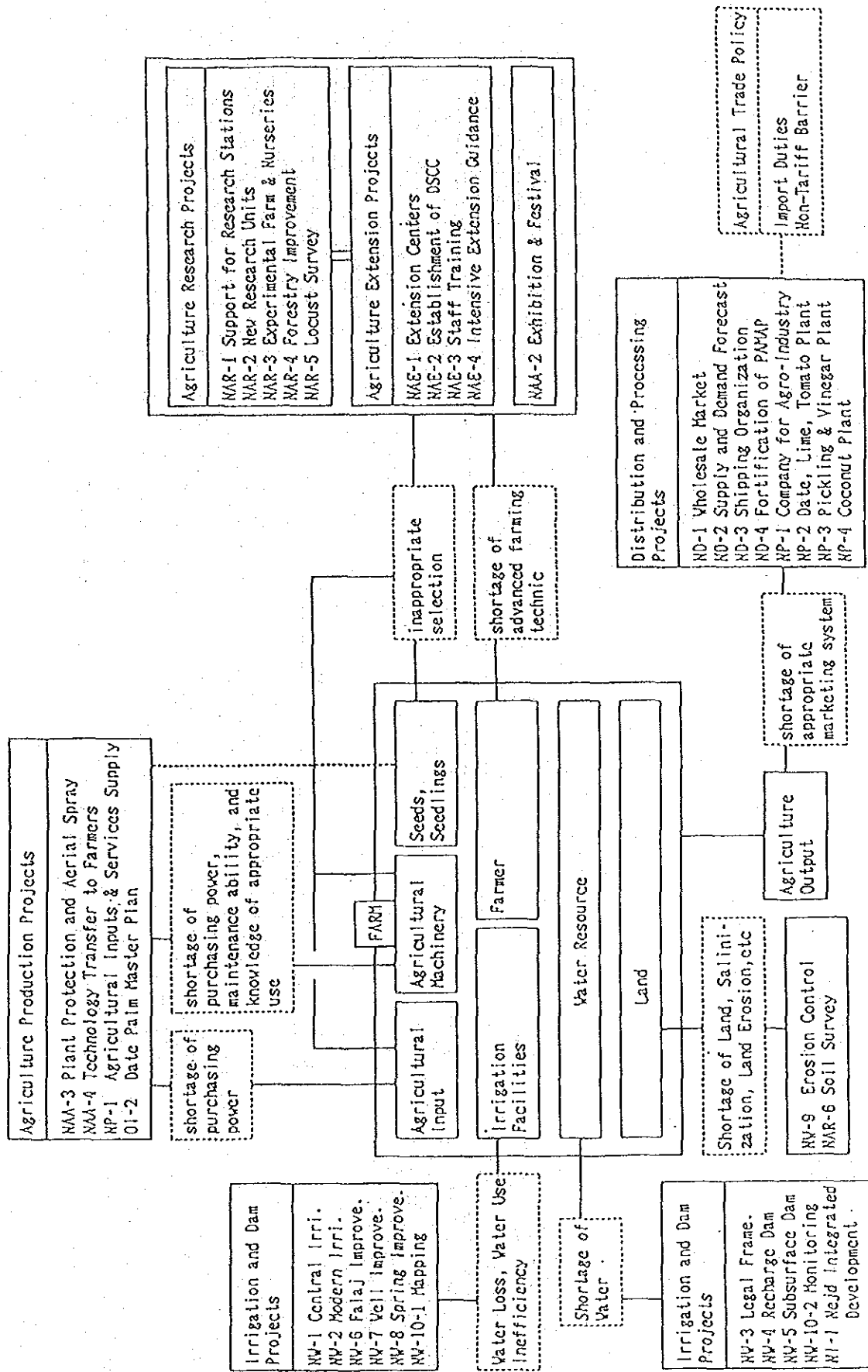


Figure 6.2 Rationale of Agricultural Farm Development

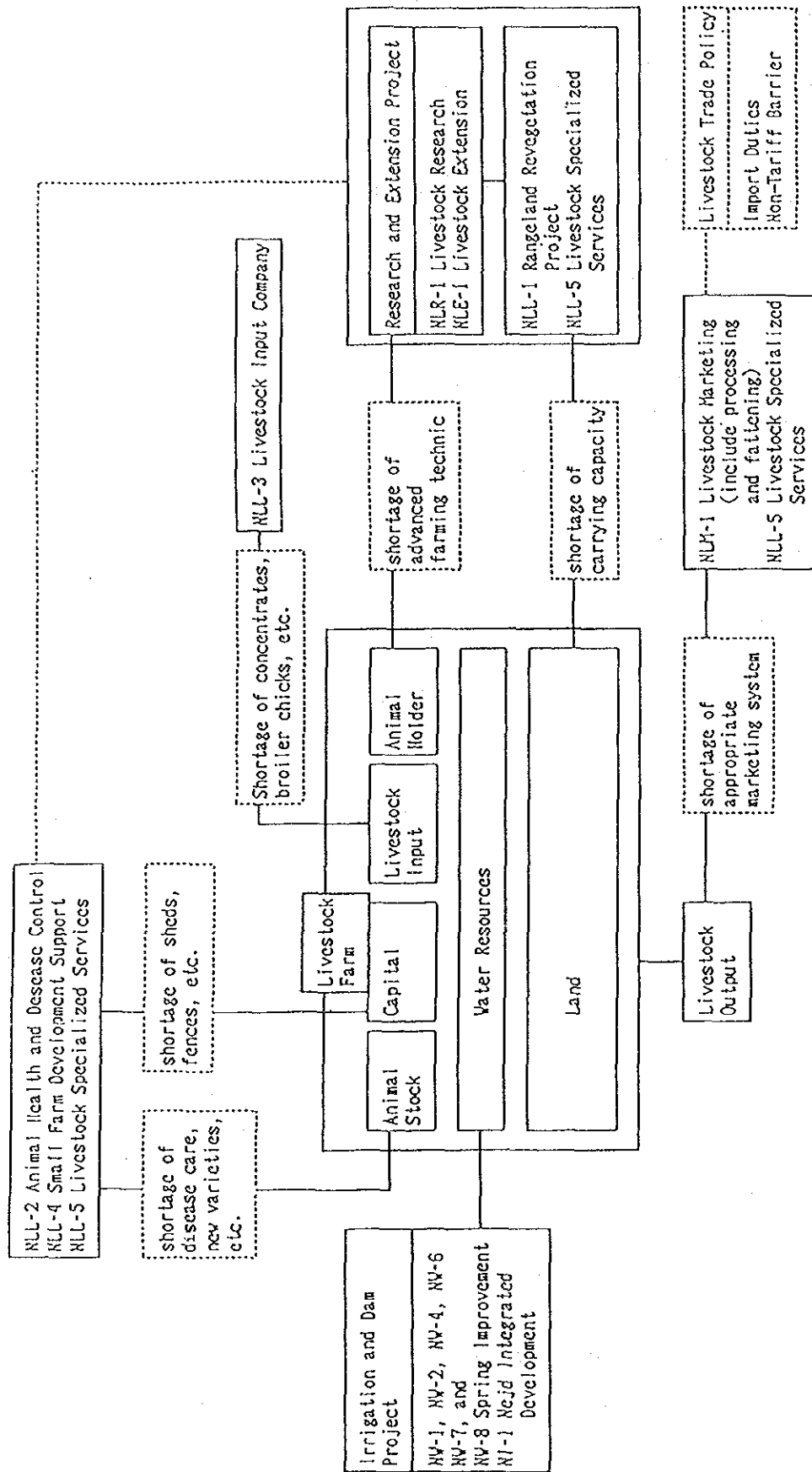


Figure 6.3 Rationale of Livestock Holding Farm Development

CHAPTER 7

DEVELOPMENT STRATEGY BY SECTOR

CHAPTER 7 DEVELOPMENT STRATEGY BY SECTOR

7.1 Water Resources and Irrigation

7.1.1 Development Target

Since it is estimated that 90 % of the water used in this country is irrigation water, appropriate development and use of irrigation water are vital because they will affect the entire policy for water resources.

The following targets are set to improve the economic profitability of agricultural production and increase agricultural productivity through the efficient and effective use of water resources.

- (1) Ensure water resources for a stable agricultural water supply.
- (2) Introduce modern irrigation methods to increase agricultural productivity and the efficient use of water resources.
- (3) Maintain aflaj for the conservation of the traditional agricultural society.
- (4) Control floods to maintain agricultural land.
- (5) Conduct investigation and observation for the efficient implementation of projects.

7.1.2 Development Strategy

Under the Master Plan, development strategies are classified into short-, medium- and long-term depending on the time period required to achieve project effect as follows.

- short-term strategy:

legal restriction of water use and new agricultural development

- medium-term strategy:

construction of recharge dams and underground dams

- long-term strategy:

water-saving irrigation

Regional characteristics and project features must be considered in the development strategy. The development strategy, and projects and programs are proposed below. However, a combination of such projects and programs will also be considered so as to provide a comprehensive effect.

(1) New agricultural development program and legal restrictions on water use

Agricultural development projects are to be implemented in areas where the development potential of new water resources has already been confirmed; about 550 ha in Nejd and other regions.

Other agricultural development plans in promising water-resources development areas are to be formulated and prepared based on results from the on-going nation-wide soil survey and water resources survey conducted by FAO and MWR, respectively.

The establishment of appropriate measures for legal control regarding agricultural water use suitable to the actual conditions of Oman is urgently required.

(2) Construction of recharge dams

As a major medium-term strategy for increasing agricultural production, the construction of recharge dams is to be implemented in the 10-year Agricultural Development Plan following the Third Five-year Development Plan.

Concentration of similar projects within a specific region should be avoided from the viewpoint of promoting well-balanced rural area development. Recharge dam projects are proposed in all regions under the full Master Plan, which targets the construction of 42 recharge dams. New land expected to use additional recharged water is estimated at more than 1,850 ha based on the results of the preliminary and feasibility studies conducted by MAF.

Generally, irrigation projects which utilize the recharged water must be implemented in conjunction with the construction of recharge dams.

(3) Construction of underground dams

The underground dams increase groundwater resources by restricting discharge and improve agricultural production. They are, in some cases, expected to be more effective than recharge dams. However, the area for the construction of the underground dams is not only limited by geological conditions but also requires a longer period of investigation. Therefore, a pilot project should be established in order to evaluate the technical and economical viability of construction.

(4) Introduction of modern irrigation facilities

Even though their water-saving effects have the greatest impact of all on farming, the introduction of modern irrigation facilities largely depends on the farmers' consensus and cooperation.

As it takes a long time to improve falaj systems, the introduction of modern irrigation facilities is proposed mainly for areas where the major water sources are wells. The target area to be developed in such a manner, over 10 years, is about 30,000 ha. If modern irrigation systems are introduced into 30,000 ha and 20 or 40 percent of the present total water consumption is saved, irrigation water equivalent to a total amount of water to be consumed in 7,500 ha or 20,000 ha with modern irrigation facilities will be conserved. Part of the conserved water would be kept for the replenishment of groundwater-balance deficit and the rest would be utilized for agricultural development.

(5) Maintenance and rehabilitation of aflaj

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. On the other hand, lack of labor for maintenance of aflaj is a

serious problem. If no steps are taken, the amount of rehabilitation required in order to reduce maintenance cost will increase year by year. Therefore as an initial step, a project aimed at permanent rehabilitation of major aflaj will be launched under the Master Plan. A pilot survey should be done to evaluate the possibilities of an enhancement of irrigation efficiency in oases through improvement of the existing distribution systems.

(6) Repair and construction of wells

A constant effort should be made to maintain the hand-dug wells, which, together with the aflaj, are vital facilities for maintaining the rural society of Oman. Accordingly, following the intentions of the Third Five-year Development Plan, the implementation of a well maintenance and rehabilitation project is incorporated into the Master Plan. In the future, the inter-connection of this project with modern irrigation projects should be considered at the implementation stage.

(7) Erosion control and protection of agricultural land against floods

It is important for agricultural and farmer's property to control erosion caused by floods. Construction work for protection against floods is planned for four areas where the necessity for such work was confirmed under the Third Five-year Development Plan. Further surveys and construction work will be implemented within the scope of the "Master Plan for Erosion Control and the Protection of Agricultural Land and Villages against Floods" to be formulated by MAF.

(8) Investigation and Observation

The continuous activities of surveying and observing in order to collect basic data is essential, because these provide vital information for planning. Observation of the existing recharge dams is particularly important for evaluation of their effects which provide precious data for the planning of future projects. Such activity should, therefore, continue in the future, following the Third Five-year Development Plan.

Aerial photography and mapping projects, whose results are used for aflaj maintenance and rehabilitation programs, should continue to be implemented step by step now that the first of four stages is completed.

7.2 Agriculture

7.2.1 Development Target

7.2.1.1 Overall Target

Currently, with respect to agriculture in Oman, resources such as land, water, etc., are not used to their full potential, and therefore production and economic efficiency are low. In order to achieve the development targets under this Master Plan for Agricultural Development, which are the improvement of the self-sufficiency rate of food, the improvement of agricultural productivity, and the efficient utilization of water resources for the next ten years, it is necessary to utilize the full potential of production. This can be done by improving the technology of the farmer, and also by encouraging cooperation among the farmers who perform the actual agricultural production, the research organizations which carry out technical development, and the extension services which are the link between technical development and agricultural production.

In order to achieve the targets of the Master Plan for Agricultural Development, priority should be given to the following;

- (1) Improvement of unit yield and improvement of produce quality.
- (2) Improvement of farm-management methods.
- (3) Control of agricultural production according to demand.

7.2.1.2 Targeted Yield per Unit Area for Major Crops

- (1) Selection of major crops

An overall evaluation of the level of importance of agricultural crops presently cultivated in Oman for promotion of the 10-year Master Plan for Agricultural Development was done after investigating, through

assigning grade and weight on the basis of various conditions such as major production region, production area, total yield, unit yield, unit price, net profit, import or export-ton, PAMAP sales-ton, recommendations by MAF, tolerance to drought, tolerance to salinity, self-sufficiency rate, net profit, and benefits per cubic meter of water consumption.

The results of evaluation are as indicated in Table 7.2.1. The fifteen most important major crops under the Master Plan are ranked. These are potatoes, tomatoes, Rhodes grass, citrus fruits such as oranges, grapes, wheat, alfalfa, sweet potatoes, chilli peppers, carrots, date palms, watermelons, sweet-melons, cucumbers and mangoes. Furthermore, though the ranking in the grading table is lower than the major crops mentioned above, some crops necessary for making farming improvement models in different regions have been ranked as sub-main crops. There are nine sub-main crops: bananas, coconuts, papayas, barley, sorghum, onions, eggplants, cabbage and okra.

(2) Targeted Yield per Unit Area

The present yield per unit area for Oman is at a low level and there is considerable scope for improvement in the future. After considering the present yield per unit area in Oman and other countries and the scope of technological improvements, the target yields to be achieved by the end of the 10-year Master Plan for Agricultural Development have been determined (Table 7.2.2).

Table 7.2.2 indicates (a) the present yield per unit area given by the Department of Agricultural Statistics of MAF, (b) the present yield per unit area of the Oman Modern Farm and Al Raja Farm, which are commercial farms in Oman, (c) the yield per unit area of Middle East countries included in the GCC, Israel, Zimbabwe, Austria, USA and Japan as indicated in the Production Yearbook (1987) of FAO, and (d) the maximum level of yield per unit area or standard yield in main production regions of Japan indicated in professional horticulture handbooks.

The reasons for varying yield per unit area according to the producer or producing country may be attributed to environmental (natural) location

Table 7.2.1 Selection Criteria and Prioritization of the Major Crops Proposed in the Master Plan for the Agricultural Development in the Sultanate of Oman

Crop	Major production region		Production			Price RO/ton	Net profit RO/ha	Import or Export ton (1988)	PAMAP Sales ton (1988)	Benefits per cubic meter of water (RO)	Recommendation by ministry	Tolerance		Self-sufficiency rate (%)	Total	Order
	Ba	In	So	Product 1,000 ton	Unit yield ton/ha							Drought	Salinity			
Dates	⊙			4	2	2	0	4	0	1	1	5	5	0	41	11
Mango	⊙			2	1	3	0	3	1	3	1	3	3	(3)	40	15
Citrus (Lime)	⊙			3	2	1	0	4	3	2	1	3	3	0-(5)	32-47	4-26
Banana	⊙		⊙	3	2	2	2	3	5	2	1	1	1	1	36	19
Coconut	⊙		⊙	2	2	2	2	2	1	2	1	5	5	1	35	21
Papaya	⊙			1	1	2	3	2	2	(3)	1	1	1	1	31	29
Pomegranate	⊙			(0)	(2)	(3)	0	(1)	(0)	(2)	1	3	3	(3)	27	31
Cuaya	⊙			(0)	2	2	0	1	(0)	(2)	1	3	3	(3)	26	32
Grape	⊙			0	2	3	4	4	(0)	2	1	3	3	5	47	5
Wheat	⊙			0	1	3	0	5	0	(1)	5	3	3	1	46	6
Barley	⊙			0	1	3	0	5	0	(1)	1	3	1	5	35	22
Rhodes grass	⊙			(3)	4	0	3	(1)	0	(4)	5	5	5	(1)	48	3
Alfalfa	⊙			5	3	0	3	(1)	0	(4)	1	3	1	(1)	44	7
Sorghum	⊙			1	4	0	3	(2)	0	(3)	1	4	1	(1)	35	23
Tabasco	⊙			1	2	5	5	1	0	(5)	2	3	1	2	32	27
Frankincense	⊙			(0)	(0)	(4)	2	(0)	0	(5)	3	5	1	(0)	12	33
Tomato	⊙			3	3	2	4	5	4	4	1	1	1	2	49	2
Chilli pepper	⊙			2	2	3	3	3	2	(4)	1	1	1	1	43	9
Eggplant	⊙			2	3	0	0	(2)	3	3	1	1	1	(3)	32	28
Potato	⊙			2	3	1	4	5	3	1	5	1	1	4	51	1
Onion	⊙			2	2	1	0	4	2	2	1	1	1	3	34	24
Carlic	⊙			1	2	4	5	1	1	3	1	1	1	2	38	17
Watermelon	⊙			3	3	2	3	4	4	3	1	1	1	1	41	12
Sweet-melon	⊙			2	2	3	4	4	3	3	1	1	1	1	41	13
Cucumber	⊙			2	2	2	4	2	2	5	1	1	1	1	41	14
Squash	⊙			1	2	2	3	2	2	3	1	1	1	(3)	37	18
Caulliflower	⊙			1	2	1	0	3	1	2	1	1	1	(3)	29	30
Cabbage	⊙			3	3	1	2	3	3	3	1	1	1	1	36	20
Lettuce	⊙			(1)	3	2	4	1	2	4	1	1	1	(3)	39	16
Carrot	⊙			2	2	2	5	2	2	3	1	1	1	(3)	42	10
Oxra	⊙			1	2	3	4	(2)	(1)	2	1	1	1	(3)	34	25
Sweet potato	⊙			1	3	2	4	(1)	2	(4)	1	5	3	(2)	44	8
Note	5			10,000	20,000	1,000	3,000	8,000	3,000	2,000	Strong	Strong	Strong	< 20		
Ba : Balinah	4			5,000	5,000	500	1,500	4,000	1,500	1,000	Medium	Medium	Medium	< 40		
In : Interior	3			1,700	12,50	170	500	1,333	500	0,333	Week	Week	Week	< 60		
So : Southern	2			430	3,13	43	125	333	125	0,083	Week	Week	Week	< 80		
Weight	1			86	0,78	0,8	25	67	25	0,017	Week	Week	Week	< 100		
Weight	1			3	1	1	2	1	1	2	2	1	1	3		

Notes: 1. Figures in parenthesis () were estimated by the JICA Team.
 Figures in parenthesis [] were obtained from the figures shown in the "Others" column in the Statistics Table.
 2. Weight: Each factor can be evaluated from all aspects and from 1 to 3 in order of importance.

Table 7.2.2 Determination of Target Yield of Major Crops
in the Master Plan for Agricultural Development

Crop	Actual unit yield (ton/ha)										Possibility of improvement %	Target unit yield ton/ha
	Oman			Middle East	Israel	Zimbabwe	Austria	USA	Japan			
	1)	2)	3)	4) (5)	6)	7)	8)	9)	10)	11)		
Date palm	4.1										50	6.0 46
Mango	2.0										50	3.2 60
Lime	10.8										50	15 39
Lemon	15.0								18		50	22 47
Sweet lime	11.0									30-40	50	16 45
Orange	11.0								23		50	16 45
Banana	13.6								6	40-50	50	20 47
Coconut	16.8										50	25 49
Papaya	12.0								10		65	19 58
Grape	15.0			11(15)	15		5.5	15	12		50	19 27
Wheat	1.5			2.4(4.7)	3.1	5.8	4.5	2.5	3.2	2.4-5.5	60	2.4 60
Barley	1.9			2.7	1.4	5.8	4.0	2.8	3.2	2.5-6.0	60	3.0 58
Rhodes grass	57.6 ¹⁴⁾										40	120 ¹⁵⁾ 33
Alfalfa	38.4 ¹⁴⁾										90	72 ¹⁵⁾ 20
Sorghum	53.3 ¹⁴⁾										65	125 ¹⁵⁾ 50
Tomato	22.2	24	48	43	51		28	53	52	50-130	80	40 80
Chilli pepper	9.0			17	39		20	12	36	15-25	80	16 78
Egg plant	19.0				33			22	31	30-150	80	32 68
Potato	25.0			20	38	16	26	34	29	30-40	70	30 20
Onion	13.7			18(51)	23	17	35	41	43	40-75	65	18 31
Garlic	8.0			41	13			15		15-20	70	14 75
Watermelon	19.0	22	31	26	16			15	32	30-60	75	26 37
Sweet-melon	13.1	16	28	24(57)					19	20-40	80	23 76
Cucumber	14.9			29(121)	29		26	13	43	40-150	70	25 68
Squash	15.8								17	25-40	70	25 58
Cabbage	23.2			31	23		45	20	40	40-80	75	35 51
Lettuce	17.0									26-49	60	20 18
Carrot	23.8			26	49		31	31	27	25-40	65	30 26
Okra	13.2									20-50	80	22 67
Sweet potato	23.8			25	39	24	13	15	23	30-40	40	25 5

Notes:

- 1) These values were obtained in 1989 from "the Annual Update of Important Statistical Series" which has been carried out by the DAS in MAF since 1982.
- 2) Oman Modern Farm.
- 3) Al Raja Farm.
- 4) The second highest yield from 1985 to 1987 in such countries as Egypt, Iran, Iraq, Jordan, Kuwait, Qatar, Saudi Arabia and UAE (FAO production year book 1987)
- 5) The highest value among those mentioned above.
- 6) - 10) FAO Production year book 1987.
- 11) Horticultural encyclopedia, Okinawa horticultural encyclopedia, Handbook for facilities horticultural.
- 12) Percentage estimated by JICA Study Team under the condition that growing elements are improved.
- 13) Target yield in the year 2000 and its percentage improved from the current yield.

14) Semi-dried Weight

15) Fresh-matter Weight

and techniques. Since man-made improvements are possible in the latter, the improvement rate for unit yield (%) to be achieved by the end of the 10-year Master Plan has been estimated on the basis of the anticipated improvement under each technological item. After that the target yields under the plan have been determined after considering various cases of improvement of the present yield per unit area ranging from 5 % to 80 %, depending on the crop.

7.2.2 Development Strategy

In order to achieve these targets, it is necessary for each farmer to acquire a high level of cultivation and farm management technology. The strategies for development are as follows:

- (1) Increase in unit yield and quality improvement
 - (a) Introduction of suitable crops on a regional basis
 - (b) Introduction, selection, breeding and extension of superior varieties
 - (c) Improvement of cropping technology, including irrigation, fertilizer use, pest control, etc., and extension of same

- (2) Improvement of Farm Management
 - (a) Introduction of optimum cropping pattern and farm-management model
 - (b) Implementation of farm-management research
 - (c) Appropriate level of farm mechanization to reduce farm-labor requirements

- (3) Establishment of an agricultural production structure well-suited to demand requirements
 - (a) Selection and introduction of crops most responsive to demand
 - (b) Establishment and extension of optimum cropping pattern and cropping technology
 - (c) Timely dissemination of pertinent information to farmers

In order to implement the above strategy, a well-emphasized farmer education program is essential. Such a program would stress farmer independence, and function to stimulate enthusiasm in agriculture at the farmer level.

Strengthening of the agricultural research and extension structure would be the basis for implementation of farmer education. In order to achieve this, training of adequate numbers of research and extension staff will be necessary. The government will also need to actively support the activities of such personnel through the establishment of required facilities and provision of necessary equipment.

In addressing the issue of farmer education, it will be necessary to carefully prepare an effective extension program relying on the latest extension methods such as audio-visual technology for presentation.

7.2.2.1 Cultivation

To achieve expansion in production to meet the targets of agricultural development, plans are necessary for expansion of production quantity mainly in the already existing cultivated areas.

The improvement of the following should be considered in order to achieve a higher unit yield.

- (1) Selection of kinds of crops
- (2) Variety selection
- (3) Investigation of ploughing and land preparation methods
- (4) Improvement of cropping systems
- (5) Dispersion of cropping season
- (6) Improvement in cultivation methods
- (7) Improvement of methods for control of crop pests
- (8) Development of new cultivation methods
- (9) Introduction of modern irrigation methods

The details regarding the above are described in volume 5, chapter 4, "Improvement Plan for Cultivation and Farming".

7.2.2.2 Farming

There are more than 83,000 farms in Oman. The national average farming scale is low at about 1 ha; although it is rather bigger in the region along the Batinah Coast (approximately 1.6 ha), but much smaller in the Salalah Region.

In the first phase, the study team selected representative examples totaling eight new farms, four traditional farms, and one commercial farm from the five main agricultural regions, and studied current conditions of agriculture in Oman.

In order to estimate a realistic farming index at the end of the 10-year Agricultural Development Plan, the knowledge and information gained from this study and results of analysis of the information available before the study were used to draw up farming improvement models, which were then utilized to estimate projected farmers' income.

Details of the above are described in volume 5, chapter 4, "Improvement Plan for Cultivation and Farming". Outlines of them are as follows:

(1) Formation of farming improvement models

Improved present farming models were first formulated on the assumption of the introduction of modern irrigation methods, major crops, and slight modifications of the ratio of area under cultivation between the different crops. Taking into account potential for technological improvement in the future, final farming improvement models were worked out on the basis of the improved present models.

Technical improvements introduced for the improved models included improvement of crop selection, introduction of superior varieties and

modern irrigation methods, improvement of cropping patterns, fertilization improvement, and more effective pest control.

Farming improvement models were formulated as follows: three types of new farms in Batinah, the Interior and Salalah Regions, two types of traditional farms in northern Oman and the Salalah Region, and, in addition, two combined crop production and livestock improvement models were formulated for new farms and traditional farms, respectively.

(2) Estimate of farm profit for farming improvement models

The Annual Updates of Important Statistics Series from the Department of Agriculture and Statistics of MAF contains data such as yields, selling prices and production costs per hectare (not including depreciation costs on initial investment and machines, etc.).

These data are used for estimating present farming profits. As for the farming improvement model, it was estimated by using expected yields and present selling prices. Costs for new irrigation, seed, fertilizers and pesticides were included in production costs.

(a) Estimate of farm profits for new farms

(i) Batinah Region (4.2 ha)

Present farming profit:	R.O.	2,700
Improved present farming profit:	R.O.	5,300
Improved model farming profit:	R.O.	10,800
(2000)	(livestock combined model breeding goats 40 head, R.O.	11,300)

(ii) Salalah Region (2.0 ha)

Present farming profit:	R.O.	1,300
Improved present farming profit:	R.O.	3,300
Improved model farming profit:	R.O.	6,600
(2000)		

(b) Estimate of farm profits for traditional farms

(i) Northern Oman (0.5 ha)

Present farming profit:	R.O.	- 230
Improved present farming profit:	R.O.	280
Improved model farming profit:	R.O.	650
(2000)	(livestock combined model breeding goats 8 head and egg-laying chickens 750, R.O.	2,600)

(ii) Salalah Region (0.5 ha)

Present farming profit:	R.O.	460
Improved present farming profit:	R.O.	680
Improved model farming profit:	R.O.	1,240
(2000)		

(3) Farming scale

Results of the estimation indicate that new farms are profitable, however, traditional farms cannot support themselves on agricultural income alone. Assuming that one family's annual living cost is about R.O. 2,500, and they earn their living by agricultural income only, an increase in their farming land to 2.0 ha is needed in northern Oman, and an increase to 1.0 ha is needed in the Salalah Region.

7.2.2.3 Agricultural Research

(1) Research Targets

Agricultural research, like agricultural extension, is one of the most important factors for improving agricultural productivity. Agricultural research will be heavily counted on to solve many of the technological difficulties facing Omani agriculture. It is consequently one of the most important issues under this agricultural development plan.

In order to effectively achieve this, research targets and subjects must be carefully formulated on the basis of accurate information about needs and requirements at the farm level.

The inherently long-term targets must dovetail smoothly with long-term government agricultural policy. In this regard, the agricultural research targets must be determined on the basis of consensus among all parties concerned. These include not only actual staff at agricultural research institutions, but also concerned officials in the formulation of government agricultural policy, academics involved in basic research at Sultan Qaboos University, representatives of extension workers in the field, etc.

Currently, a study on a "Framework for Research" is being constructed, and it is anticipated that this will help set an effective orientation for long-term agricultural research proposed under the Master Plan.

In order to maximize the benefits to be obtained from long-term research, continuity of research efforts should be emphasized.

On the basis of study findings, the JICA team proposed the following research targets:

(a) Integrated improvement of agricultural production.

(i) Region-wise introduction and selection of appropriate crops.

- (ii) Region-wise introduction, selection and breeding of superior varieties.
 - (iii) Establishment of stable high-yield, high-quality crop-production techniques responsive to demand requirements (cropping season, fertilizer application method, etc.).
 - (iv) Establishment of an integrated program for pest and weed control.
 - (v) Mechanized farming technology.
- (b) Conservation and effective use of water resources.
- (i) Development and improvement of irrigation techniques.
 - (ii) Development of irrigation techniques using brackish water.
- (c) Development of arid farming technology.
- (i) Study on salinization problem and salt tolerant crops and varieties.
 - (ii) Study on cultivation techniques for the high temperature, summer season.
- (d) Agricultural economic research towards maximized reduction of production cost and increased farm profit.
- (e) Research on regionally specialized agricultural products (honey, perfume, etc.).
- (f) Study on afforestation and preservation/promotion of the same for the public good.
- (i) Selection and preservation of drought-tolerant tree species suitable to Omani conditions.
 - (ii) Development of afforestation technology.
- (g) Training of agricultural researchers and technical staff.

In addition to the above, it is recommended that research be carried out on date palms concerning the improvement of production quality,

replacement of old trees with superior seedlings, processing of main and by-products, etc. Dates account for 40% of all cropped area in the Sultanate and are a traditional crop of special importance to the Omani culture. Dates are also important as a caloric source and may become more valuable in the future.

(2) Establishment of a Research Structure

(a) Research Management

(i) General

Research management assumes the function of determining operating policy and overseeing the day to day direction of research. In recent years, with the need for highly specialized or region-oriented research, it is assumed that such will be carried out at separate research entities of different responsibility for specific areas of experiment and study, with care taken to avoid the overlapping of efforts. And within each separate research institution, it is essential that an atmosphere be established which allows maximum independence for the creative talents of each researcher while still maintaining the integrity and orientation of an organized entity.

Management functions include arranging the research structure, hiring and deployment of personnel, procurement of equipment and materials, allocation of funds, supervision of internal affairs at the institution, and other such duties affecting the shaping of the research environment, as well as decisions on research subjects, and collating, publishing and extending findings.

(ii) Monitoring and Evaluation of Research Progress

In monitoring the progress of research, evaluation should be carried out at each stage. Such monitoring and evaluation would serve as a means to ensure accurate, efficient and

effective execution of research activities, and would cover the entire research process including creating the specific subject from the farmers' problems warranting research, implementation of the research subject, devising practical technologies to realize findings and their extension.

Evaluation of research progress would be performed at the preliminary, intermediate and final stages.

o Preliminary evaluation

Preliminary evaluations will be made before implementation of the research, and would assess the appropriateness of items as research subjects, and their implementation, from the standpoint of the current technical levels and performance of the institution and the researcher, and also whether the research target is realistic.

o Intermediate evaluation

Intermediate evaluations will examine a research program in progress with a view to assessing effectiveness of its implementation and potential problems points. At this stage, steps are formulated to improve, or modify, the research program, if necessary.

o Final evaluation

At this stage the outcome of the research activity will be assessed, as will the methodology applied to achieve it.

Evaluation of results should be performed not only from a technical and/or academic point of view, but must also reflect the viewpoint of those intended to actually apply and use the technology.

Such a broad-based evaluation will serve towards improving

the efficiency of all aspects of future research activity.

(iii) Notification and Extension of Research Results

After review of research findings by an evaluation team and/or technical committee (limited not only to experts from within the subject research body, but possibly including as well experts from other institutions), the details of research should be distributed as soon as possible to all concerned parties.

Research results should be compiled at each institution in an annual report or some other periodical form for publication in order to prevent redundancy of research at other research bodies and to serve as a reference in the formulation of future research planning.

(b) Securing and nurturing researchers

(i) Securing researchers

At research organizations, while going ahead with research activities, it is necessary to employ available skilled researchers, and also to endeavor to train researchers who will become key researchers in the near future. These activities are part of the the vital aspects of research management. Training and expanding the number of skilled researchers is a very important factor for maintaining and upgrading the level of research at the institution.

In addition to instilling trainees with a high level of professional and academic knowledge covering a wide range of subjects, it is also important for them to have practical experience at the site of agricultural production. Trainees should learn that communication with farmers and extension experts will provide the basis for accurate understanding of the problems facing agriculture in Oman. They will then be

prepared to reflect this in their research activities.

In addition, it should be stressed that where feasible and practical, research staff and trainees should be sent to research institutions, universities, etc., outside Oman for wider exposure to advanced techniques.

(ii) Establishment of Training Centers for Research Staff and Extension Staff

For systematic training of researcher staff and extension officers, training centers should be established at the Rumais Agricultural Research Center and in the Southern Region. For more information about training center, see Section 7.2.2.4, Extension Services.

(3) Expansion of Research Facilities

Due to insufficient facilities and equipment, the agricultural research sector in Oman in general 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. In the future, it is expected that this institution will carry out broad, basic research which will serve the entire country. This requires providing the latest, most sophisticated equipment to the center.

Only the field workshop has been completed at the Jimmah Agricultural Research Station. A research building, and research equipment are still required. These should be provided as promptly as possible.

At the Salalah Agricultural Research Station, the research and administration building and equipment should be urgently upgraded. Particularly in response to the special nature of the Southern Region, necessary facilities and equipment should be provided for expanded

research in coconuts, coffee, bee-keeping, perfumes, etc. as well as irrigation technology.

The present Sohar Experimental Farm in northern Batinah should be upgraded to research station status considering that weather and soil conditions in the Batinah Region differ from those in the north and south, particularly with a view to accelerating research in vegetable and fruit cultivation important to the area.

At a future date, establishment of agricultural research stations at Sharqiya and Dhahira, which exhibit unique regional conditions as well would make an effective contribution to improving Omani agricultural technology.

In order to support the above research activities, it will be necessary to also establish training facilities for research and extension personnel.

Establishment of a library and documentation center for collection, compilation and collation of documents relevant to agricultural research is recommended. 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.

(4) Future Research Subjects

(a) Crop-wise Research Subjects

(i) Vegetables

Availability of high quality vegetables throughout the year is very important. Furthermore, quality control, which has not been an issue heretofore, will definitely be reflected in the price of products in future. In particular, quality-control technology for produce export will be necessary. Therefore, research for dispersing the planting period which has up to now been concentrated around a particular time, introduction and

breeding of new varieties, and improvement of quality should be pursued.

Furthermore, research in vernalization to hasten the flowering process, particularly applicable to the introduction of strawberries, is also necessary.

The costs of facilities like greenhouses vary depending on purpose and materials used. Research in the future into effective usage of greenhouses is anticipated.

(ii) Field Crops

The government is taking various measures to promote wheat production, and at the same time is developing new varieties to improve quality, increasing yield and expanding the area for cultivation. In the future, further research on the selection and breeding of high yield varieties with resistance to diseases, development of irrigation methods and economical mechanization is essential.

Only a small portion of the consumption quantity of pulses is being produced and this has possibilities for expansion in future depending on the results of research.

(iii) Date Palms

The important research subjects concerning date palms are utilization of space under date palms and thinning and replacing of old date palms. When the old trees, the productivity of which has become relatively low, gradually thin out, there are two possibilities; one is replacing these with superior new varieties by application of tissue culture, etc. and 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 will have to be studied in the future: improvement of irrigation systems, development of an inter-cropping system and development of processed foodstuffs which have added value, etc.

(iv) Fruit

Research on cultivation techniques of fruit trees such as orange trees, to replace limes will become necessary. Also, selection of superior varieties of other fruit such as grapes of high quality and greater marketing value is necessary.

(v) Special products

Research on special products such as honey, perfume, pomegranates, coffee, pepper, etc. should be stepped up.

(b) Factor-wise Research Subjects

(i) Irrigation Technology

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 individual crop water requirements, appropriate irrigation methods, and feasibility of irrigation using brackish water.

(ii) Pest and Weed Control

The main pest control method is the chemical control method, but to conserve the environment and to produce safer foods, not only dependence on agricultural chemicals but concepts of integrated pest control methods will be needed.

Research related to diagnosis of crop disease is particularly important for crop production. With progress in the development of pesticides, the importance of research on viral diseases has been increasing, because disease caused by viruses cannot be controlled by pesticides. This will become an increasingly important research subject.

Regarding research on classification and identification of crop pests, development of detection, classification and identification techniques has been progressing at both the Rumais Research Center and Salalah Research Station. Such research will continue to be very important.

Research on physiology and ecology of harmful insects is the first step to forecasting a system of harmful insect occurrence in the future. In addition, research on biological control methods such as usage of sex pheromon for forecasting occurrence and communication disturbance, usage of natural enemies etc. is particularly needed in the future.

Importance must also be attributed to studies on toxicity and residual duration of agricultural chemicals from the standpoint of the environmental and health impact on human beings.

Also studies on desert locust occurrence, monitoring and countermeasures for control are essential. The research structure is expected to play a leading role in effectively addressing this problem.

With regard to weeds, their ecology must be studied, and research on rational and efficient control methods are necessary.

(iii) Soil and Plant Nutrition

Improvement and expanded application of fertilizer would

be 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.

Upon completion of the "Soil Survey Project" now in progress with cooperation from FAO, follow-up soil survey in areas ranked according to highest development potential should be continued in order to identify the full extent to which an increase in cultivation area is possible.

(iv) Arid Region Agriculture

In order to maintain long-term, stable agriculture in Oman, comprehensive research on prevention and countermeasures 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.

Similarly, research related to horticulture, plant breeding and plant physiology would be required to formulate countermeasures for high temperature damage to crops.

(v) Agricultural Machinery

Various experiments are considered necessary for selection and improvement of type, model and size of agricultural machinery best suited to various conditions in Oman. Studies on the "soft" aspect of farm mechanization, including economical methods for machinery use also need to be carried out.

(vi) Breeding and Seed Production

Research of this would include introduction and selection of varieties bred outside Oman, collection and selection of traditional Omani varieties, cross-breeding of genetically superior foreign and domestic varieties. Considering that the gestation period is longer in the case of bio-technological breeding methods than in tissue culture, these should, for the time being, be excluded from consideration. But a well-organized combination should be made from among the above methods.

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

Seed production requires a higher technological ability than general cultivation, and the development and transfer to Omani farmers of appropriate techniques would be pursued.

(vii) Agricultural Economy

It can be expected that the importance of research on agricultural economy will continue to increase. Such research should be conducted on a broad sociological basis, aimed at the formulation of agricultural policy.

Research is also necessary in the area of most effective allocation of water and other limited agricultural resources under proper farm management towards maximized farm productivity.

Also, measures to improve the traditional falaj-water-management system must be carefully analyzed under this item due to the central importance of this system to village society.

(viii) Afforestation

Due to the public impact both economically and culturally (and in terms of impressing upon the younger generation the importance of conserving precious natural resources), of forest conservation and afforestation, research in this area should be addressed from an integrated governmental approach including all concerned agencies in addition to MAF. Various results can be expected from afforestation.

Some of the components involved in this project are not necessarily pure research work, but careful research in particular with regards to selection and conservation of tree types suited to Oman as well as pilot afforestation methods should be on the agenda. Careful attention would also have to be given to the degree that afforestation would compete with agriculture in terms of water consumption.

7.2.2.4 Extension Services

An increase in agricultural productivity is essential to meeting the demand for food which is expected to increase rapidly in the future. To this end, new and highly productive techniques which have been developed at the experimental stations should be introduced to the farmers along with policies ensuring effective application of these techniques. The most basic activity for increasing agricultural productivity in the future in Oman is extension services for the farmers.

The extension-services plans under the Master Plan are one of the most important sectors.

(1) Employment and Training of Extension Staff

(a) Subject Matter Specialists (SMS)

An SMS should be assigned for each special field in these regional offices, but at the moment there are only five SMSs. They must supervise the work of personnel of the extension centers in each region, and they are also required to provide technical advice in their special fields.

A particular problem is that despite the fact that there is a serious need for techniques to increase farm productivity in important fields such as modern irrigation and date palm cultivation, there are no SMSs at all. In the areas of vegetables, general fruit trees, and field crop cultivation, as well as plant protection and socio-economics, the number of SMSs need to be increased.

(b) Extension Staff

There are only 85 staff working in all 43 extension centers. It is estimated that at the moment each individual extension officer is responsible for about 1000 farms. This is three or four times greater than the number for which one person is responsible in

developed countries. Hence, the number of personnel should be increased three or four times, considering the increasing importance of extension services, the currently low technical level of farms in Oman, the fact that farmers are distributed over wide areas, the need to undertake larger new irrigation projects under this Master Plan, and the need for on-the-job training for Omanis who will replace expatriate extension staff.

The number of personnel should be steadily increased along the lines indicated in the training program given below.

(c) Training of Extension Staff

Considering both the importance of and the difficulties involved in extension services in Oman, securing a sufficient number of extension officers with sufficient quality is an extremely important issue.

More Omani junior college and university graduates need to be hired to secure high quality Omani extension officers, but it is also important to provide education to develop basic knowledge whenever there is an opportunity to do so for the high school graduates and persons with lesser educational training currently working at the extension centers. Communication skills, leadership, and other qualities that go beyond academic achievement can only be developed through appropriate practical training and direct experience.

Three training courses per year are provided in Oman for extension officers, but the content of these courses needs to be developed further.

Replacing expatriates by Omani nationals is a particularly important issue, and the following concepts are needed to effectively educate these extension staff.

(i) The training should be well planned.

- (ii) Training curriculum should be set up.
- (iii) Staff need to develop practical leadership abilities.
- (iv) Facilities and equipment required for training should be provided.

As already mentioned, the role that the educational system will play in terms of a basic academic foundation will be extremely important in early securing well trained extension staff.

The construction of a new agricultural junior college functioning to train not only extension officers but also middle level agricultural engineers would be expected to contribute greatly to accelerating the pace of agricultural development in the Sultanate. However, the educational program at such a junior college would necessitate integrating the requirements of the academic curriculum of the Ministry of Education and Youth and the training goals of the Ministry of Agriculture and Fisheries regarding extension personnel. Thus a coordinated effort between these two authorities in the establishment and operation of the school is required.

(2) Equipment and Facilities for Extension Services

(a) Training Centers for Extension Staff

For training the extension staff and extending the techniques researched and developed, training centers should be established to strengthen the link between research institutions and extension centers.

Such training centers would be established at the Rumais Agricultural Research Center and in the Southern Region. Instructors would be experts from the research institutions, and the training would reflect the results of research in crop cultivation, crop protection, agriculture management, and other research subjects.

The training center will be primarily aimed at training extension staff but it should also undertake the following activities.

- (i) Training in the latest technology and research management methods for current and prospective research staff.
- (ii) Function as a forum for exchange between researchers and extension staff, thereby providing farmer feed back to research institutions, universities, and other entities engaged in agricultural research.
- (iii) Develop audio-visual educational materials in cooperation with the Development Support Communication Center (see (c)).
- (iv) Invite outside experts from PAMAP and elsewhere to assist in providing not only extension officers and researchers, but also to help farmers and other interested parties with short-term training on agricultural production, harvesting and selling crops, marketing, and other specialized areas of concern.
- (v) Training in the methodology of agricultural statistical surveys would be provided for statistics staff.

(b) Installation and Strengthening of Extension Center Equipment

(i) Equipment

o Mobile A/V Unit

Opportunities for direct contact between extension staff and as many farmers as possible should be increased. At this time it is important to deploy audio-visual material effectively to maximize the benefits of the extension services. Such a facility would accordingly be provided on a regional basis.

o Computers

As it develops into better-quality training and other support for key farmers, the quantity of data needing to be processed will surely increase dramatically. Computerized data management will help greatly in providing advice on farm management, crops, cultivation periods, cultivation area, harvesting periods, pest and disease control, etc.

o Simple Analytical Equipment

Analytical equipment should be provided to the extension centers, and simple analysis of soil and water conducted there to respond quickly to needs in the field.

o Reference Books

Reference books, illustrated materials, research manuals published in Arab countries, and other necessary books and materials should be provided. This is necessary to support extension staff in their daily self-study and education efforts.

(ii) Agricultural Technology Information Units

Agricultural Technology Information Units should be established at the extension centers throughout the country to offer farmers technical information with regard to farming and related sciences. The units provide easy-to-understand introductions to agricultural techniques and farm input. These units should be open to farmers and rural housewives alike, with facilities for viewing videotapes and diagrams, and places for meetings. These information units would provide significant information towards improving farm management, including crop market prices, etc.

In addition to improving farm income, general enhancement of daily rural life is important for raising the standard of

living in the farming villages. In this regard cooperation between the ministries concerned could be pursued.

In carrying out the activities under this item, the DSCC described in (c) below would be effectively utilized.

(iii) Extension Center and Sub-Centers in Remote Areas

It is very difficult for the extension staff to reach remote areas and return in the same day. Extension center and sub-centers should be established in such remote areas where necessary to provide farmers with access to extension officers and extension center activities.

(c) Development Support Communication Center (DSCC)

The Development Support Communication Center is designed to be a part of the overall agricultural information services and produces video tapes, radio and TV programs for farmers. It also works to integrate the various programs such as that for improving the standard of living in the farming villages operated by the Ministry of Social Affairs and other government departments. Materials created for extension services by this communication center are used by the training centers, the agricultural technology information units, and the mobile A/V units. Problems and results arising from using these materials are fed back from the farm to the center by the extension staff for reflection in the preparation of subsequent materials.

Toward effective and integrated implementation of the activities under this section, it is recommended that operation of the DSCC be performed under the guidance of a committee comprised of representatives from the concerned ministries chairmanned by the MAF minister.

(3) Farmer Technical Training

(a) Key Farmer Training

Under current extension services, key farmers are the focus of training in cropping techniques, with their fields functioning as demonstration fields for new varieties, new cultivation methods, etc. It is expected that key farmers will disseminate these techniques to colleagues in their villages.

In Oman, an extension program for 2,500 farmers has been in progress since 1987. Thus, under the Master Plan, it is recommended that this extension program be continued. The number of people targeted by this extension program will be increased, and they will be trained as key farmers.

(b) Farmer Education and Training Facilities

As described in (2) (b) above, farmer education and training is to be carried out using mobile A/V units and the agricultural technology information units. In this regard, effective means for utilizing audio-visual materials are discussed below.

(c) Audio-visual Farmers' Training

(i) Educational Techniques using Audio-visual Technology

Various techniques should be used for training farmers, and the appropriateness of those chosen greatly influences the results of extension work.

For people who understand things better through direct experience, concrete and realistic methods should be employed. For people who understand best through indirect experience, abstract or symbolic methods should be employed. Thus, in the agricultural communities where the educational level is low, more concrete and direct techniques involving personal experience, seeing and hearing are appropriate.

In general, it is a good idea to combine extension techniques as much

as possible. Activities should be targeted at both individuals and groups. It is important to establish contacts with the entire regional community as well.

(4) Link Between Extension and Research

A close link between the research and extension sectors is essential to maximize the cost effectiveness of investment in development of Omani agriculture.

Towards this end, the training center discussed above as well as all other possible opportunities must be effectively utilized as forums for exchanges between research and extension personnel. Also, administrative measures will be necessary to provide incentives to farmers to adopt new techniques, as a means of promoting the timely shift of research results to the field.

7.3 Livestock

7.3.1 Development Target

Present productivity and profitability of the livestock industry are generally low in Oman. From the viewpoint of national food security, it is essential to increase the self-sufficiency rate, which is only 29 and 19 percent for red meat and table eggs, respectively in spite of their importance as the primary diet in the nation. It is possible that a high potential for further development in the livestock sector exists because of the present low productivity and profitability.

Present constraints on animal husbandry can be summarized as follows.

- (1) Feed resources are insufficient because they have not yet been effectively used, in spite of the fact that they depend fully on the limited water and land resources.
- (2) Because the program for breeding and improvement of livestock is not in place, productivity remains low.
- (3) Livestock economic losses are large because animal hygiene and epidemic control systems have not yet been well established.
- (4) Efficient breeding management is not practiced mainly due to the low economic awareness of livestock holders in general.
- (5) The distribution system, facilities for marketing livestock, and product processing, etc. have not yet been well developed. Consequently, distribution of products is not smooth, and an enthusiastic increase in animal production is not stimulated.

In an effort to eliminate the above mentioned constraints which hamper the productivity improvement of the livestock industry, livestock development targets within the development scope of the Master Plan are as follows:

- (1) Securing and developing feed resources
- (2) Improvement of livestock
- (3) Improvement of animal hygiene and elimination of serious epidemic diseases
- (4) Improvement of livestock management and expansion of intensive livestock management
- (5) Improvement of marketing environment

7.3.2 Development Strategy

7.3.2.1 Livestock Development Concept

The development target in this Master Plan is to increase livestock productivity by encouraging the farmers of Oman to use intensive livestock management. The approach which will utilize the full development potential of livestock and realize this goal is as follows:

(1) Objective livestock holders

Small- or medium-scale agriculture-based holding types which possess some of their own feed resources, should be highlighted as main objective livestock holders for the following reasons:

- (a) Since most of the livestock holders in the country are small- or medium-scale agriculture-based holding types, priority must be placed on the improvement of productivity in their agriculture and livestock management.
- (b) Within the limited agricultural resources, effective use of agricultural by-products or residue for feedstuff and livestock manure for fertilizer, are essential for livestock and cultivation, respectively. A mutual supply of feedstuff and fertilizer is quite

possible on agriculture-based holding type farms.

(c) Domestic-type livestock holders seldom possess their own feed resources and mainly engage in non-agricultural occupations. Therefore, development potential here is low due to limited involvement in livestock management.

(d) Most of the commercial livestock farms are already being managed well. Moreover, as far as herbivorous livestock are concerned, further development of new commercial farms is not expected, except in limited areas such as Southern Nejd, due to limited water resources. Nevertheless, on commercial poultry farms which are easily established and operated by the private sector itself, government support is less necessary except in the area of marketing, which requires some improvements.

(2) Increase self-sufficiency rate of livestock products

Traditionally, livestock products have been the basic diet of the Omani people. Meat particularly has been essential to the maintenance of traditional dietary customs during celebrations immediately after "Ramadhan" when large quantities are consumed. Since the self-sufficiency rate of livestock products is still low in Oman, improving the rate is essential for national food security. On the other hand, however, there are serious limitations with the agricultural, water and grass resources, and such resources will allow very little expansion of livestock. In this context, the development of livestock in the target year 2000, shall be promoted under the concept described below.

(a) A self-sufficiency rate of 100 percent is targeted for poultry, i.e. broilers and table eggs, because poultry requires neither a large amount of land, nor a large quantity of water, and is competitive in price compared to imports.

It is expected that the establishment and the proliferation of small-scale poultry farms would increase the employment opportunities in rural areas. Moreover, it will promote the permanent settlement

of farmers in rural areas due to increased farm income.

(b) In connection with fresh milk, its freshness is particularly important. Therefore, a self-sufficiency rate of 100 percent is also targeted. The price of milk is also competitive with imports. A definite self-sufficiency rate for the other dairy products has not yet been targeted but will be set on the basis of future market surveys and feasibility studies, taking into account competitive power against imports.

(c) With respect to the meat of herbivorous livestock, which depend on extensive water and land resources for grazing, maximum efforts will be made to increase the self-sufficiency rate for meat within the available feed resources. Focusing only on the improvement of the self-sufficiency rate, it is possible to increase it by increasing the number of livestock through an extensive supply of mixed feed ingredients which consist of imported material. However, this study does not simply aim at improving the rate, but recommends a well-balanced supply of both fodder and the feed ingredients, taking into account the physiological characteristics of the herbivorous livestock. It is also possible to increase the rate by fattening imported young livestock with the mixed feed ingredients. However, this measure is not considered in this study because of its reliance upon imported materials, which are not regarded as contributing to national food security. This is discussed below.

(i) Herbivorous animals require roughage feed even during fattening stages to some extent. If precious domestic grass resources are fed to imported fattening livestock, the domestic grass resources for breeding livestock will be correspondingly reduced. In that case, the development of breeding livestock would be retarded. The development of domestic breeding livestock which can propagate itself is more important than the fattening of imported livestock from the viewpoint of national food security. Therefore precious domestic grass resources should be applied to the development of domestic breeding livestock.

(ii) In the case of feeding animals imported from foreign countries, there is some danger concerning imported epidemic diseases unless a thorough quarantine system is established. Moreover, any resultant epidemics would bring about large economic losses to the animal husbandry. Also, the elimination of epidemic disease is extremely expensive.

(3) Development concept for livestock

In accordance with the description of (1) objective livestock holders and (2) increased self-sufficiency of livestock products, the development concept for various types of livestock is discussed below.

(a) Poultry

Poultry management only requires a limited area in comparison with other herbivorous livestock breeding. Therefore, it is recommended that holders who possess relatively small areas of farmland establish poultry farms with the support of the government and manage them under the guidance of the government. In order to attain 100 % self-sufficiency for broilers and table eggs, more highly productive and large-scale poultry farms shall also be established. However, such large farms will be managed entirely by the private sector except for marketing and supply of superior chicks, which will be supported by the government.

Due to the sensitivity to disease of poultry, strengthening of CVIL and training and expansion of veterinary staff is to be pursued. The production ratio for large-scale to small-scale poultry holders by the project target year is 75:25 for broilers and 70:30 for table eggs (based on the Feasibility Study for Establishment of Poultry Project in Oman, GRM, 1988).

(b) Cattle

(i) Dairy cattle

In the outskirts of the capital area (for example the South Batinah and the Interior), which contain most of the major consumers in the country, and the Southern Region, where dairy cattle breeding prevails, the conditions for establishing dairy product-processing factories are satisfied from the viewpoints of the collection of the fresh milk and its marketing. 100 % self-sufficiency in fresh milk will be attained in Oman through helping farmers to raise cows cross-bred from local species and exotic species. This goal would be attained on the basis of intensive extension service and governmental support such as the artificial insemination service, etc. The superior effects of cross-breeding have almost been confirmed in Oman.

(ii) Beef cattle

As described below in the "demand forecast", efforts will be made to improve the productivity and quality of beef, which has the highest domestic demand of any meat. There are several problems with beef production, such as over-grazing in the Southern Region and marketing disadvantages due to price differences between domestic and imported beef. It is difficult for the private sector to solve these problems alone. Accordingly, the problems will be solved systematically, under the guidance of the government.

Specifically a joint government and private sector corporation will be established to promote integrated development of produce, processing and distribution for cattle products.

In order to overcome the geographical disadvantages in marketing, particularly in the Southern Region, an intensive, as well as large-scale, modern organization for fattening is indispensable for high-quality and low-price beef production. Large-scale fattening will be under the guidance of the Public Corporation, which will be established and operated jointly by the government and private sectors.

At the same time, intensive management of beef cattle fattening by farmers should also be promoted. Generally, with respect to cattle, intensive feeding-management methods should be extended to holders who possess relatively large farmland for the promotion of high quality beef and milk at low prices.

(c) Goats

Goats are the most suitable livestock for feeding, especially in light of the fact that they use roughage resources so effectively. Actually, goats account for the largest number of livestock in the country. Moreover, Omani people prefer to eat goat meat. Under these circumstances, the best effort shall be made to expand goat production, focusing particularly among the small- and medium-scale agricultural-based livestock holders who have, to some extent, established their own feed resources. It is recommended that these holders adopt intensive feeding management, expansion of breeding scale, and fattening of young goats by themselves.

(d) Sheep

Mutton is not as popular among Omanis as goat meat is. In addition, since there is no production cost difference between mutton and goat meat, the production of sheep is less profitable. Therefore, efforts shall be made to produce high quality mutton in the future. On the other hand, sheep are better able to subsist on roughage than goats, and can be more dependent on manufactured compound stockfeeds during the fattening stage. In other words, the fattening efficiency of sheep is superior to that of goats. In this context, extension of intensive feeding-management programs for sheep and the production of high quality mutton shall be promoted among medium- and small-scale agricultural-based holders, who have some of their own feed resources. It is further recommended that the fattening be extended to all young lambs except for replacements.

(e) Camels

A camel's diet consists mainly of roughage, and therefore, in terms of effective use of feed resources, it is suitable for breeding in Oman. However, the meat and milk of camels are less marketable than that of other livestock, and what used to be the primary function of camels, i.e. transportation, is no longer necessary. Accordingly, the number of camels needs to be reduced and the surplus of feed resources needs to be allocated to more profitable livestock.

It must be remembered, however, that the breeding of camels is a traditional part of the Omani lifestyle, and its meat and milk are used for domestic consumption. A drastic reduction in camels is not recommended for these reasons. Consequently, a gradual reduction shall be implemented by limiting the replacement of camels, except in the case of camels with superior racing ability or milk productivity.

In addition, special attention must be paid to the limited water and grass resources in the country for future livestock development and supply. The expansion of livestock will not only take place by the area's expansion of feed resources or by an increase in the number of head of livestock, but by increasing the productivity and quality of each live animal through the extension of intensive management programs.

(4) Development concept by region

The country is herein divided into three regions, -- the Batinah, the Interior (including Sharqiya, Dakhliya, Dhahira Region) and the Southern Region. Regional strategies for livestock development are discussed below in terms of the livestock species to be emphasized for each.

(a) Batinah Region

In the Batinah Region, where a considerable number of agricultural-based livestock farmers are concentrated, there is an advantage because of its close proximity to the capital area, which is the largest area for consumption in the country. Based on this, the livestock to be developed has been proposed as follows:

(i) Large-scale farms Dairy cattle (cross-breeds) are recommended.

(cultivated land: more than 5 feddan)

Reasons:

- Geographically advantageous due to close proximity to the consumption area, which will enable them to maintain the freshness of milk.
- Advantageous for collection of milk due to the concentration of farms.
- Advantageous for certain large-scale self-supplying feed resources basis (i.e. cultivated land) which are required for breeding dairy cows.

(ii) Medium-scale farms Sheep and goats are recommended.

(cultivated land: 2 to 5 feddan)

Reasons:

- Effective use of feed resources is feasible due to the combination of cultivation and livestock breeding.

(iii) Small-scale farms Poultry (layer) are recommended.

(cultivated land: less than 2 feddan)

Reasons:

- Advantageous for maintaining freshness and for transportation due to the close proximity to the consumers.
- Advantageous for the collection of eggs due to concentration of farms.

- Feasible to be managed by small farmers because poultry does not require a large area.

(b) Interior Region

Because the rangeland in this area is vast and farms are scattered, the livestock proposed for development in this region is as follows:

- (i) Large-scale farms Dairy cattle (cross-breeds) are recommended.

(located relatively close to the capital area and with cultivated land of around 5 feddan or more)

Reasons:

- Geographically advantageous due to close proximity to the consumption area, which will enable them to maintain the freshness of milk.
- Advantageous to raise dairy cows in the Interior Region from the standpoint of disease prevention due to relatively low humidity.
- Advantageous for certain large-scale self-supplying feed resources (i.e. cultivated land) which are required for breeding dairy cows.

- (ii) Large- and medium-scale farms Goats are recommended.
(cultivated land: more than 2 feddan)

Reasons:

- Effective use of feed resources is feasible due to the combination of cultivation and livestock breeding.
- Goats rely mostly on fodder available on the rangeland.

- (iii) Small-scale farms Poultry (broiler) are recommended.
(cultivated land: about less than 2 feddan)

Reasons:

- Poultry can be fed by the small farmers because it does not require a large area.
- The distance between poultry farms and consumers is not as important as for eggs, which require shorter transportation distances to maintain freshness and to avoid damage.
- The offensive odor of the manure of the poultry is less of a problem in rural areas where the residences are spread out.

(c) Southern Region

Southern Region can be further divided into three sub-regions -- Jabal, Salalah Plain and Nejd Area -- based on their topographical and feed resource differences. The major livestock to be developed in these areas is as follows:

- (i) Jabal Area Cattle and Poultry are recommended.

Reasons:

- The rangeland which extends over the Jabal Plateau is a large, natural pasture land, and has the only and very important supply of high quality natural grass which enables breeding of herbivorous livestock.
- Most cattle in Oman are grazing in this area.
- Cattle grazing here is appropriate not only because of the high quality of the natural feed for cattle, but also because there is less possibility of over-grazing, which destroys

natural pasture, as with goats and camels.

- The Jabal area is located at a relatively high elevation with relatively cool summers because of the influence of the monsoon. Therefore it is advantageous to raise poultry in this region due to the low tolerance of poultry against very hot conditions.

(ii) Salalah Plain

Salalah Plain can be characterized by its flat land with some residential areas, and by small- and medium-scale farmers mainly engaged in irrigated agriculture. The major livestock proposed for this area is:

- Large-scale farms (5 feddan or more) ... Dairy cattle
(cross-breeds)
Cattle fattening
- Medium-scale farms (2 to 5 feddan) Goats and Sheep
- Small-scale farms (2 feddan or less) ... Poultry

(iii) Nejd Area Cattle (Feed lot) goats and sheep are recommended.

Reasons:

- In order to increase the commercial value of beef in the Jabal area, it is necessary to produce high quality beef at a low cost by means of large-scale and intensive management of fattening. To this end, a considerable amount of hay will be required. Fortunately in the Nejd area, a development scheme for the agricultural land irrigated by fossil water, is being proposed. Therefore, an increase in hay production is very possible.

- This area is appropriate for large-scale fattening management because of its distance from the existing residential areas, which do not allow the offensive odor associated with large-scale fattening management.
- In order to promote the permanent settlement of the nomads traditionally raising goats and camels in this area, it would be effective to pursue intensive husbandry of goats and sheep based on development of the large reserves of fossil water available in the area.

7.3.2.2 Targeted development figures

(1) Goal of livestock productivity in 2000

Based on the "Improvement of livestock" and the "Improvement of animal hygiene and livestock management", it can be expected that the productivity of each livestock in 2000 will be improved to the extent shown in Table 7.3.1.

(2) Potential number of livestock in the target year

In accordance with the study discussed above, the potential number of livestock to be fed by the target year (the year 2000) is estimated in table 7.3.2. According to this table, the estimated potential increase of each type of livestock in the target year corresponds to 150 % for sheep, 126 % for goats, 75 % for cattle and 59 % for camels. This is compared to the present estimated number of each livestock. Details of this calculations are described in volume 5, chapter 2.

(3) Target of farm economy

Based on the discussed premises above, the balance of some types of farm economy has been studied for several livestock breeding models. The economic balance in the target for different feeding models is estimated in Table 7.3.3.

Table 7.3.1 Principles and Rate for Estimating Animal Production

Item	Cattle		Goat		Sheep		Camel	
	Local Cattle	Exotic	Cross-Bred	Extensive	Intensive	Extensive	Intensive	Local
	15 months	13.5 months	15 months	15 months	10 months	15 months	10 months	24 months
Production Interval	15 months	13.5 months	15 months	15 months	10 months	15 months	10 months	24 months
Annual Delivering Percentage Result of Live Births	73%	80%	73%	80%	120%	80%	120%	40%
Replacement Ratio	Female 20% Male 15%	Female 28%	Female 20%	Female 25% Male 40%	Female 23% Male 30%	Female 25% Male 40%	Female 23% Male 30%	Female 6% Male 15%
Mortality Rate (+immature)	Mature 2% young 12.5%	Mature 3% young 10%	Mature 2% young 12.5%	Mature 5-10% young 12.5%	Mature 3-10% young 10.6%	Mature 5-10% young 12.5%	Mature 3-10% young 10.6%	7%
Meat Production Weight	300kg 250kg	500kg 400kg(12m)	320kg 150kg (3m) 25kg (5m)	55kg 46kg	60kg 51kg	51kg 44kg	55kg 50kg	500kg 350kg
Young Male	50kg (3m) 100kg (5m)	50%	50%	28.5kg(200d) 28.5kg(200d)	32kg(200d) 32kg(200d)	25kg(200d) 25kg(200d)	48kg(320d) 48kg(320d)	50%
Young Female	50%	50%	50%	50%	50%	50%	50%	
Carcass Yield Rate	250kg	4500kg	1200kg		120kg			
Milk Yield (kg/year)								

Source: JICA estimate

Table 7.3.2

Estimated Livestock Population in 2000

('000)

Region	Cattle	Goats	Sheep	Camels
North	54	909	225	15
South	112	75	4	27
Total	168	984	229	42
Increase Rate From 1989%	75	126	150	59

Table 7.3.3 Estimated Economic Balance of Some Type of Farm

Management Model	Rough Revenue	Operating Cost	R.O. Profit
Intensive Management of 40 head of Goats	1,825	921	904
Nomadic Management of 100 head of Goats	2,583	1,344	1,239
Intensive Management of 10 head of Cross-Bred Cows	2,230	1,465	765
Cattle Management of 80 head in Southern Jabal	4,693	3,191	1,502
Fattening Management of Beef Cattle in Southern Oman	2,372,060	2,049,865	322,195
Intensive Broiler Management (9,000 Broilers p.a.)	6,750	4,702	2,048
Intensive Layer Management (75,000 eggs p.a.)	3,825	2,568	1,257

According to the table, each management type ensures a promising profit. The depreciation cost in intensive management, however, is a large proportion of the management. Therefore, an effort shall be made to minimize depreciation costs, particularly in the initial stages of livestock development when the management techniques have still not been well developed.

(4) Self-sufficiency rate for livestock in the target year

Livestock production and its self-sufficiency rate in the target year (2000) can be estimated on the basis of the previous "potential number of livestock fed in the target year" and is depicted in tables in volume 5, chapter 2. The parameters for estimation of livestock production are also described in volume 5, chapter 2.

As described in volume 5, a 100 % self-sufficiency rate is promising for chicken, eggs, and fresh milk, and a 48 % self-sufficiency rate is viable for red meat. Details of this calculation are described in volume 5.

More concrete development strategies for achieving the above target values are discussed below.

7.3.2.3 Establishment of the Development Strategy

In order to improve the present situation of livestock development and to accomplish the above-mentioned development targets, livestock development will be promoted in accordance with the concrete strategy shown in the Table 7.3.4, in terms of the "Constraints of development" described in section 7.3.1, "Development Target".

The basic concept for development projects, research/extension, and the subsidy institution under the above-mentioned development strategies, can be summarized as follows:

(1) Development projects

The development projects will be planned with the necessary government support, in order to extend and promote more modern and intensive livestock management to the livestock holders in the country.

(2) Research and extension

In the research activities, special emphasis shall be put on the development of feed resources and breeding management techniques, which are directly connected to increasing livestock productivity. While in the extension services, improvement of the livestock holder's economic awareness and prompt communication of research results and development accomplishments to the farmers should be stressed.

(3) Subsidy institution

Farmer encouragement through production incentives is essential for the future expansion of livestock products at the farms' level. The government's subsidy scheme in the proposed development projects basically aims at providing farmers with production incentives. Therefore, the subsidy should be the minimum amount so as not to decrease the farmer's own management efforts. Furthermore, this subsidy system should focus on expediting the farmer's self-sufficiency, and should not aim to provide the farmer with permanent subsidies.

Table 7.3.4 List of Development Strategies

Constraints to Development	Development Projects	Development Strategies Research/Extension	Subsidy Institution
Shortage of feed resources	<ol style="list-style-type: none"> 1 Regeneration of southern rangeland 2 Preservation of rangeland through reduction of grazing livestock, i.e., purchase of feeding calves for fattening 	<ol style="list-style-type: none"> 1 Development of new feed resources 2 Development of effective use of existing feed resources 3 Estimate of nutrient requirements of animals and development of effective feed supply methods 4 Extension of the above technique and above accomplishments communicated to farmers. 	<ol style="list-style-type: none"> 1 Purchase of grazing livestock
Low livestock productivity	<ol style="list-style-type: none"> 1 Implementation of artificial insemination 	<ol style="list-style-type: none"> 1 Development of breeding and improvement methods. 2 Breeding to superior species and supplying to farmers. 3 Extension of the above techniques and accomplishments communicated to farmers. 	

Table 7.3.4 (Continued)

Constraints to Development	Development Strategies		
	Development Projects	Research/Extension	Subsidy Institution
Insufficient establishment of animal health and disease control system	<ol style="list-style-type: none"> 1 Improvement of animal quarantine system 2 Improvement of animal health system 3 Implementation of vaccination program (Stage-4) 	<ol style="list-style-type: none"> 1 Development of vaccines available for specific disease characteristics 2 Communication of health control techniques to farmers. 	<ol style="list-style-type: none"> 1 Supply of and subsidy for medicine and chemicals for farmers.
Low economic awareness of livestock holders, i.e., undeveloped breeding management techniques	<ol style="list-style-type: none"> 1 Improvement of extension-related facilities and system. 	<ol style="list-style-type: none"> 1 Development and extension of effective management techniques. 	<ol style="list-style-type: none"> 1 Subsidy for initial investment for commencing intensive livestock management.
Less developed livestock marketing system	<ol style="list-style-type: none"> 1 Improvement of marketing facilities and distribution of livestock products. 2 Production of high quality meat through establishment of fattening management. 	<ol style="list-style-type: none"> 1 Development of quality-improvement method for livestock products (Research on fattening method, etc.) 	<p>Recommendation</p> <p>Dissolution of retailing price differences between domestic products and imported goods.</p>
Others: Insufficient basic data for development	<p>Collection and accumulation of basic data for livestock development (to conduct surveys and studies)</p>		