

CHAPTER 1: INTRODUCTION

1.1 Prelude

The Republic of Yemen (ROY) is located in the south-western part of the Arabian Peninsula, an area that is categorized as one of the arid regions of the world, with a land area of about half million square kilometers excluding the many islands in Red Sea and Arabian Sea (CSO 2002) (Fig. 1.1). It was called Yemen Felix (Al-Yaman Assa'e'd) or Arabia Felix (Al-A'rabia Assa'eeda). Yemen has a unique multi-climatic zones and year-round-cropping due to its physiography and location. It was known as the food basket of Arabia, because of its fertile land and active population as well as the intensive effort applied in farm land. Yemen, historically, had one of the oldest civilizations in the Middle East based on agricultural development, in which the people of Yemen managed to establish the spectacular mountain terraces system on the steep slopes of the rugged mountainous areas, some thousands of years ago, in order to conserve soil and to optimize rainfall water use. Yemen depends on rainfall to cultivate and produce crops, so that Yemeni people cultivate their land under rainfall conditions at large scale, and they efficiently use and control flood water and spring water. Water rights of flood water and springs were well established and efficiently used to cultivate farmland according to its location from the source of water and to agreements between land owners. It (water right) became well-known among the people, due to continuous practices and/or according to written documents which were transferred from generation to generation till today.

Yemeni people inherited the knowledge of water harvesting such as Dams (Marib Dam), water traverses, reservoirs (in Arabic is called Saharig, Siq'aya, Karif, etc.) and irrigation channels. About three quarters of the population of Yemen are sedentary and living in villages scattered all over the mountain hills around the cultivated lands and they cultivated the land used to produce their food. For centuries, Yemen was self-sufficient in food production, both crops and animals production, and the surplus was exported to neighboring countries.

Recently, changes have happened to the life style and consumption pattern of the increasing population, which in turn caused increasing demand on food, water and other daily requirements. These changes encouraged the people to turn to internal and external migration, which caused abandonment of terraces and their maintenance, as well as the absence of traditional cooperation among farmers due to migration of men and shortage of labor forces and increasing labor wages (Hehmeyer, 2000). Also, neglecting and/or forgetting traditional agricultural practices, such as crop rotations and cropping schedule are evident. Increased population and internal migration enhanced the encroachment of urban area over the fertile

agricultural land. The change of the economy and life style and the import of many food stuff have increased the need for cash, which in turn encouraged the people in agricultural areas to change the cropping pattern from food crops cultivation to Q'at (a stimulant plant) cultivation, because of its high income per unit area compared to other crops especially cereal crops (Brunner, 2000). Q'at expands over the good and fertile land. The ever increasing Q'at consumption among both sexes has encouraged the fast expansion of Q'at acreage, so it forced farmers to introduce agro-chemicals such as pesticides, insecticides and fertilizers and use them randomly, uncontrolled and without any care about human health and the environment. Q'at expansion encouraged farmers to use groundwater excessively, to dig deep wells randomly and to irrigate Q'at fields irrationally; consequently the number of wells increased to 45000 wells (Qahtan, 2000). The extraction of groundwater exceeds the renewable amounts and goes without any intention to the depletion of this precious source of water, which had accumulated for centuries. These practices are causing the alarming continuous decline of groundwater level in many aquifers basins, for instance the Sana'a basin and Saa'dah basin etc.

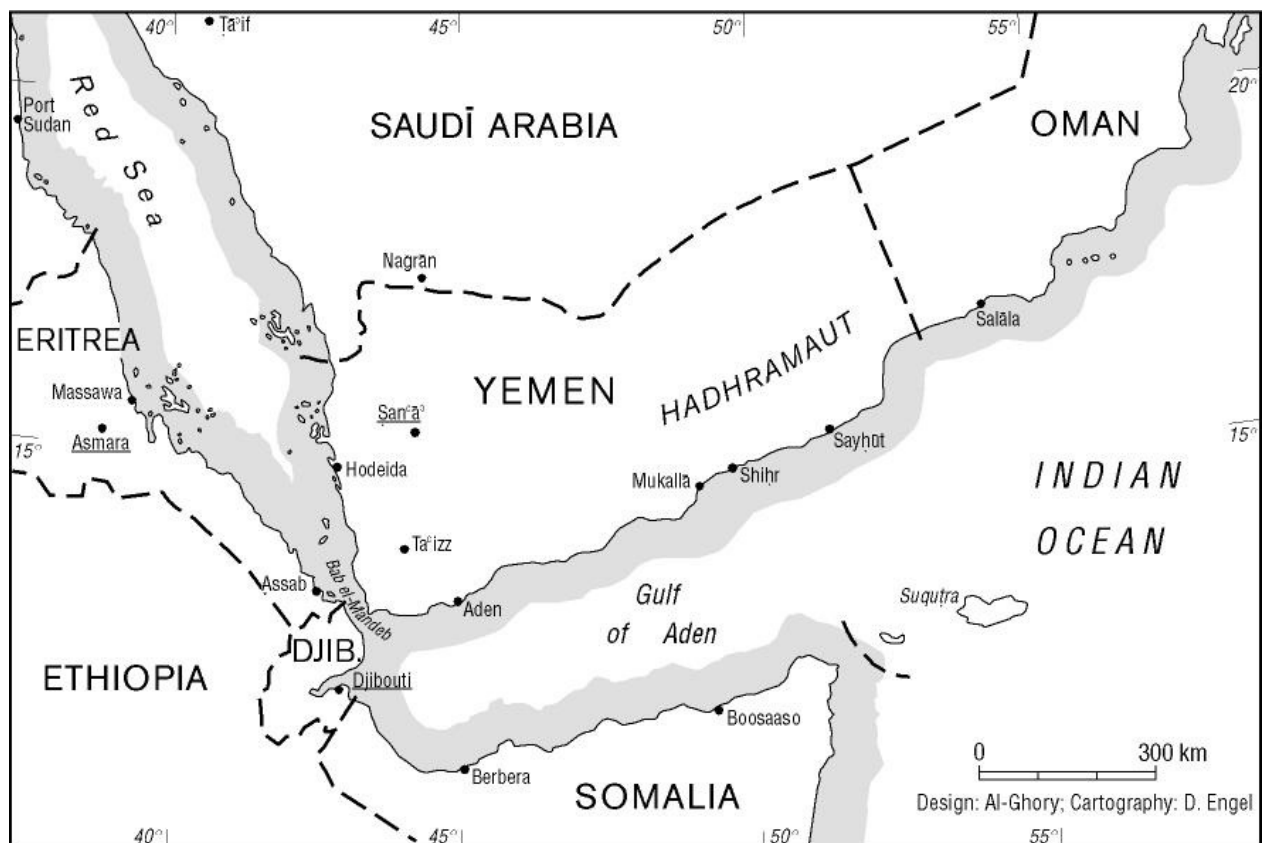


Fig. 1.1: Map of the Republic of Yemen

1.2 Problem Description

The problem of this study can be considered as a complex problem, because it is a major problem at a large scale in the whole country, which gets deeper to the micro scale. The problem is associated to the following three domains:

1. Limiting renewable natural resources (Land and Water).
2. Increasing population growth, and migration (with consequent adverse effect on resource management)
3. Persisting unsustainable use of natural resource, owing to current agricultural practices.

For better understanding the study problem will be described in terms of its three attributes:

- (i) Pressure on Renewable Natural Resources
- (ii) Economic Change and Its Consequences
- (iii) Q'at phenomenon/ problem

1.2.1 Pressure on renewable natural resources

The pressure on natural resources has increased with the growing of population, expanding urbanization and the increasing needs for water. According to the 1994 Census the population increased by 3.6% annually, as it reached 16.482 millions, meanwhile, resources (cultivable land and renewable water) remained finite. The cultivated land is about 1.5 millions hectares and due to increasing population, the cultivated land per capita is reduced by from 0.2 ha in 1970 to 0.06 ha in 1995 (Bamatraf et. al.,1996). That implies per capita cultivated land is reduced by 70% since 25 years. On the other hand, the rainfall, only source of water, and ground water, that has been stored for centuries, is the major resource base. The average annual rainfall is approximately 60 billion cubic meters (BCM), most of which evaporates shortly after rainstorms. The remainder runs across the surface as runoff and/or percolates into the ground to recharge the groundwater. It is estimated that 1.5 billion cubic meters (BCM) resemble the average annual renewable amount, while the average annual abstraction is 2.1 BCM, i.e. there is a negative gap of 0.6 BCM (Bamatraf, 1996, and Van der Gun et al., 1995). The increasing population and unsustainable practices in agriculture and manufacture have encouraged access to ground water by digging surface/deep wells manually and/or by drilling for domestic and agriculture groundwater use. So, the amount of water used for domestic and agricultural use increased and caused the gap between recharges and abstraction. The new practices of access to ground water go without any control; this means that every landowner has the right to dig a well on his land. Therefore, people dig wells everywhere on their land where they expected to find water, mostly upstream of springs, which in turn caused drying out of spring water, while spring water was

traditionally distributed between owners of adjacent land holdings, according to the area they own.

Unsustainable practices, such as changing the cropping pattern (expansion of Q'at) and/or misusing water and land, have reduced food production, which increased the gap between food production and food consumption. The increase gap will increase poverty, and at the end will cause the problem of vulnerability to food insecurity. Unsustainable water management and uncontrollable access to groundwater abstraction are starting to show up in many areas, for instant ground water level in Sa'adah basin has fallen by 40 m during 9 years (DHV, 1993). There is a threat of water shortage in Sana'a basin and similar highland basins (Van der Gun et al, 1995). Nowadays, the city of Taiz is suffering from the problem of water shortage.

Families are getting larger at an average of 7.4 persons per family (CSO, 2000); in turn their needs are increasing compared to the land production. So, the male family members migrate to cities in Yemen or to neighboring oil countries, leaving the care of farmland to women. They send money to their families to meet their needs and the expenses of land cultivation. Because of dependency on women to run farms, then the efficiency of land maintenance is lower, especially for families with few women. Such families will face the problem of farm-labor shortage; so either they have to spend a lot of money on labor or the cultivation and maintenance of land will be limited or neglected. As the cultivated land in the mountain terraces areas consists of small and fragmented land parcels, it is not suitable for wide scale mechanization. The manpower with animal power is suitable for appropriating it. Therefore, the productivity of the land will be low with little work applied to the terraced agricultural land.

1.2.2 Economic change and its consequences

The economic situation in Yemen has been affected by changing the world economy and world interest, especially after the second Gulf war in 1990 and its consequences. Moreover, and after unification on 1990, the economic system has shifted from Central Planning System to the Free Market System. This change became confusing for the people/farmers to deal with. In Central Planning System, government was the main investor in many sectors such as agriculture, manufacturing and services. While in Free Market System, government divested its investment in many sectors to open the door to local and foreign private sector to invest in agriculture, manufacturing, and services, etc. Due to the absence of enabling environment for investment, the investors flinched in investing. The consequences/impacts of limited investment have decrease employment opportunities and increased inflation, which also decreased the ability of

the un-employed and low-income segment of the population to acquire most of the essential commodities.

Subsidy of imported commodities such as wheat, flour and rice etc was a part of the government policy, which started in middle 70s of last century; this policy had affected the local economy in three ways, in my opinion. First, foreign currency went to support foreign farmers. Secondly, farmers in Yemen depended more on these cheaper imported commodities than on local products. Thirdly, farmers started to grow Q'at instead of grain. In some areas they even uprooted coffee trees and replaced them by Q'at plants not only because coffee and Q'at grow in same climate, but also because of income from Q'at is faster and higher compared to all other crops. Subsidies that government paid for imported foodstuff (such as wheat, flour, rice etc.) had increased farmers' reliability on cheap imported food instead of growing it on their land and encouraged them to grow Q'at to guarantee the cash to buy their needs from the market.

After the second Gulf War about 731,800 migrants (43.5% laborers and 56.5% is their companions, families and children) returned from Gulf States, especially from Saudi Arabia (91% of them came back from Saudi Arabia, 6.3% from Kuwait, and 1.9% from the other States) (CSO, 1991). With returning of migrants stress on natural resource increased because of increased need for food, water, housing and employment. More over, the 1994 war against secessionists, and its consequence; i.e., unemployment, inflation and poverty add to the socio-economic challenges facing the country. As a result, Yemen adapted (in March, 1995) the Economic Reform Program (ERP) proposed by the International Monetary Fund (IMF) and World Bank which aimed to lifting subsidizes to food imports, permitting exchange rate of Rial against foreign currency to the free market, adopting market mechanisms to regulate prices, decreasing the budget deficit and decreasing the inflation rate (AOAD, 1996, al-Bushari, 1999, al-Maitami, 2000, al-A'oulq'y, 2001, al-Fusail, 2001 and BNEA, 2002). "Since the conclusion of the war (civil war in 1994), the government entered into agreement with the International Monetary Fund (IMF) to institute an extremely successful structural adjustment program. Phase one of the IMF program included major financial and monetary reforms, including floating the currency, reducing the budget deficit, and cutting subsidies. Phase two will address structural issues such as civil service reform. The World Bank also is active in Yemen, providing an \$80-million loan in 1996" (U.S. Department of State, 2002).

Subsequently, the Government's economic reform program has endorsed certain measures in 1995 such as:

a) Raising the exchange rate from 12 YR. /US\$ to 50 YR. /US\$.

- b) Increasing the tariff of electricity by 60% and the price of petroleum products by 90%, except diesel in order to avoid adverse effects on irrigated agriculture.
- c) Correcting the monetary policies, especially the rate of reserve and discount.
- d) Commencing of privatization of public corporations; i.e., transferring state farms, factories, companies and other enterprises to private sector to improve production.

Furthermore, in 1996, and 1997 the Government announced the second and third phase of the Economic Reform Program respectively.

Gradual lifting of imported food subsidy was completed by 1998, making life difficult for many families due to increasing of unemployment by 35%, and poverty by 30% especially for low-income and for unemployed. Therefore, nowadays everyone pursues their own interests, looking for income to cover the family's basic needs and neglecting cooperation with other people. Even in villages, farmers had neglected their traditional cooperation with others in agricultural work and activities as before. As work on agricultural land is reduced, so the productivity of the land decreases.

The Cabinet approved law to release the banning on fruit and vegetables importation since 1984, gradually in three years from 1998 till 2000, meanwhile, the government prepared for tax proposals on imported commodities. Worth noting that, the banning on import of fruit and vegetables in 1984, encouraged investment in agriculture, and thus production had increased and become sufficient for local demand with same surplus to export. Concurrently, the Government has encouraged the export of agricultural commodities, through establishing the Agricultural and Fisheries Production Promotion Fund (AFPPF), which covers among other promotional measures 30% of the air transport cost (AOAD, 2000).

1.2.3 Q'at phenomenon/problem

Q'at is an evergreen plant, which is grown and consumed in Yemen and East Africa. The leaves and young branches are harvested and chewed as a stimulant. The scientific name of Q'at is *Catha edulis*, Forsskal. *Catha* equal Q'at, *edulis* means eating and Forsskal is the name of the Swedish botanist who first described and named the Q'at; he died in Yemen in 1763 during the Danish expedition led by Carstin Niebuhr (Hansen, 1964). Q'at, a genus comprising more than 75 species, belongs to the family Celastraceae which contains 500 species classed in 40 genera (AOAD, 1998).

Q'at “phenomenon” in Yemen has advantages and disadvantages. Its advantage is that Q'at has turned and to be an industry that employs about 24% of the labor force (planting, irrigating, spraying, picking and marketing). It helps to redistribute the wealth, because of the movement of

cash from Q'at consumption to production areas. Yet Q'at disadvantages are much more harmful as it affects consumer's health and the environments. The expansion of Q'at on good fertile soil, consuming about 40% of water resource and the consumption of about 20% of the families income are serious threat. Its affect on human health is mainly related to agro-chemicals; which are used either to protect the plant from pest or to enhance its growth.

The area grown to Q'at is not accurately known, it was estimated in 1972 by 43,000 ha, then it increased to 103,000 ha by 2000 (Sherif et al., 2002). However, Q'at expansion and its water consumption are neither well understood nor properly documented. The expansion of Q'at forces farmers to dig wells and/or buy water from trucks to irrigate their Q'at fields. Uncontrolled access to groundwater has reduced the water reserves. Therefore, signs of poor water management and uncontrolled access to ground water and abstraction are evidently apparent in many aquifer basins.

Q'at is consumed daily by most of the adult male population of Yemen, with increasing number of adult's females and teenagers. Before unification, Q'at was not consumed in eastern governorate of Yemen, in Hadhramout and Almahra it was socially illegal; but after unification it was consumed extensively, encouraging farmers to grow more acreage on the expense of other crops. Q'at farmers have access to agro-chemicals (mainly pesticides) to protect against pests and to increase its production to cover the increased demand in the market. These farmers could be divided into two groups on the basis of their knowledge in dealing with agro-chemicals and impact on human health. The first group comprises most of the farmers, who may not have enough idea about the dangerous toxic effect of these chemicals on the consumer's health or on themselves. The second group is that some farmers, who get information about agro-chemicals from extension specialists on plant protection, working in local agricultural projects. Both groups of farmers spray Q'at with pesticide and may harvest it and ship it to markets, regardless of the "safety" period of the poisons. They only think about their profit and how much will be gained from selling Q'at, but do not think about the harmful effect on consumers. Unfortunately, Q'at is consumed daily, even this Q'at which has been sprayed with poison few days ago. Although, the effect of agro-chemicals on human health is not well investigated but it is becoming a health problem, that needs special attention, systematic research and proper policies to address such a life threatening problem.

The area of Q'at has gradually expanded compared to area of other crops, during the last three decades, due mainly to high income per unit Q'at area, which is much higher than that of other crops, even of coffee. Also, growing Q'at needs less work compared to the other crops, and the plant is drought tolerant. It can recover and start to grow new leaves during the rainy

season after a long drought. The drought period may sometimes exceed 5 months especially in the mountain areas, where it is difficult to irrigate by other methods. Roads built to every village and town, due to the traditional cooperation among people and activities of Local Development Associations (LDA) during middle of the 1970 of last century, connected rural area and urban area. This help indirectly of Q'at expansion in which distribution of Q'at become easier and it reached to every city, town and populated area. Therefore, consumption of Q'at increased gradually encouraging farmers to grow more of it.

1.3 Study Objectives

The overall objective was to contribute to the problem solution from a socio-geographical perspective through a situation analysis of resource management; and specifically this research aimed at:

- 1) To assess a selected complex Q'at farming system and its effect on renewable natural resources, the reasons of Q'at expansion and some of its environmental, social and health effect on increasing dependence on groundwater, water rights, and increasing chemical use and its effect on human health and environment.
- 2) To investigate underlining causes of migration and its regional/local consequences on declining food crop production, maintaining the cultivated land and changing of cropping pattern and traditional agricultural practices.
- 3) Economic study is needed to evaluate cereal cultivation system and to compare it with cash crop such as Q'at, which mostly expand over cereal cultivated area.
- 4) To conclude with practical recommendations on sustainable resource management.

1.4 Q'at model and Hypotheses

1.4.1 The Q'at-complex analytical model

The Q'at-Model is a hypothetical representation of Q'at expansion in Yemen. Recently, the effect comes from two levels the national level and regional level. The national level is characterized by three stages: the first happened in the early 1970s, the second one followed after early 1970s to 1990 and the third stage started after 1990 (Fig. 1.2).

a) The First Stage (before 1970s)

In the first stage, the Q'at area was small and the population was also small, households mostly depended on farm production for grain. At that time, the household used to produce some vegetables on farm or in home gardens. Imported food was limited to important

needs. Agriculture import in 1964 valued at 9.6 million YR, whereas exports valued 4.8 million YR (50% of import) (CSO, 1972). In 1971 agriculture import increased to 99.8 million YR, whereas export increased to 20.9 million YR (21% of import) (CSO, 1972). In Q'at production governorate (former North Yemen) farmers produced some of their needs of grains and got remaining quantities from local market, or they sold Q'at in neighboring villages in exchange of grain. Migration was common among Yemenis at that time, actually among men but at small numbers especially to Aden (former South Yemen), East Africa (Somalia, Ethiopia, Djibouti etc), USA and the UK. Migrants used to support their families to live better life. In that early time, there was limited foreign aid coming mainly from the Soviet Union, the People's Republic of China and the United State of America. All the aid was in service projects, such as construction of roads and water projects. The Soviet Union and China provided assistance to North Yemen since early 1950s, during the Imamate period. The most important projects were the construction of the modern port at Hodeida and the paved roads between Hodeida and Sana'a, and between Hodeida and Taiz (U.S. Department of State, 1975).

b) The Second Stage (Early 1970's to 1990)

The second stage of the Q'at-Model covers the time after early 1970s to 1990. This stage was characterized by the high migration rates and by government subsidy of imported food especially wheat and flour; which coincided with fast expansion of Q'at. What actually had happened during this stage? The people from villages started to migrate internally to the cities looking for better jobs and higher income. However, many people migrated to neighboring oil countries after the oil boom in the mid 1970s. Even, most of those who were in Africa flowed back to Yemen and then to the oil countries. Similarly migrants to the USA and the UK increased but in small numbers. The main benefit from migrants was the flow of cash remittances either to their families and/or to deposit into banks in Yemen. On the other hand, more foreign aid started to flow into Yemen in the early 1970s. According to the background notes of the U.S. Department of State (1975), Saudi Arabia, after its recognition of the former Yemen Arab Republic (North Yemen) in 1972, it (Saudi Arabia) became Yemen's principal aid donor, with both direct financial assistance (over \$100 million in 1974) and project aid. Other significant donors were Kuwait, United Arab Emirates, People's Republic of China, the Soviet Union, the World Bank, the U. N. Development Program, Iraq, the German Democratic Republic, the Federal Republic of Germany and the United States. The United States of America installed the water system in

Taiz in early 1960s, which was known as Kennedy's Project. The aid was terminated in 1967. Then it was renewed in 1972, which provided Yemen by food assistance for famine relief, under Public Law 480 (PL-480) Food for Peace. In addition, the PL-480 aid was used to construct the road from the port of Mocha, through Taiz to Sana'a and was involved in the small self-help rural development project.

The aid from World Bank was a credit for agricultural development in the western Coastal region, Tihama projects, coinciding with the aid from the oil-rich Arab countries (Gulf State). This flow of funds to Yemen, either as remittances from migrants or as foreign aid, had changed the situation of the economy in Yemen. The change appeared at the household level as more consumption of food and non-food imported commodities. The debt of the government, on the other hand, was recovered; so it found itself on position of Arab Oil Countries to help its people not only by imported commodities, but also by subsidizing the imported food. Subsidy to imported commodities was the problem, instead of spending surplus money in productive agricultural and industrial projects, which could have provided more jobs. So, the subsidy of imported food encouraged many of the farmers to depend completely on it. Because it is cheaper than that produced locally, especially when the daily labor wage increased with migration of men from villages to cities or to neighboring Gulf countries. According to CSO, 1976/77, Ragaei, 1986, CSO, 1989 and 1991 imported agriculture products in 1975 valued at 862 million YR and have consistently increased to 2,332 million YR, 4,332 million YR and 7,556 million YR during the years 1980, 1987 and 1990 respectively. Whereas, export in 1975 valued at 46 million YR (5% of import), and then decreased to 29 million YR in 1980 (1% of import), yet it increased to 587 million YR (14% of import) and 775 million YR (10% of import) in 1987 and 1990, respectively. The main imported commodities were cereals and cereal products followed by sugar and sugar products. Work in the farm became more duties of women, while men were working either in cities or abroad and supported their families by sending them cash money to buy their needs. The results of that were: firstly, the production of food crops decreased, and secondly farmers started to change the cropping pattern from grain crops to Q'at. Therefore, Q'at cultivation had expanded on the land of grain and even in the land of coffee, through uprooting coffee trees. Q'at can easily be sold in local markets and make good income from the land compared to the other crops such as grains and even the coffee.

c) The Third Stage after 1990

In the third stage, the unification of Yemen occurred by merging the two parts of Yemen, South and North, into one country, called the Republic of Yemen. During this stage many changes in the world took place such as the Gulf Crises as a result of Iraq invading Kuwait and its sub-sequent war in 1990. The outcome was the return of around 700,000 migrants from the Gulf countries, especially from Saudi Arabia by end of 1990. The world economy was shifting to free market system in which countries like Yemen, with a weak economy will encounter great difficulties for survival. For that the government started to apply some actions to solve the old mistake it made in the early 1970s; i.e., subsidizing imported food stuff. So, the subsidy has been lifted gradually starting in 1995. But the families are already dependent on imported wheat and flour, and Q'at cultivation expanded on the agricultural land it became in 1996, around 93,246 hectares (CSO, 1997). Data collected during the last three decades, showed imported agriculture products in 1991 valued 7,317 million YR, increased to 15,988 million YR and 124,782 million YR in 1995 and 2000 respectively. Whereas, export of agriculture products, valued 443 million YR (6% of export) in 1991, increased to 1,426 million YR (9% of export), 15,386 million YR (12% of export) in 1995 and 2000 respectively. The main imported commodities were cereals and cereal products followed by sugar and sugar product.

1.4.2 Research hypothesis

Looking to the regional level (Fig. 1.3), the problem resulted from this prevailing economic Circumstances and expansion of Q'at are:

- 1) In many farmlands, agriculture work became the duty of women, also cooperation between farmers decreased to minimum in agriculture work not as they used to cooperate in the past.
- 2) Migration of men contributed nowadays, neglecting terrace maintenance and neglecting traditional agriculture practices, such as crop rotation and cropping schedule, in turn it caused lower crop production, especially grain products in the mountain terraces, which was completely dependent on men and animal power.
- 3) Weakness of water management, due to improper practicing and misuse the water rights, that were practiced traditionally to ensure efficient and equitable water distribution.
- 4) Improper runoff distribution due to intervention of influential community-leaders and the consequent losses of other right.

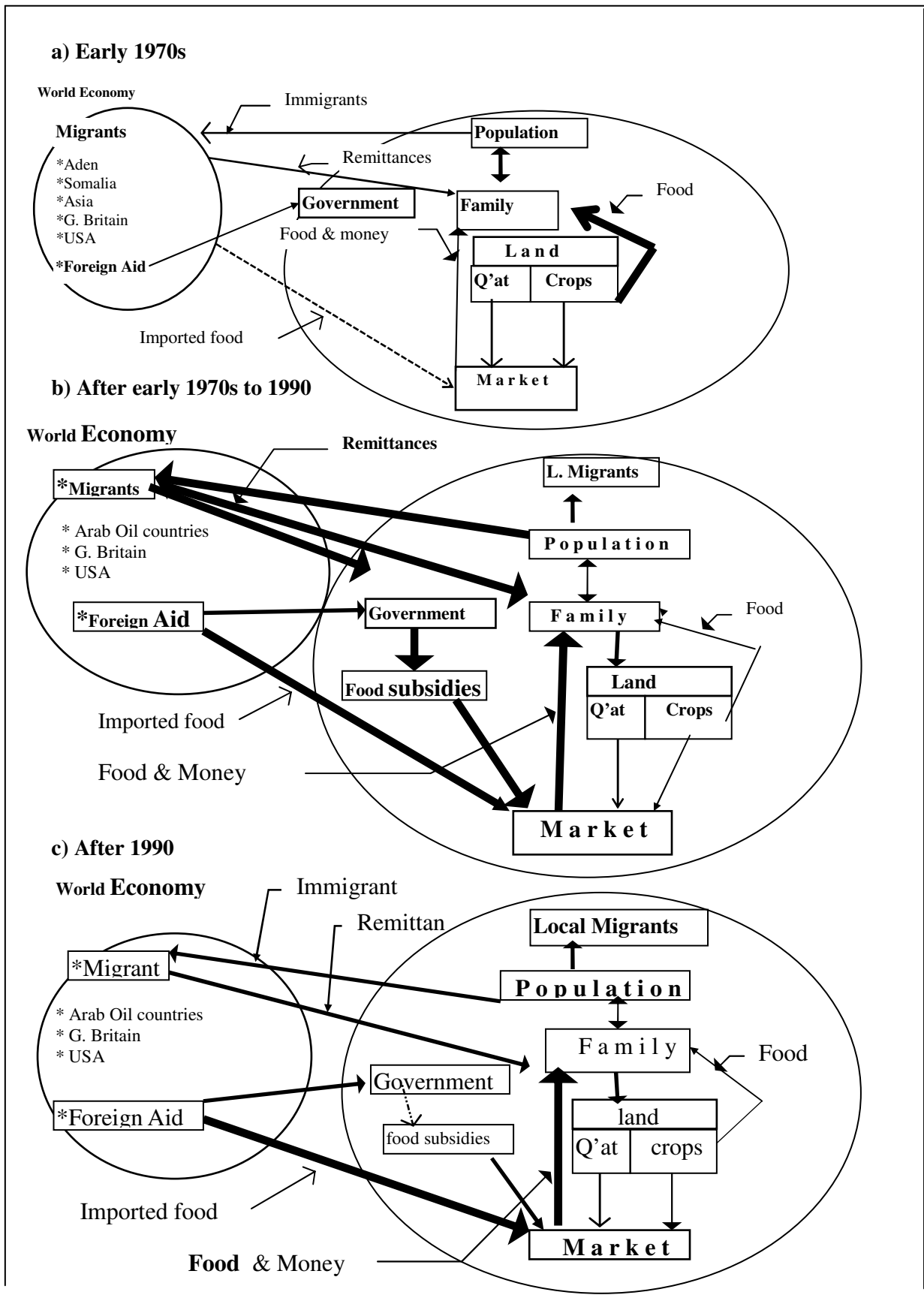


Fig. 1.2: Q'at model at national level

Sources: Interpreted by the Author 2004.

- 5) Expansion of Q'at resulted in increasing the number of surface and deep wells, and intensive abstraction of groundwater for irrigation.
- 6) In relation to the Q'at expansion is the intensive use of agro-chemicals on Q'at, especially pesticide to increase Q'at yield and to cover market demand and its effect on human health, environment and groundwater.

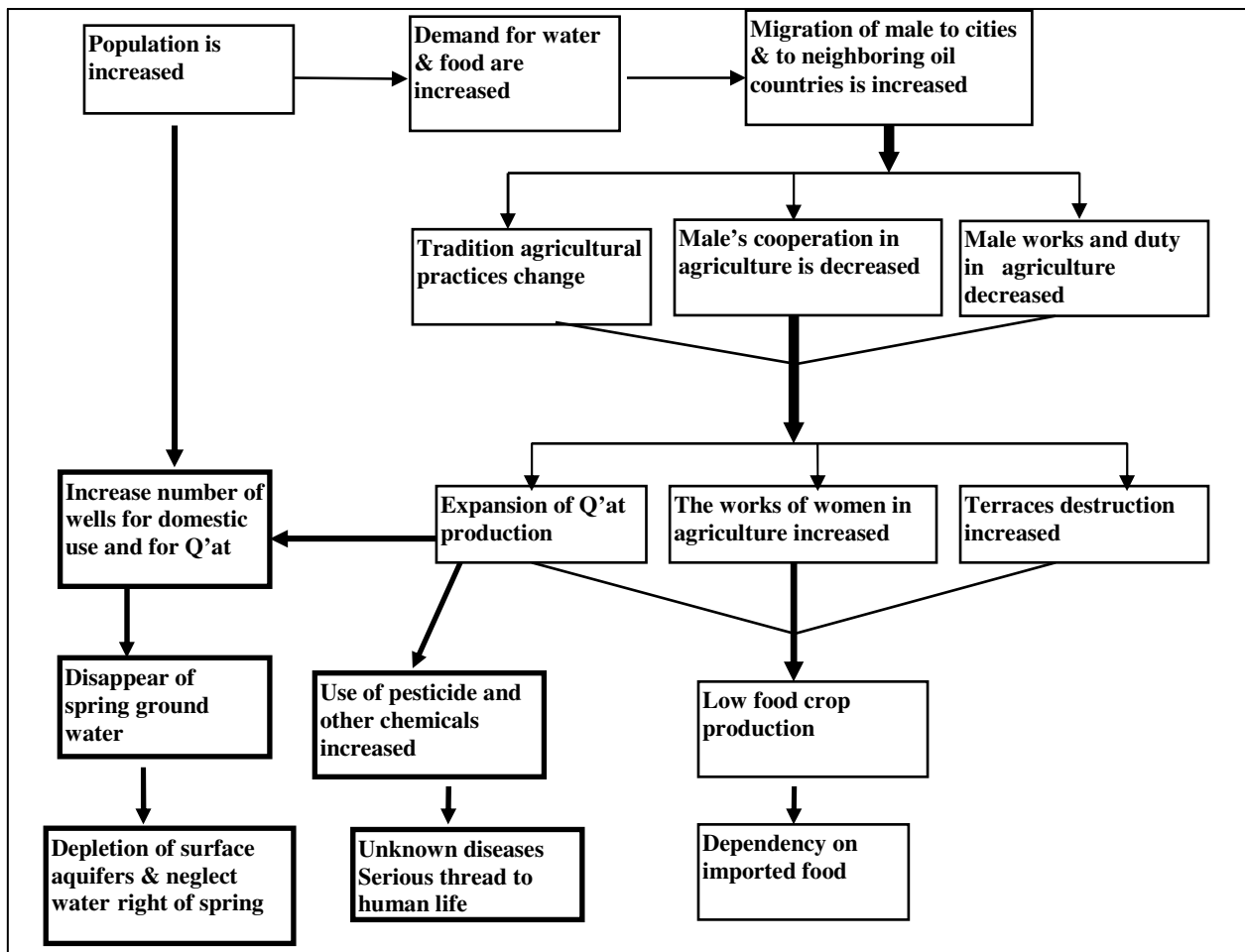


Fig. 1.3: Q'at model at regional level

Sources: Interpreted by the Author 2004.