Towards Reflexive Land and Water Management in Iran

Linking Technology, Governance and Culture

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Thesis

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Contents

To Fatemeh the beloved daughter of Prophet Mohammad **(**Peace be upon him)

Preface

> "*We made from water every living thing" (Quran, 21:30)*
> *"The earth has been created for me as a mosque and as a means of purification" (Prophet Mohammad Peace be upon him)*

As a soil scientist who received his MSc degree in 1997 and started his career as a researcher at the Soil and Water Research Institute (SWRI), I first looked at land and water issues through an engineer's "spectacles". At first, however, I was hardly aware that my vision was coloured by the special type of spectacles that I wore.

> *I don't know*
> *Why it is said that the horse is a noble creature,*
> *That the pigeon is a beautiful bird.*
> *I do not know why nobody keeps a vulture in a cage.*
> *I do not know why clover flowers are considered inferior to red tulips.*
> *Eyes should be washed to see things in a different way.*
> *Words should be washed*
> *To become the wind itself, the rain itself.*
> ***"The sound of water's footsteps"***[1] *Sohrab Sepehri (1927-1980)*

In subsequent years I gradually realized that there are also other views on land and water issues. Since the start of my career, new concepts such as sustainability, integrated management, and participatory approach were introduced and raised the question whether conventional methods are still adequate to solve current problems of land degradation and water scarcity with which we are confronted. This gradually brought to my mind the question what "conventional agriculture" and what the rationale behind it is. Also why the new concepts are being introduced and what the differences are between conventional and sustainable methods. Participation in the FAO conference of 2003 entitled "*Global food security and the role of sustainable fertilization*" made me think more seriously about the questions raised. The conference taught me that soil fertility as the basis of sustainability should be considered from a broad perspective encompassing its environmental and socio–economic aspects. According to the 'reductionist vision' that still dominates the productionist paradigm, however, soil fertility management has often been reduced to just giving fertilizer for more production. With respect to sustainable fertilization, the conference focused on issues such as globalization, environmental crisis, climate change, limitation of land and water resources and intensification, and also their effects on natural resources including land and water and how all this may threaten food security in the third millennium. It was difficult

[1] http://www.netnative.com/news/02/jul/1033.html , (last accessed 11 July 2009)

to look at the complex phenomena with the same glasses that I was wearing as a soil scientist and most of the time I had the feeling that I was looking for my key in the wrong place.

> *In an old Sufi story about the wise-fool Mullah Nasrudin, the Mullah is seen searching for a key under a street lamp. Helpful passers-by join in the search but to no avail. They ask the Mullah if he is sure that he lost the key there. The Mullah replies that he lost it yards away under a tree but since its dark there he thought of looking under the street lamp*

It was the time to continue my journey.

> *I must go tonight*
> *I must pack the suitcase*
> *which has enough room for my robe of solitude*
> *and must go where*
> *I can see epical trees*
> *towards that wordless enormity which keeps calling me.*
> *Somebody again called Sohrab*
> *where are my shoes ?*
>
> *"**The primal call"**[2] Sohrab Sepehri*

My perplexity motivated me to search for the background of the problems and to inquire into the reasons for the required paradigm shift. Hence, I started to study Islamic philosophy and theology to become more familiar with the worldviews underpinning the context in which I am living. This shift from quantitative to qualitative inquiry not only involved a complete re-orientation on the level of scientific discipline but also on the personal level. The new approach helped me to get more inside the context on the one hand and also brought a lot of new questions to me on the other hand. Through my thesis entitled "*Environmental ethics according to Islamic philosophy and Kalam, especially Mollasadra's and Ghazalli's ideas*" I worked my way back from the broad area of philosophy to the phenomena of the environmental crisis including land degradation and water scarcity and thereby to the original discipline on which I had started to work.

Through this valuable journey I came to realize that the new paradigm towards sustainable development is a response to the consequences of industrialization with which western countries that have passed this phase are confronted and that other countries around the globe are also increasingly confronting. In other words, generally speaking, people in the West,

[2] http://poems.lesdoigtsbleus.free.fr/id95.htm (last accessed 11 July 2009)

having more or less autonomously gone through the process of industrialization, were internally confronted with its consequences. Therefore, the idea of sustainability was intended to cope with those consequences that emerged from the inside. But in a country like Iran where industrialization was implemented much later, compared to western countries, and in which it is still an ongoing process, people are already confronted with some of its consequences. Although it is irrational to postpone action, because it is a good opportunity to use the experiences of the developed countries and to prevent the more negative consequences of industrialization, it seems that developing countries like Iran, in the way they are using those experiences on sustainability, are following the model of industrialization and modernization (transferring and importing from abroad and top-down approach). The global system, in tackling the urgent global issues, seems also to be exporting its strategy the same way as has been done in the process of modernization. Therefore, the mode of transfer should be changed by taking into account both the context of origin and the context of destination.

These considerations convinced me to continue my PhD study in the western context which is the origin of those concepts and theories of modernization and sustainability. The Applied Philosophy Chair group at Wageningen University, The Netherlands, which is devoted to problems of agriculture and the environment, presented a middle course between pure philosophy and natural science which offered a new language enabling me to communicate with the people who wear different glasses and to get deeper into the complex phenomena of land and water management.

My journey of experience aimed not so much to dive deep but to swim in the different parts of the dark room in order to touch the "elephant" of *Jalal ad-Din Muhammad Balkhi* known as *Rumi*[3] and shed light on the complex phenomena as much as possible.

> *Once upon a time, there lived six blind men in a village. One day the villagers told them, "Hey, there is an elephant in the village today." They had no idea what an elephant is. They decided, "Even though we would not be able to see it, let us go and feel it anyway." All of them went where the elephant was. Every one of them touched the elephant.*

[3]Rumi (1207—1273CE) was a 13th-century Persian poet, jurist, and theologian. (http://en.wikipedia.org/wiki/Rumi) Elephant and the blind men. (last accessed 11 July 2009)

"Hey, the elephant is a pillar," said the first man who touched his leg.
"Oh, no! it is like a rope," said the second man who touched the tail.
"Oh, no! it is like a thick branch of a tree," said the third man who touched the trunk of the elephant. **…**

They began to argue about the elephant and every one of them insisted that he was right. It looked like they were getting agitated. A wise man was passing by and he saw this. He stopped and asked them, "What is the matter?" They said, "We cannot agree to what the elephant is like." Each one of them told what he thought the elephant was like. The wise man calmly explained to them, "All of you are right. The reason every one of you is telling it differently because each one of you touched the different part of the elephant. So, actually the elephant has all those features what you all said."

"Oh!" everyone said. There was no more fight. They felt happy that they were all right.

My thesis can be seen as the story of my journey. I have tried to bring and link different aspects of land and water issues together in a reflexive way to shed light on the complex phenomena of the environmental crisis in order to find a way out towards sustainable land and water management.

This is the moment to thank God and all those people who have provided me with this opportunity and have supported me as a '**reflexive scientist**' in my effort to drive my small boat through the river of experience.

My deep gratitude goes to Michiel and Jozef for their supervision. Dear Michiel and Jozef, I appreciate your pragmatic approach that allowed me to come out of my room and share our worldviews in the corridor of the Hotel of William James' *Pragmatism:* the pragmatic methodology…

> …lies in the midst of our theories, like a corridor in a hotel. Innumerable chambers open out of it. In one you may find a man writing an atheistic volume; in the next some one on his knees praying for faith and strength; in a third a chemist investigating

> a body's properties. In a fourth a system of idealistic metaphysics is being excogitated; in a fifth the impossibility of metaphysics is being shown. But they all own the corridor, and all must pass through it if they want a practicable way of getting into and out of their respective rooms (James 1987: 510 quoted by Sheppard, 2001).

I am very grateful for the support of Dr Moameni and Dr Baybordi, who helped setting up this project and acted as members of the supervising committee.

Dear Henk and Leon, I sincerely appreciate your support and the informal discussions with you from which I have learned a lot and I especially appreciate your efforts during the final phase of my PhD project.

Dear Bea, I would like to thank you for your kindness and all your support during the last four years. I also would like to declare my appreciation to my friends and colleagues in the chair group of Applied Philosophy: Tassos, Gilbert, Clemens, Rixt, Bram, Silvia, Vincent, Liesbeth, Volkert, Cor, and Bert. I spent four years with you and I enjoyed communicating with you; I have learned so many things during our formal and informal discussions.

I am grateful of my colleagues at Soil and Water Research Institute (SWRI), especially the colleagues from the Soil and Water Department branches around the country who helped me in the empirical parts to do a large survey and to collect data needed for this broad project. Also I would like to thank my colleagues at the Agricultural Research and Education Organization (AREO) and the Ministry of Science, Research and Technology (MSRT) for their financial support and all formalities that they have done to facilitate success of my PhD research project.

I am thankful of Hossein Mehdizadeh who is interested in my project and helped me to design the empirical part of the project which was a platform of cooperation for our future research on sustainability. I appreciate my dear friends Reza Aghnoum and Afshin Hassani-Mehraban for their help in designing my thesis. I would also thank the Iranian student community at Wageningen University for organising many social events which empowered our imaginative capacity to remember different occasions and created a friendly atmosphere in which we could feel at home and be supportive of each other.

I should also express my thanks to my family in Iran for the love that they devoted to me, my wife and my children to enable us to do our job with success.

Finally, I would like to express my deepest appreciation to my beloved wife Minoo and my daughters Niayesh and Nikan, who have accompanied me on the river of experience and have

made valuable efforts to keep our family boat quiet, healthy and enjoyable during the journey which still continues.

Still I am traveling,
I think
There is a boat in the rivers of world
And I – the pilgrim of that boat – have been singing for a thousand years the lively song of ancient sailors
To the ears of the holes of seasons
And I am advancing
Where does the journey take me?"
*"**Traveller / Pilgrim**"*[4] *Sohrab Sepehri*

Mohammad Reza Balali
Wageningen- the Netherlands
8 September 2009

[4] http://www.sohrabsepehri.com/poems.asp?status=showpoem&poemid=136&language=e , (last accessed 11 July 2009)

Chapter1
Introduction

> *"Humans cannot predict the future. But, if we can adequately understand the past, we can use that understanding to influence our decisions and to create a better, more sustainable and desirable future."*(Costanzia *et al*., 2007: 522)

> *"Different ways of defining problems imply different solutions and ways of allocating scarce resources in an effort to bring about change. Winners and losers also emerge in relation to different strategies and policy agendas."*(Murphy, 2007:3)

> *"The key to effective management of water resources is understanding that the water cycle and land management are intimately linked. Every land-use decision is a water-use decision. Improving water management in agriculture and the livelihoods of the rural poor requires mitigating or preventing land degradation."* (Conserving land—protecting water[5], IWMI, 2007:551)

Where are we? Where do we go from here?

Humankind lives in an era of crisis. At the beginning of the 21st century the world is currently facing an unprecedented environmental crisis. Concerns on land degradation and water scarcity are growing rapidly around the world. Food security is threatened by the degradation of land and water resources due to the intimate link between global water cycles, land management, and food security.

The main challenge that confronts Iran is confronting other countries the same way: to continue the expansion of food production to meet future demands without imposing negative effects on the environment. Since the country has a long history of agriculture, its inhabitants have already occupied almost all the fertile land. In recent times, however, there has been a slight increase in the total area under cultivation. This was achieved by bringing under cultivation the barren lands that only have a marginal agricultural potential. However, the negative water balance implies that no more new land can be brought under cultivation, and that the country is already facing a critical situation regarding the management of water resources and sustainable food production in existing cultivated lands (Moameni, 2000).

[5] http://www.iwmi.cgiar.org/assessment/Water%20for%20Food%20Water%20for%20Life/Chapters/Chapter%2015%20Land.pdf (last accessed 8 June 2009)

The case of Iran is also relevant for other countries of the Middle East and North Africa (MENA), which not only have a similar (arid and semi-arid) environment but, to a large extent, also share the same religion and history. The transition to sustainable land and water management is especially urgent for this region because data from a major report published on 11 March 2007 by the World Bank show that all countries in the region are facing a severe water crisis. Nearly 80 per cent of all precipitation in the region is used for different purposes, compared with only two per cent in other regions such as Latin America, the Caribbean and Sub-Saharan Africa[6]. The water crisis is expected to get worse in light of high population growth and climate change. In fact, it is estimated that per capita water availability in the region will fall by half by 2050.

This brief look at our current position and the expected future towards we are heading is a starting point for this dissertation to elaborate upon a broad narrative that can shed some light on land and water issues and hint at possible ways for reaching a position of sustainable land and water resource management.

To this end, this chapter gives a general picture of Iran regarding land and water (1.1) as one of the MENA region countries which will be the focus of this PhD dissertation. Next (1.2) we will describe the complexity and interconnectedness of land and water issues, the deficient conceptualizations of sustainable development in the context of advise for and guidance of action, We will also justify the need to construct a framework to help us understand the range of human-environment interactions. This framework, we argue in (1.3), should be as much as possible context dependent and also sensitive to the specific features of the region to accomplish a successful transition to sustainable land and water management. In section (1.4) we will state our main research objectives and our methodology, which will be refined later in Chapter 2, after the establishment of a fruitful conceptual framework. This introductory chapter closes with an introduction to the structure of this dissertation and a general overview (1.5).

1.1.General picture of Iran

Geo-climatological position

With an area of more than 1,648 thousand sq. kms Iran is the 16th largest country in the world. It is situated in the eastern portion of the Northern hemisphere, in South-West of Asia, and is one of the Middle East countries (Fig1.1). Geographically, Iran is located between 44^{o} 05′ and

[6]http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:21267699~pagePK:64257043~piPK:437376~theSitePK:4607,00.html (last accessed 8 June 2009)

63° 18′ east longitude and 25° 03′ and 39° 47′ north latitude. Iran borders in the north with Azarbaijan, Armenia, Turkmenistan and the Caspian Sea, in the east with Afghanistan and Pakistan, in the south with the Oman Sea and the Persian Gulf and in the west with Iraq and Turkey. The elevation ranges from below sea level to more than 5,000 meters above sea level. The temperature fluctuates between –30°C and 50°C and the annual precipitation varies from about 25 mm in the Central Plateau to over 2,000 mm in the Caspian Coastal Plain with an average of 250 mm for the country in general. Approximately 90% of the country is arid and semi-arid. Under such climatic conditions, ecosystems are very fragile and vegetation is of special importance.

Central Iran is a steppe-like plateau with a hostile climate, surrounded by desert and mountains; Zagros on the western border and Alborz to the north. Underground water irrigates the oases where a wide variety of grain and fruit trees are cultivated. The shores of the Caspian Sea have a humid climate and are suited for tropical and subtropical crops (cotton, rice and tea). The annual evaporation loss is high, ranging from about 700 mm along the Caspian Sea shores to over 4,000 mm in the Central Plateau and southern part of the Khuzestan and Southern Coastal Plains in southwest. The annual evaporation in the dry parts of the country is 16 times beiger than the annual average rainfall (250 mm) (Moameni, 2000).

Fig. 1.1. Map of Iran

Religion and Population

Most Iranians are Muslims; 90% belong to the Shiá branch of Islam, the official state religion, and about 8% belong to the Sunni branch, which predominates in neighboring Muslim countries. 2% Non-Muslim minorities include Zoroastrians, Jews, Bahaís and Christian.

With a total population of about 60.6 million Iran occupies the 15th position in the world among the countries with the biggest population. It has an average density of 35.3 people per sq.km. In 1995, some 35.3 million or 58.3% of the total population were urban, 25.3 million or 41.7% were settled in rural areas (Ministry of Agriculture, 1996). Based on statistics released by the government, urban population in Iran doubled within eighty years, rising from 28 percent in 1921 to 61.3 percent in 1996. As a result, the demographic configuration of the country has drastically changed, shifting from village and tribal to urban population. The latest urbanization-related statistics show that the number of city dwellers increased from 39.6 million in 1999 to nearly 45 million in 2004, indicating a rise of 63.4 to 66.4 percent (in urbanization rate)(Iran-Daily, 2005). It is projected that when Iran reaches a total population of 120 million in three decades, it will have one of the 10 largest populations in the world (World population -major trends, 2008) and urbanization processes will still continue. Accordingly, demands for food and using more land and water will also increase in the future.

The status of food production

An approximation of the relative share that food has in Iran's national economy is quite revealing. The food sector roughly accounts for 40% of Iran's Gross National Product (GNP) in 1993 and 40% added value[7] in the national economy in the same year. The fact and figures of the report of the Ministry of Agriculture (1996) also clearly indicate the extent to which Iran's national economy is food-dependent. Also, they clearly explain the fact that food security has a high priority on the Iranian national development agenda.

The agriculture sector has a prominent place in socio-economic development of Iran. It accounts for 17 % of Gross Domestic Product (GDP) (by considering the fixed price in 1991), 20% of non-oil exports, 25% of employment opportunities, over 80% of food supply, and 90% of raw materials needed for industrial use (Center for Agricultural Planning and Economic Studies, 2003). The agriculture sector consists of four subsectors including farming, livestock, forestry and fisheries. The farming subsector, with a 57 % share in added value in agriculture, is the largest. The livestock production with 40.8% sharing added value holds the second place. Forestry and fisheries, with shares of 1.5 and 0.21 percent, have a relatively small contribution to agricultural production (Ministry of Agriculture, 1996). With about 64,000 villages as a unit of production, instead of the farm, which are distributed all over the country and about 3,480,733 producers who work in the agriculture sector (Ministry of Jihad-e- Agriculture, 2002), its importance is clearly exemplified.

Land and water resources: Availability, use, and future demand

[7] **Value added** refers to the additional value created at a particular stage of production. http://en.wikipedia.org/w/index.php?title=Value_added&oldid=207577006 (last accessed 8 June 2009)

The cultivable area is estimated at about 51 million ha, which is 31% of the total area. In 1993 about 18.5 million ha, or 36% of the cultivable area, were considered to be usable for agriculture, while 14.4 million ha were actually cultivated (FAO, 2005). Currently, the total area of cultivated lands in the country is about 15,500,000 ha (Statistical Center of Iran, 1998b), of which 7,000,000 ha (45%) are used for irrigated agriculture (including fallow) with an average holding size of 2.9 ha and 8,500,000 ha (55%) are used for dryfarming with an average holding size of 6.4 ha. About 90% of the irrigated lands are used for annual crops (including fallow) and the remaining 10% are used for production of perennial crops (mostly orchards). In areas with enough rain the annual crops constitute about 98% of the total production (Moameni, 2000).

As it was mentioned earlier, since the country has a long history of agriculture, its habitants have already occupied almost all fertile lands. In the more recent past, however, there has been slight increase in the total area under cultivation, achieved through bringing under cultivation the barren lands and national resources lands[8] with marginal agricultural potentials (gravelly lands, salt-affected lands, rangelands). By comparing the 1973 and 1998 agricultural censuses, it became clear that in a quarter of a century only 483,000 ha (2.8%) of new land areas were brought under cultivation (Ministry of Agriculture, 1992); in contrast, the population had increased about 85% within the same time period (Moameni, 2000).

However, it is believed that the availability of agricultural land is not a major constraint in the development of Iranian agriculture. The major constraint is the availability of water for the development of these lands. The irrigation potential, based on land and water resources, has been estimated at about 15 million ha, or 29% of the cultivable area. Nevertheless, this would require optimum storage and water use (FAO, 2008 AQUASTAT). However, Moemeni (2000) believes that land also is one of the problems for processes of development because from a total of 20,000,000 ha land areas surveyed from 1953 to 2000 (including the majority of cultivated lands), good-quality lands (class I lands) cover only 1.3 million ha (6.5 %). The remaining lands have various degrees of limitations and/ or hazards for irrigation farming.

During the last 50 years more water became available with the construction of a large number of dams and reservoirs and with the pumping from the aquifers. The availability of new water sources together with population pressure caused the intensification of agriculture in the existing arable lands. Because plant nutrients were not applied to farm lands, crop yields both on irrigated and non-irrigated land were very low. Economic crop production was not feasible without adding nutrients to the arable lands that were exhausted by permanent agriculture over centuries. The vicious circles of low yields responsible for the poverty of the farming

[8] Non-arable lands, under government control, which are not suitable for cultivation.

population had to be broken, and one of the easiest means of accomplishing this was by the wide and efficient use of fertilizers. The government, conscious of the problem, initiated studies on the potential crop production of different types of soils in conjunction with fertilizers. Consumption of inorganic fertilizers in Iran started in the 1950s when the fertilizer needs of the main crops were determined. Since then, fertilizer consumption has variably increased (Fig1.2) (Balali *et al.,* 2003).

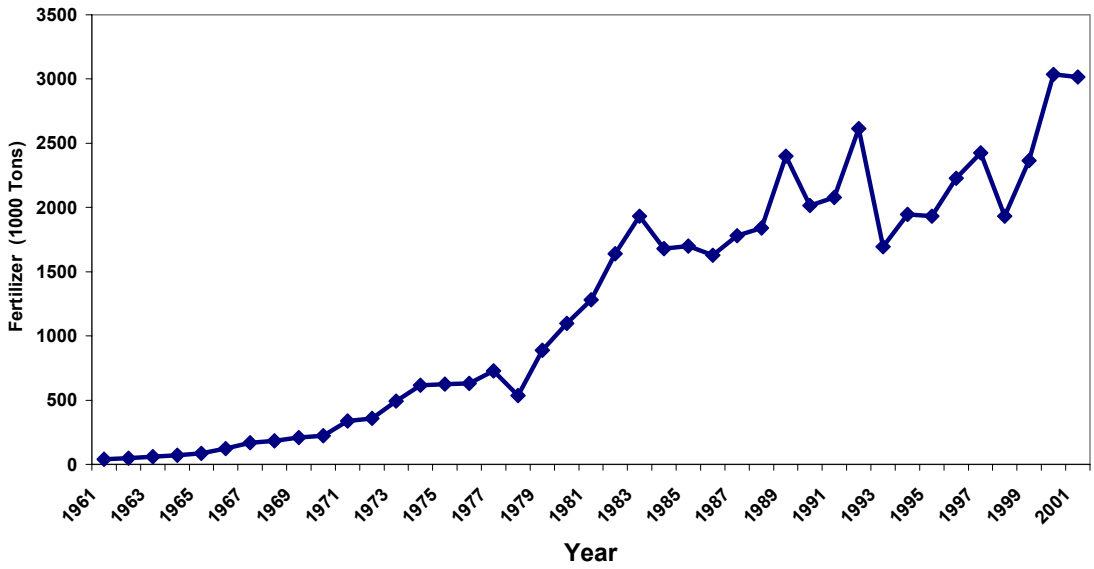

Fig. 1.2. Fertilizer consumption in Iran over time (Balali et al., 2003)

Water supply in Iran consists of both surface and groundwater resources. Available data for Iran's freshwater resources are presented in Table1.1. As is seen in this table, the average renewable water [9]is 130 billion cubic meters only. 94.25% of water withdrawal is used for agricultural purposes, 4.57% for domestic use and 1.0 % for industrial use. The trend of total water use and proportion of agricultural, industrial and domestic use has been changing. This can be followed from 1951 to 2020 in Table1.2 (Bybordi, 2005). Accordingly, since the 1960's domestic and industrial use of water is growing sharply and is expected to continue in the future as well.

Table1.1. Water availability and use in Iran (Alizadeh and Keshavarz, 2005: 96)

Component	Volume(bcm)	Perecent of total
Precipitation	413	100
Evaporation	283	70
Renewable water	130	30
Surface water	105	
Ground water	25	

[9] The average amount of water available every year

Total water use	87.5	100
Agriculture	82.0	94.25
Domestic	4.7	4.75
Industry(etc.)	0.8	1.00

Table1.2. Water use in different sectors in Iran 1951-2020 (Bybordi, 2005:151)

Year	Population (Million)	%			Total (bcm)
		Agriculture	Urban	Industry	
1951	20	100	0.0	0.0	35
1961	26	98.88	0.67	0.45	44.5
1971	32	98.2	1.2	0.60	49.9
1981	40	96.1	3.1	0.80	62.4
1991	56	95.1	5.9	0.85	82.0
2001	65	92.84	8.4	1.92	93.7
2020	100-120	90.65	7.54	2.29	104.8

In spite of low amounts of annual rainfall and hence insufficient recharge of the aquifer in the arid and semi-arid conditions of the country, the proportion of annual discharge of groundwater to land area is high. According to Jamab Consulting Engineers (1990) the amount of annual discharge from the aquifer over a period of 25 years (1965 to 1989) changed from 14 billion m^3 to more than 49 billion m^3; an increase of about 350%. Under the climatic conditions of the country, the estimated total rainfall recharge reaching the aquifers is 46.6 billion m^3. On the other hand, the annual discharge from the groundwater is 49.7 billion m^3. The result is a negative water balance of 3 billion m^3 each year (Fig1.3). Under the current management levels, this amount of groundwater together with surface water supplies is just adequate to irrigate those land areas that are already under irrigation farming.

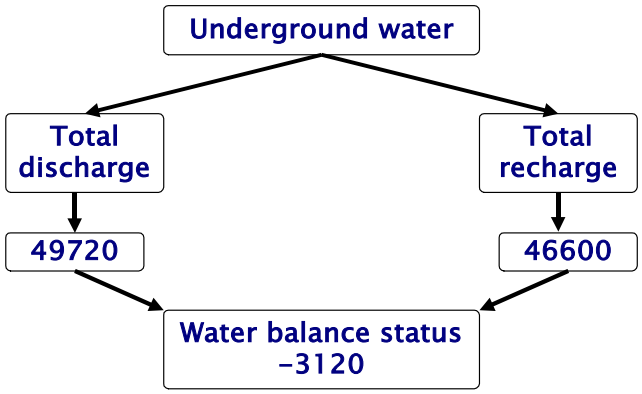

Fig. 1.3. Estimated water balance of Iran (figures in million m^3) (Moameni, 2000:16)

As a result, the negative water balance implies that (1) no more new land can be brought under cultivation and (2) the country is already facing a critical situation regarding management of water resources and sustainable food production on existing cultivated lands. Excluding some striking regional variations, the negative water balance has to be regarded as an indication of a looming water crisis at national level (Moameni, 2000), which can threaten food security. It is suggested that due to the rapid rate of population growth, water need of the agriculture sector will increase by 20 billion m^3 (Ministry of Agriculture, 1996). If these requirements are to be met, groundwater resources will have to provide a greater proportion of the total supply. With current utilization efficiency rates, pumping additional water from aquifers will aggravate the situation. Supplying sufficient water to ensure food security for 100 million people will remain a real challenge in the next 20 years.

From another perspective, Iran can be considered as a country facing water stress. Given the high population increase and recent persistent drought conditions, Iran's average annual supply of renewable freshwater per person fell from 2,254 m3 in 1988 to 1,950 in 1994, and the estimated figures for the year 2020 is 1,300 m3, respectively (Ghazi, 2002). Biswas (1998) believes that generally a country will experience periodic water stress[10] when freshwater supplies fall below 1,700 m3 per person per year (Fig1.4). Given this statement, Iran is beginning to encounter water stress.

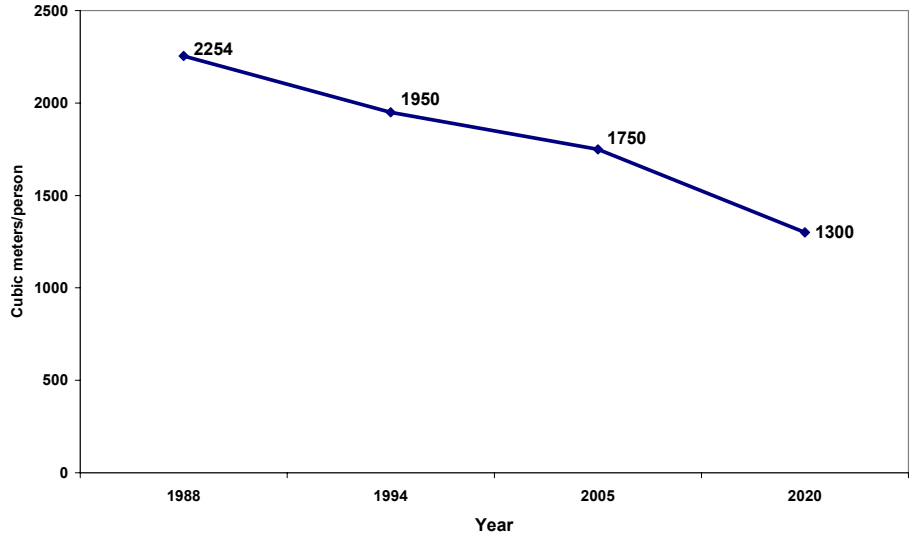

Fig. 1.4. Annual supply of renewable freshwater per person in Iran (1988-2020) (Alizadeh and Keshavarz, 2005)

According to IWMI (2007), Iran is also approaching the situation of physical water scarcity, in which more than 60% of river flows will be withdrawn. These basins will experience

[10] The level of water stress depends upon technical scarcity, demographic scarcity, and hydraulic density of population (Falkenmark, 1999).

physical water scarcity in the near future (Fig. 1.5). It should be noted that physical scarcity *(water resources development is approaching or has exceeded sustainable limits)* here means that more than 75% of river flows are withdrawn for agriculture, industry, and domestic purposes (accounting for recycling of return flows). This definition—relating water availability to water demand—implies that dry areas do not necessarily suffer from water shortage. However, based on the data in Table1.1, almost 70 percent of all annual freshwater resources in Iran are already used, and the remaining 30 percent may not be technically feasible to use. As far as hydraulic density of the population is concerned, spatial distribution of water resources in Iran is uneven. Almost 30 percent of all annual freshwater of Iran is concentrated at the south western part of the country, where only a very small percent of the population is located. According to these figures, and based on available freshwater resources, the population of Iran has reached its maximum capacity unless sustainable policies are focused on demand management (Alizadeh and Keshavarz, 2005).

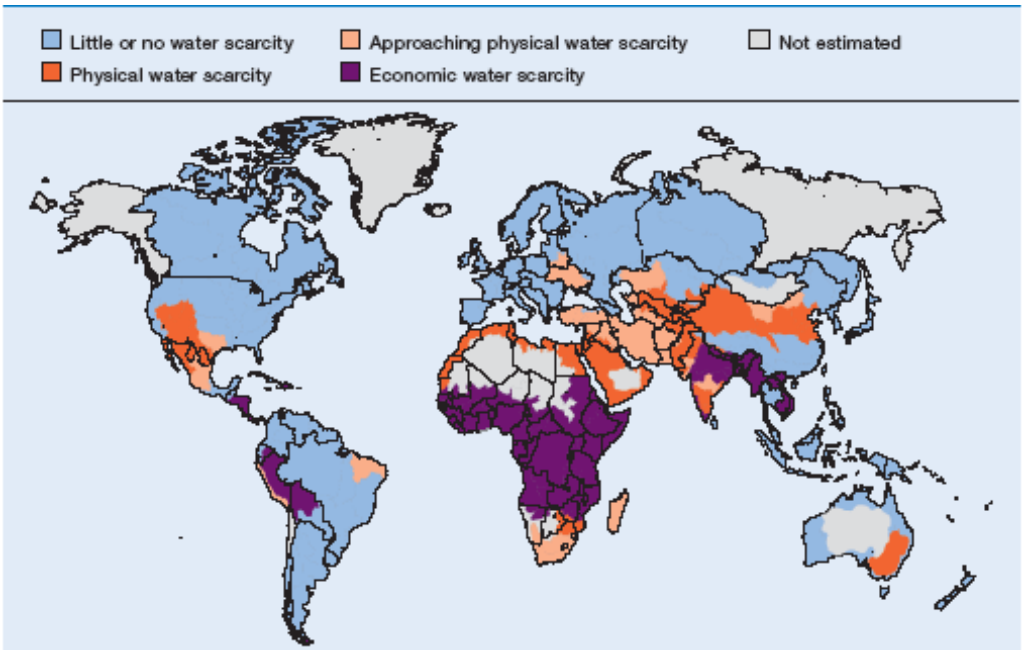

Fig1.5. Area of physical and economical water scarcity (IWMI, 2007:11)

1.2. Land and water problems

During the past decades, with practices such as the use of simple and traditional technology, and the traditional kinds of field management, the rate of land degradation was low (FAO, 2008) and water scarcity was manageable. In other words, in earlier times, the people of Iran found solutions that enabled them to maintain soil productivity: (1) the management system was based on long fallow periods; (2) the land tenure system knew tenants who inherited expertise from their experienced ancestors; (3) cultivation was of low intensity and (4)

population growth was modest, with no demand for labor from other sectors (Moameni, 2000).

However, recently in Iran, land degradation and water scarcity is a matter of concern at the national level, as indicated in the previous section. A study conducted by Moameni and Zinck (1999) on the Marvdasht plain, an intermountain basin in the Zagros Mountains (South-Central Iran), exemplifies the situations of land degradation in intensively cultivated areas of Iran. The results which they obtained demonstrated that the new agricultural land use systems have led not only to soil chemical degradation, including nutrient depletion and salinity, but also to soil physical deterioration, such as soil compaction by agricultural machinery and crusting. Moreover, the information obtained from soil survey and land classification studies in Iran reveals that large tracts of productive agricultural land had gone out of cultivation, because of (1) the arid and semi-arid climatic conditions of the country, (2) the inherent characteristics of soils that reflect their geological composition, (3) mismanagement of the soil and water resources, and (4) intensification of crop production on old arable lands with a long history of wheat cultivation. Of these, the last two factors are the most important ones, aggravating the situation (Moameni, 2000:17).

There is consensus among many scholars (Safinejad, 1989; Lahsaeizadeh, 1993; Moameni 2000; Rezaei-Moghaddam *et al.,* 2005; Ardekanian, 2005) that the land reform of 1962[11] and the nationalization of forest and rangeland[12] together were the turning point towards modernization of the country which brought both negative consequences as well as some advantages.

Small holdings, as the main result of land reform, which after the Islamic revolution of 1979 still are the main factor having a negative impact on land stewardship, is aggravating land degradation. In addition to the small sizes of the holdings, fragmentation of land ownership and the distances between farms are determinant factors when questioning the sustainability of crop production in Iran. The fragmented land ownership and the distances between farms pose new problems, which can eventually lead to uneconomic holdings in the new cropping systems and be an obstacle to agricultural development. This is because mechanized crop

[11] The size of private holdings was limited to 20 ha of irrigated land, as a result of which large areas could be distributed to landless laborers (Lahsaeizadeh, 1993)

[12] Programs adopted before the nationalization of forests and rangelands related to a narrow set of natural resource assets such as forests, ranges and hunting grounds. Development plans of the 1960s prohibited exploitation of forests and launched research into rangeland production and protection. But under the law nationalizing forests and ranges, activities and measures undertaken previously were changed and, subsequently, education, extension, and infrastructure development were replaced by the use of force. Evaluation of the achievements and activities under the nationalization of forests and ranges indicated a number of negative effects (FAO, 2008).

production on small farms may not be economically justified (Soltani, 1978). Hence, the mechanization process now favors land consolidation.

Moreover, at present, landowners, land tenants, program planners and local authorities prefer short-term benefits rather than placing land preservation above production. This contradicts sustainable land use, which optimizes current production within the framework of maintaining land productivity for the long term (Moameni, 2000).

Following the growing problems in the rural area, immigration to the urban area has increased. Moreover, the growing population at the same time pushed the expansion of cities and changed arable land around the cities into urban and industrial sites. Moameni and Malakouti (2005) stated that an agricultural land use change is one of the main factors which reduced the quality of land resources. Since 1957, about 166,570 ha among the best arable land around 7 big cities of the country have been changed to urban services and industrial site. For instance, Ghaiumi Mohammadi *et al.,* (2005) obtained that during the last 80 years (1923 to 2002) 38.200 ha of the Isfahan-Borkhar hydrologic unit, which has the most important and largest civilization of central Iran with antecedents more than 3000 year old, have been converted and occupied by other activities.

Concerning the current condition in the water sub sector some of the main limitations and constraints encountered are "low rainfall throughout the country (average 250mm rainfall as compared to 800 mm in the world), erratic and uneven distribution of rainfall, out flow of 6 percent of renewable water resources to the neighbouring countries, low irrigation efficiency(38.08% in average), increased demand for water, due to population increase, unutilized water resources, over utilization of ground water resources, under utilized capacity of water resources under dams, due to lack of sufficient irrigation structures, gradual reduction of water quality and pollution of water resources."(Nowrouzi, 2003: 142)

According to Nowrouzi (2003), the extensive decline in the quality of water resources in recent decades has accelerated and is, due to use of chemical fertilizers and pesticides, industrial wastes, urban sewerage, pollution of water resources, still increasing. For controlling environmental pollution, standards are being established, but practically not implemented. Artificial recharge of ground water aquifers and management of critical plains are confronted with water depletion. Moreover, due to droughts and depletion of renewable water resources in the country, especially during the recent years, disagreement and conflicts have emerged among consumers and between regions, thereby creating intense environmental and social crises in the country.

It can be summarized that increasing demands and expectations of farmers, the application of new technologies and, in particular, population growth have caused pressure on the resources that are needed for the expansion of cultivated lands on the one hand, while at the same time arable land has been changing into urban and industrial sites on the other hand. This brought about a need to use more water, an imbalance between urban, rural and nomadic areas and inappropriateness of economic and social indicators of rural and nomadic areas. All of this can be considered as some of the main causes of degradation of water and soil resources, forests, ranges and, environment. As a result, agricultural production in Iran faces a number of limitations. These limitations include harsh ecological conditions, limited amount of lands suitable for agricultural development, shortage of water resources, rapid population growth, increasing demand for agricultural products, insufficient investment, over-exploitation of natural resources and increasing degradation of natural resources (FAO, 2008). Moreover, conditions and events have increased the importance of national management of land and water in the country's macroeconomic planning models. The increased need for national planning and expansion of land and water resource management will continue into the future.

The general picture of the country reveals that the current land and water issues are complex and that the different aspects are intertwined. In other words, *sociopolitical and economic context*, *demographic*, and *biophysical aspects* can be considered as the three interlinked key driving forces behind land degradation and water scarcity. The result is an accelerated degradation of resources and diminished ecosystem resilience (IWMI, 2007).

However, the governments around the world and the Iranian government as well have accepted sustainable development and they are trying to incorporate its principles into their policies and activities. In order to meet fundamental objectives and to determine the main course of movement from present conditions to future ones, especially since the Rio summit of 1992 and the issues of Agenda 21 action plans have to be formulated in the country in order to manage humans' impact on the environment. Within the framework of these action plans an independent execution program can be prepared for each strategy, and the relationships between all the strategies can be derived through determination of general objectives. The main objective is efficient and equitable development and utilization of land and water resources of the country in accordance with the socioeconomic and environmental needs of present and future generations.

For instance, the Iranian government has recently signed a project with the United Nations Development Program (UNDP) to help it tackle the depletion of land and water resources by adopting *community-based methods*. In this regard, the Hable-Rud basin, a 1.2 million ha hydrological basin in the provinces of Tehran and Semnan has been chosen as a pilot for strengthening the sustainable management of the country's land and water resources. This is

the second phase of the Sustainable Management of Land and Water Resources in Hable-Rud Basin Project. The following statement indicates something important:

> "Saeid Ferdowsi, UNDP project officer, said the main challenge the project faced during its inception was that the 'three pillars of sustainable development' – environment, society and economics – were not properly integrated by relevant government bodies"[13]

This shows a lack of conceptualization of sustainable development in the context of the country's guide for action. It is also what Rezaei-Moghaddam *et al.* (2005) believe when they state that agricultural development in developing countries historically has suffered from a lack of conceptualization and theory-based action.

Taking actions towards sustainability is new around the world and this seems to be an opportunity for the developing countries to apply the experiences of others in tackling their current issues. However, it seems that these countries like Iran, in the way they are using those experiences, are following the model of industrialization and modernization (transferring and importing from abroad and top-down approach). The global system, in tackling the urgent global issues, seems also to be exporting her strategy the same way as has been done in the process of modernization. As Brouma (2003) expresses:

> "These ideas gained currency in the early 1990s. There has been an attempt to export them to the South via such agencies as the World Bank and through the energies of such institutions as UNCED, the World Water Council and the Global Water Partnership and the associated Global Water Forum in The Hague in March 2000." (Brouma, 2003: 11)

Considering these issues, we need to construct a framework to help us understand the full range of human-environment interactions and how they affect societal development and resilience (Costanza *et al*., 2007: 525). Reasonably, most important question of the current PhD thesis is what kind of land and water framework can be sensitive to the specific features of the region to accomplish successful transition to sustainable land and water management. For this we need to find the key driving forces behind land degradation and water scarcity, and their linkage in every specific context.

1.3. Linking land and water issues

[13] UNDP to tackle depletion of land and water resources in Iran. http://www.payvand.com/news/05/jul/1246.html , (last accessed 8 June 2009)

Although there is a broad consensus that we are facing a growing global environmental crisis- land degradation and water crisis- not surprisingly, there is less consensus with respect to the question of the causes and consequences of this crisis. Opinions and responses can be categorized into three groups that focus more or less on single aspects. The first group of people stresses the - partially technologically induced - scarcity and shortages of our limited land and water resources. The second group focuses on unsound governance and mismanagement. Finally, the third group draws our attention to public perceptions and preferences. There is, however, growing awareness among environmental social scientists that every single one of these aspects is important and relevant for sustainable solutions to the global land degradation and water scarcity. But these different aspects should not be treated separately, these scientists claim, because technological developments, governance regimes and personal belief systems and lifestyles are strongly interconnected.

A recent collection of papers from environmental social scientists who examine the ways that technology, governance and people shape each other is the book edited by Joseph Murphy, entitled *Governing technology for sustainability* (2007). In this book, the challenge of sustainable development is explored by 'rethinking the relationship between people, technology and governance. In fact, understanding and recasting the people-technology-governance nexus might be two of the most important challenges associated with sustainable development'[14].

Therefore, in order to facilitate descriptive and normative analysis of land and water issues from the point of view of sustainable land and water management, in Iran and the other arid and semi-arid regions, we will use this framework – the technology-governance-people nexus – to explore and examine both the problems of land and water and the possibilities of a transition to sustainable land and water management. It is a useful tool as it lays the foundation for descriptive and normative analyses. Moreover, as the process of land degradation and water scarcity is rooted in the history of land and water management, to know how we arrived here and where we should be going, and also to learn from the historical experiences of land and water management, requires an examination of the relationships between land and water management, social organization and religious or cultural belief systems, the "technology-governance-mentality nexus", over three periods in Iran's development. To this end, use also will be made of the three paradigms with respect to land and water resource management, identified by Allan (2006): the pre-modern paradigm, the industrial modern paradigm, and the reflexive modern paradigm. Within the reflexive

[14] Murphy, 2007: 207. A little bit further, on page 217, we read: 'This nexus is a web of relationships, with each element constantly reproducing or reshaping the other two. Governance, for example, leads to strategic decisions about technology, based in part on assumptions about people. At the same time, however people can resist those assumptions and the way they are used to justify some technologies and not others.'

paradigm sustainable development is fully taken into account by reconsidering the relationship between technologies, social institutions and cultural systems. The aim of this project is to get a theoretical and practical understanding of the conditions for a successful transition from industrial modernity to reflexive modernity in Iran and the MENA region, towards sustainable land and water management. This matrix of nexus and paradigm (three key elements and three paradigms) will be elaborated upon in Chapter 2.

1.4. Research questions and methodology

Iran and the countries from the MENA-region suffer from an environmental crisis that has its main causes in a particular relationship between technologies of soil and water management, social institutions and cultural aspects. This PhD thesis is concerned with the causes and consequences of this environmental crisis and looks for the trends and tendencies that suggest a way out of this crisis towards sustainable land and water management, which is especially urgent for the MENA region. The complex aspects of land and water resources' degradation and their entwinements reveal that we need to construct a framework to help us understand the full range of human-environment interactions and how they affect societal development and vice versa (Costanza *et al.*, 2007).

The research questions are:

1. *What are the causes and consequences of the environmental crisis Iran is confronted with, in particular the degradation of land and the depletion of water resources?*
2. *What kind of (reflective) framework and paradigms are needed to comprehend these causes and consequences?*
3. *What kind of technical system is needed in the reflexive modernity paradigm of Iran?*
4. *What are the institutional requirements for a reflexive modernity paradigm in Iran?*
5. *What kind of ethics is needed that fits in the reflexive modernity paradigm for Iran?*
6. *What kind of soil and water science is needed within the reflexive modernity paradigm for Iran?*

Research methodology

The current PhD research project is designed to find an ethical acceptable relationship between land and water technology, management and social systems within a reflexive framework. Because of the variation of stakeholders involved in land -water relationships and their different value systems (native and western values) that affect natural resource management nowadays, the framework sought must be applicable to this diversity. So, it is important to point out that our approach is 'pragmatistic', i.e. that its moral core value revolves around possibilities for living and working together (Keulartz *et. al*., 2004). This is

also the core message of reflexive modernity. Thus, the *reflexive framework of land and water management* will suggests a strategy of land and water management in Iran.

The methodology of this research process (the research questions) comprises the complex interplay of several types of research needed to answer the questions of the research project. We are confronted with two types of research and their combinations, i.e. theoretical and empirical research. The first one comprises literature review and the second one comprises qualitative research, including interviews with stakeholders (farmers, village informants, soil and water experts, and policy makers)**.**

These different types of methodologies and their combination are necessary because the project will combine ethical, environmental, economic and socio-political aspects. This requires approaches that include participation and consultation and at the same time aim at political institutions to enable the mediation of the conflicting interests of land and water users and the involvement of agencies which manage land and water. The framework to be put forward later is only useful for land and water users if they can assimilate integrated land and water resource management and if the innovation of 'integration' is appreciated as a political process and not just as a technical, investment or information sharing process. Therefore, this research project requires a new holistic approach and an unprecedented level of political cooperation**.**

As mentioned earlier, in this research we are confronted with a complex situation and also try to take into account a developmental point of view of the transition from pre-modern to modern and reflexive modern paradigms of land and water management. Moreover, the main reason behind our use of qualitative research was dissatisfaction with positivist methodology and its one-sided reduction of reality. To capture land-water arrangements in their historical transition processes without reducing the complexity to simplicity, we need a triangulation of theoretical and qualitative research methodologies (Della Porta, 2008).

In view of the exploratory approach undertaken, we will use a triangulation of methods and resources: a combination of research of relevant documents, participant observation, and in-dept semi-structured and open-ended interviews.

1.5. Overview and structure of dissertation

This PhD dissertation encompasses four parts and 10 chapters. Starting with the question of where do we stand and where do we go from here, Chapter 1 raises the dilemma of the need for more food to meet future demand without imposing negative effects on the environment which is already under pressure in Iran and MENA region countries. Accordingly, the

transition to sustainable land and water management is especially urgent for this region. Given this general picture of the country and the fact that current land and water issues are complex the *sociopolitical and economic context*, *demographic aspects*, and *biophysical aspects* can be considered as the three key interlinked driving forces behind the land degradation and water scarcity, that led to an accelerated degradation of resources and a diminished ecosystem resilience. Deficient conceptualization of sustainable development in the region, justifies the need to construct a framework to help us understand the full range of human-environment interactions. A framework that is sensitive to the specific features of the region and can help to accomplish a successful transition to sustainable land and water management. This normative idea provides the starting point for the search for an appropriate theoretical framework that includes different aspects of land and water issues, which will be the subject of Chapter 2.

Part I. Theoretical and conceptual

Chapter 2 describes the notion of the 'technology–governance–people' nexus as an appropriate framework. It formulates the three most important aspects of land and water management regimes, including technical, social and belief systems which are strongly connected. Accordingly, this 'technology–governance–people' nexus will be explored for three periods in Iran's development. To capture these elements, the term 'water paradigm' of Tony Allan (2006) will be introduced. In chapter 2 also the three paradigms, the pre-modern paradigm, the emergence of industrial modern paradigm and the shift to reflexive modern paradigm with respect to land and water resource management, will be discussed. The matrix of 'technology –governance –people' nexus and paradigms is shown in Table 1.3.

The construction and development of the *reflexive framework for land and water management,* that is going to be introduced, should take the Iranian context into account. In doing so, the main objectives, research questions and methodologies for data collection of the current PhD research project are refined. Also, a brief outline of the reflexive modernity paradigm or '*Reflexive framework of land and water management'* will be given. The framework has to meet three requirements:

1) Revitalization (rehabilitation) of the traditional paradigm;
2) The integration of this paradigm with that of industrial modernity;
3) This requires a new paradigm in which the benefits and advantages of both will be maintained as much as possible.

Table1.3. Land and water management paradigms in Iran and its key elements

Paradigms / Elements	Pre- Modern (Traditional) (- 1960)	Industrial Modernity (1960-1990)	Reflexieve Modernity (1990-)
Technical system	Qanat (Underground irrigation system)	Well - Large Dam	?
Social institution	Buneh (Traditional cooperative farming system)	Smallholding	?
Ethical system	Zoroasterianism& Islam	Mechanistic worldview	?

Part II. Historical background: Past, present and future of land and water resource management

This part aims at the exploration in detail of the paradigms of pre-modernity (tradition) and industrial modernity in the context of Iran, to find the elements that need to be taken into account in the *new reflexive framework*. Past and present features of land and water resource management in Iran will be drawn in chapter 3 and 4 by describing the traditional paradigm and industrial modern paradigm respectively. In Chapter 5 the idea of reflexive modernization that emerged as a new paradigm in response to the challenges of industrial modernization during 1960s and 1970s is explained. This paradigm leads to approaches that include participation and consultation and simultaneously aim at political institutions to enable the mediation of the conflicting interests of land and water users and at the involvement of agencies that manage land and water; this requires a new holistic approach.

Chapter 3 sketches the main features of the premodern Iranian land and water management paradigm. In the pre-capitalist society of Iran the sector of land and water management can be characterized by its key technical system (the *Qanat* system of underground irrigation channels), its main governance institution (the *Buneh* cooperative organization of agricultural production) and its belief system (first Zoroastrianism and later Islam).

The shift from tradition to modernity and the ending of the age of Qanat by the land reform of 1962 is discussed in Chapter4. The idea of modernity in general and the emergence of modern land and water management in the specific context of Iran are outlined. Since the 17th Century, the idea of modernity gradually took hold of Western societies. At the end of the 19th Century and the beginning of the 20th Century this idea was introduced as a model of development to traditional societies such as Iran. To gain a better understanding of the

successes and failures of current land and water management we will, first, have a closer look at the idea of modernity in general, and then, secondly, examine to the course of the modernization process in the specific context of Iran, especially with respect to the technological systems, the social institutions and the ethical frameworks that determine land and water management.

In Chapter 5 the various responses to the environmental crisis will be discussed, ranging from the radical anti-modernism of the first wave of environmentalism to the notion of reflexive modernity of second wave. Furthermore, the notion of reflexive modernity with respect to land and water resource management, including Tony Allan's three stages model of reflexive modernity, will be elaborated. In addition, some significant signs and indicators of a reflexive turn in Iran are listed. Finally, an effort is made to answer the question how a reflexive land and water management in the MENA-region, including Iran, should take shape and what its main contours are.

In order to assess the viability of this answer empirical research has been done. Its outcomes are the subject of the next part.

Part III. Empirical questions: Stakeholders' opinions on the possibilities and constraints of a transition to reflexive land and water management

After drawing the historical background in the previous part, the contours of reflexive land and water management framework in Iran were outlined in Chapter 5. Because Iran is in a phase of transition from industrial to reflexive modernity and the reflexive framework of land and water management needs to be constructed in a bottom up approach, knowing the attitudes of relevant stakeholders towards the opportunities and constraints of this transition phase is important. The Chapters 6, 7 and 8 present results of empirical research that was carried out four times to collect attitudes, interests and values of selected land and water stakeholders (farmers and village informants, soil and water experts and present policy makers), relating to sustainability, tradition, industrialization and their possible integration, nature and so on. Their agreements and differences are compared in Chapter 9. Also the elements that should be taken into account within a *reflexive framework of land and water management* are introduced.

In Chapter 6 the attitudes of farmers and villagers towards the current situation and the future possibilities of reflexive land and water management are explored. 156 Iranian farmers and 42 Iranian villages' informants from villages, which were chosen among 14 provinces around the country, took part in the interview. Results of this large survey are discussed in this chapter in which, first, the current perspectives on land and water resources management are described.

Second, the possibility integration of traditional and modern land and water resource management will be discussed. Third, the farmers and village informants' attitudes towards sustainability and, fourth, their attitudes towards technology are explored. Fifth, the farmers and village informants' attitudes towards science and research and, sixth, their attitudes towards rural institutions and farmers' participation will be outlined. Finally, farmers and village informants' attitudes towards nature and environmental and agricultural ethics are discussed.

Chapter 7 presents soil and water experts' attitudes on constraints and opportunities of this transition phase. This is the result of a questionnaire which was completed by 94 Iranian soil and water experts who took part in several international and national conferences[15], and also by those who work at Iranian organizations. Accordingly, the main land and water policy priorities in Iran are outlined. The experts' attitude towards sustainable development, their assessment of the current situation of the country in terms of sustainable land and water management, and experts' attitude towards the possible integration of traditional and modern land and water management paradigms are discussed. Finally, experts' perception of land and water ethics, within the broader horizon of land and water management aimed at sustainable development, and their perception of nature, are being portrayed.

Chapter 8 presents also policy makers' attitudes towards the constraints and opportunities of this transition phase towards reflexive modernity. In line with the theoretical parts of the PhD project (Part II) and the results of large scale research that was done, open-ended interviews were done with 12 policy makers/high level informants. The results of these interviews are the subject of this chapter. The causes of land degradation and water scarcity in Iran, advantages and disadvantages of the land reform of 1962 and the industrial modernization in Iran are outlined. Also the opportunities and constraints of land and water management paradigms in Iran and the transition towards reflexive sustainable modernity are discussed. In addition, the chapter explores the view of policy makers on science, research and technology as part of the problem and part of the solution. The challenges of and hopes for participation and the governments' role in this regard, will be elaborated on. Finally, ethical issues and the need of ethics regarding land and water, ethics in science and technology and ethics on an organizational level are discussed.

Chapter 9 present a comparison of the stakeholders' attitudes, interests and values, which were discussed in Chapter 6, 7 and 8. The possible agreements and differences with regard to the transition phase, between farmers and village informants, soil and water experts, and

[15] Held in Iran on subjects related to sustainable use of land and water resources.

policy makers, are discussed in Chapter 9. Finally, the elements which should be taken into account within a *reflexive framework of land and water management* are introduced.

Part IV. Towards reflexive land and water management

Where part II describes the historical background and part III the experimental phase, in part IV we return to the main question that was raised in Chapter 1 and Chapter 2, concerning the possible meaning of a reflexive land and water management in the non- European constellation of Iran.

In Chapter 10 the outlines of a new *reflexive land and water management in Iran* are sketched. This framework is context dependent and also sensitive to the specific features of the region. Both are necessary for a successful transition from industrial modernity to reflexive modernity that encourage activities towards sustainable land and water resource management in Iran and the other countries of the Middle East and North Africa (MENA) region. As mentioned before, these countries do not only have a similar (arid and semi-arid) environment, but also share, to a large extent, the same religion and history.

Part I
Theoretical and conceptual

Land and water management in Iran and in the entire MENA region is confronted with serious sustainability problems. The country has to meet the ever higher needs for food and water of a rapidly growing population, without imposing further negative effects on a vulnerable environment that is already under high pressure. Part of the challenge is to do justice to the complexity of the issues, if only to forestall simplistic 'solutions' that ultimately make matters worse. Any serious attempt to unravel the causal factors contributing to the current predicament or pointing to possible solutions quickly leads to the realization that the various issues and problems are highly interwoven. In order to envision a sustainable development path for land and water management in the region, we therefore need to construct a framework that is capable of understanding the full range of human-environment interactions. Moreover, such a framework should also be sensitive to the specific features of the region, if a successful transition to sustainable land and water management is to be accomplished.

The notion of the 'technology-governance-people' nexus promises to provide the outlines of an appropriate framework in which the interconnectedness of the technical, social and cultural dimensions of any system of land and water management is duly emphasized. To capture the historically and spatially specific characteristics of such a system, we will adopt Tony Allan's notion of a water paradigm. In rough outline, three successive paradigms can be distinguished in the development of land and water management: the pre-modern paradigm, the industrial-modern paradigm, and the reflexive-modern paradigm.

A central aim of this thesis is the further development and specification of a *reflexive framework of land and water management*, especially with regard to the Iranian context. In introducing and explaining this central task, we will also have occasion to refine the main objectives, research questions and methodologies for data collection for the research that is reported in this thesis.

Chapter 2
Theoretical and Conceptual framework

This chapter aims to elaborate the theoretical framework of this PhD project. In doing so, firstly, the notion of 'technology-governance-people nexus' will be introduced (2.1). Secondly, we will introduce Tony Allan's (2006) notion of water paradigm and distinguish three historically successive paradigms in land and water management covering the pre-modern era and the eras of industrial and reflexive modernity, respectively, each with their own key technical, social and ethical system (2.2). Thirdly, the research questions on which this PhD project wants to focus will be formulated (2.3). Finally, selected methodologies to answer those questions will be explained (2.4).

2.1. The technology-governance-people nexus

As has been discussed briefly in the previous chapter, there is a broad consensus that we are facing a growing global land degradation and water crisis. However, there is less consensus on the main key drivers, causes and consequences of this crisis. Regarding water, most people seem to be convinced that the main causes of the water crisis is water shortage or water stress, resulting from population pressures, coupled with industrialization and urbanization, and, more recently, with global climate change and the disastrous combination of lower precipitation and higher evaporation. While the world's population tripled in the 20th century, water use has grown six-fold. This massive rise in the consumption of water, which went hand in hand with an increase in contamination of this finite resource, was made possible by relatively recent technological advances in dam building, well-drilling, and pump technology. Consequently, people who attribute the global water crisis to water scarcity primarily look for technical solutions, and promote the design and development of more adequate or appropriate technologies like desalination, drip irrigation, rain water capture and storage, and water-free toilets.

There is, however, a growing number of people who do not attribute the global water crisis merely to the growing scarcity of finite water resources, but mainly to 'a crisis in governance', as it was called at the 2nd World Water Forum of 2000 in The Hague. The very same year, the World Water Council made the following statement: 'There is a water crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people - and the environment - suffer badly' (Cosgrove and Rijsberman, 2000: xix). In his keynote address at the 4th World Water Forum of 2006 in Mexico, HRH Prince of Orange Willem-Alexander of The Netherlands also highlighted that the water crisis is in fact a management crisis (WWF, 2000: 16). The second

edition of the UN's World Water Development Report from 2006 likewise claimed that the water crisis is one of water governance, essentially caused by the ways in which we mismanage water, and outlined many of the leading obstacles to sound and sustainable water management: sector fragmentation, poverty, corruption, stagnating budgets, declining levels of development assistance and investment in the water sector, inadequate institutions and limited stakeholder participation.

Yet another group of people, amongst them many environmental philosophers, wags their finger at our unsustainable and 'water-intensive' lifestyles. Globally, consumption preferences and patterns show an increasing desire and demand for products that require high levels of water. Water consumption is also bound to increase as long as people are not facing water scarcity directly and physically, and believe that access to water is an obvious and natural thing.

While the first group of people stresses the - partially technologically induced - scarcity and shortages of our limited land and water resources, and the second group focuses on unsound governance and mismanagement, the third group draws our attention to public perceptions and preferences. There is, however, growing awareness among environmental social scientists that every single one of these perspectives is important and relevant for sustainable solutions to the global land degradation and water scarcity. But these different perspectives should not be treated separately, these scientists claim, because technological developments, governance regimes and personal belief systems and lifestyles are strongly interconnected.

The question that arises here is how exactly these three aspects are to be connected. Finding an answer to this question is a key challenge for sustainable development. As was mentioned in the previous chapter, the issue has been addressed in the book edited by Joseph Murphy, *Governing technology for sustainability* (2007), which includes a collection of papers from environmental social scientists who examine the ways that technology, governance and people shape each other. In this book, the challenge of sustainable development is explored by 'rethinking the relationship between people, technology and governance. In fact, understanding and recasting the people-technology-governance nexus might be two of the most important challenges associated with sustainable development' (Murphy, 2007: 207).

2.1.1. Refining the technology–governance-people nexus

As was indicated in the previous section, it is important to focus on those aspects (technology, governance and people) simultaneously because they are regularly simplified and often treated separately in relation to sustainable development. For instance, technology is cast simply as a solution to environmental and social problems and people are regularly reduced to

being only self-centered consumers. Governance is naively portrayed as multi-stakeholder cooperation solving problems based on an unlikely consensus over how they should be understood and addressed. In order to elaborate a more satisfactory integrated approach, Murphy engages with three influential approaches in the literature on sustainable technological development and with related approaches in the literature on governance and the role of human actors.

Contextual accounts of technology

The three approaches discussed by Murphy can be designated under the respective headings of 'alternative or appropriate technology (AT)', 'social construction and shaping of technology', and 'system innovation and transition to sustainability'.

The vision and practice of AT, defined as technology that fits its context, challenge mainstream technologies in various ways. It has been popularized by Ernst Schumacher. AT puts the emphasis on local and decentralized rather than hierarchical and centralized procedures, so that technological change becomes a more participatory and democratic process instead of a process imposed from above by an elite of experts.

The 'social construction and shaping of technology' is an approach that opposes the view that technologies either closely lag behind scientific advances or follow a logic of their own, having only secondarily 'effects' on society. Instead, the approach stresses that social norms and new technologies mutually shape each other. Empirical studies that adopt this approach generally recognize that this mutual shaping is an inherent political process.

The approach designated as 'system innovation and transition to sustainability' considers the whole socio-technical system. From a theoretical standpoint a focus on socio-technical systems is useful because, first, it can accommodate and integrate research that is oriented in other ways, e.g. focused on the micro level[16]. Second, the focus on socio-technical systems provides a way to overcome the entrenched division between material and cultural aspects, which may be helpful in developing new modes of sustainable consumption. Finally, it can help explain why superior technologies with better environmental performance are not always being adopted. Such a failure can be blamed on a wide range of factors, usually operating together – regulatory frameworks, cultural values, market imperatives, infrastructural constraints and so on.

[16] Industrial ecology research tends to focus at the material level and only on production

These three approaches provide a useful antidote to the still prevalent tendency to discuss technology in decontextualized ways. Thus it can be helpful to remind us that 'technology includes the artifact itself and the things that surround it that make it useful, such as knowledge and social practices' or that 'technology includes the artifact and its context and history, and that this has implications for the transfer of more sustainable technologies between settings'. Murphy therefore concludes that contextualized accounts are important for a discussion on technology and sustainability: 'Perhaps, most importantly, contextualized accounts undermine the idea of plug-in 'technological solutions' to environmental and social problems – technologies that will deliver sustainability without changing the context or being changed by it.' (ibid, 209)

The tension between consensus and conflict views of governance

The shift from government to governance has emerged in the political sphere since the late 1980s. 'Governance' has been defined as policy making through complex networks. The concept has emerged as a way of understanding the contemporary relationship between state, society and the policy making process, particularly as an alternative to hierarchy and markets[17]. 'Government' is understood as centralized, hierarchical and perhaps technocratic, whereas 'governance' involves power moving away from the center, and policy making through complex networks. With regard to sustainability, governance is perceived from three points of view: the 'functionalist and critical vision', the 'transformation and institutional change' and the 'shift from technical reason to political reason'.

From a functionalist perspective, governance in the area of environment and sustainability can be explained as the state's response to the complexity of problems and its own limited resources. To overcome the poor performance of public policy in this area, the state draws other actors into the policy process because of their knowledge and commitment to produce more successful policies, all the while assuming that there is a consensus on problems and how they can be solved; it is precisely this assumption that supports cooperation between stakeholders. From this perspective governments allow power to move vertically and horizontally away from them because doing so is more likely to lead to solutions.

From a critical perspective, environmental governance can be understood as a way of managing legitimacy problems by drawing some critics into a relationship with the state whilst at the same time marginalizing others. This is achieved through 'participation' and

[17] In this debate 'hierarchy' describes the state making policy in relative isolation, based on its authority to do so, whereas 'the market' refers to policy being made by the forces of supply and demand. Governance, in contrast, involves a wide range of policy actors, making and implementing policy together (ibid, 211)

'partnership'. A critical perspective suggests that governance is a way of managing conflicts such as those associated with (un)sustainable development (ibid, 211). Inevitably, therefore, governance involves conflicts around the meaning of the new technology and efforts to manage these (ibid, 212).

With regard to the second viewpoint, 'transformation and institutional change', Murphy discusses two strategies that might be used to overcome the deficiencies of the bureaucratic state in environmental policy making. The first strategy involves a transformation of state environmental policy from curative and reactive to preventive, from exclusive to participatory, and from centralized to decentralized policy making, wherever possible, and from domineering, over-regulated environmental policy to policy which creates favorable conditions and contexts for environmentally sound practices and behavior on the part of producers and consumers. The second strategy involves a transfer of responsibilities, incentives and tasks from the state to market.

The third governance perspective which is discussed by Murphy is the shift from technical reason to political reason or the shift from command-and-control regulatory approaches (statutory environmental targets or technology standards) to policy instruments which allow social actors freedom to coordinate amongst themselves in pursuit of societal goals, with far less (or even no) central government involvement. The central idea is a transformation of the relation between state and society and different accents on the steering role of the state. This is the central idea of the metagovernance concept, which explores how the central government might operate in complex multi-actor and multi level contexts.

The multiple identities of people

According to Murphy, people are variously perceived as consumers who act only as egoistic self-centered welfare maximizers, or as 'sufferers of injustice and bearers of useful knowledge' or as 'participants in the process of environmental decision making'. In different ways all of these are important for sustainable development and for this reason we must appreciate people's multiple identities beyond the consumer perspective. In other words, in addition to being consumers, people are also activists with a cause, members of communities, citizens of countries, sufferers of injustice and carriers of knowledge, to name just a few of their multiple identities (ibid, 209).

Concluding this review we subscribe to Murphy's judgment that contextual accounts of technology, an approach to governance with a focus on the tension between consensus and conflict and a view of human actors recognizing their multiple identities together provide a

realistic way of dealing with the whole technology-governance- people complex regarding sustainability.

This framework – the technology-governance-people nexus – will be used to explore and examine the problems and possibilities of a transition to sustainable land and water management in Iran.

2.2. Land and water paradigm: appreciating the social and natural environment cognitively as well as normatively

To address the challenge of sustainable development, we will focus on the transition from industrial modernity to what sociologists like Ulrich Beck, Anthony Giddens and Scott Lash (1994) have called 'reflexive' modernity. Reflexive modernity does not indicate a break with modernity, but stands for a radicalization within modernity – a 'modernization of modernity'. An important aspect of this 'second order' modernity is the reevaluation and rehabilitation of the tradition. That is why we will start with a description of the pre-modern technology-governance-people water nexus. Instead of water nexus or network, we will, following Tony Allan (2006), preferably use the term water paradigm[18]. Water paradigms in Allan's sense, comprising the pre-modern, the industrial and the reflexive modern paradigm, 'have determined the way that water resources have been perceived and managed during the twentieth century' (ibid, 1). The concept of 'water paradigm' usefully draws attention to the necessity of starting with the political contexts in which water resources are allocated and managed.

[18] The term paradigm is borrowed from Thomas Kuhn (1970) who postulated in 1962 that science progresses through periods of "normal science," which operates within a scientific paradigm, interspersed with periods of "scientific revolutions". Kuhn said the scientific achievements on which 'normal science' are based serve to define the problems and methods for research and "to attract an enduring group of adherents". These scientific achievements, together with the "law, theory, application and instrumentation" that they incorporate, form the basis of a scientific paradigm. It is this paradigm which is studied in universities as preparation for students to join the scientific community (Beder, 1997: 3).
Greene, J. C. (2008) indicated that the concept of 'social science paradigm' which was introduced by Handa (1986) is closely related to the German Weltanschauung or worldview. Like Kuhn, Handa addressed the issue of changing paradigm; the process popularly known as 'paradigm shift'. In this respect, he focused on social circumstances that precipitate such a shift and the effects of the shift on the social institutions, including the institution of education. This broad shift in the social arena, in turn, changes the way the individual perceives reality. Another use of the word *paradigm* is in the sense of Weltanschauung (German for world view). For example, in social science, the term is used to describe the set of experiences, beliefs and values that affect the way an individual perceives reality and responds to that perception. Social scientists have adopted the Kuhnian phrase "paradigm shift" to denote a change in how a given society goes about organizing and understanding reality. A "dominant paradigm" refers to the values, or system of thought, in a society that are most standard and widely held at a given time. Dominant paradigms are shaped both by the community's cultural background and by the context of the historical moment. http://en.wikipedia.org/wiki/Paradigm (last accessed 10 May 2009)

Several writers have applied the concept of a paradigm to water management. Observing dramatic changes occurring around the world, Gleick (2000) also discusses twentieth century water management approaches and looks at the new paths being explored for the coming decades. He describes this shift as 'the changing water paradigm', which 'has many components, including a shift away from sole, or even primary, reliance on finding new sources of supply to address perceived new demands, a growing emphasis on incorporating ecological values into water policy, a re-emphasis on meeting basic human needs for water services, and a conscious breaking of the ties between economic growth and water use.'(ibid, 127)

Kravcík *et al.* (2007) also use the notion of a water paradigm and argue for the need of a new water paradigm. For them a water paradigm is 'a sum of suppositions, concepts and attitudes of different groups in society (not only scientists) about water.'(ibid, 6) The need for formulating a new paradigm is a consequence of the failure of the "old paradigm" to offer lasting, sustainable solutions to some of the burning questions of water resources and water circulation (ibid,7). The old paradigm, which considered water as an eternally renewable resource, has failed, the truth being that water is only a renewable resource as long as the water cycle is functional. A new paradigm is therefore needed which will carefully protect the fragile equilibrium of this water cycle (ibid, 67). In spite of its apparent failure, Kravcík *et al.* (2007) argue that the old water paradigm achieved exceptional effectiveness in solving many immediate and particular problems of water such as managing to retain water, transport it over great distances, use it, purify it and carry it away. They hold that the new water paradigm must learn from the mistakes of the old paradigm. Among the biggest mistakes of the old paradigm, they believe, is that water was perceived as an isolated entity, water's interaction in the framework of the whole ecosystem being neglected, particularly water hidden from view (water in soil, in the atmosphere, in plants).

The need to consider water in the soil is emphasized by Falkenmark and Rockström (2006), who also use the idea of a water paradigm and suggest the emergence of a 'new blue and green water paradigm'. Due to the higher complexity of water resources issues compare to previous portrayals — it is not only a question of water allocation among irrigation, industry, and municipalities but also involves difficult decisions for balancing green and blue water for food, nature, and society – they argue that the role of water-resource planners and managers will change and that water resources planning and management will have to incorporate land-use activities consuming green water and its interaction with blue water, generating surface runoff and groundwater recharge. Accordingly, Falkenmark and Rockström (2006) suggest that integrated water resource management (IWRM) requires a redefinition, both in focus (generally perceived in terms of allocating blue-water resources) and scale (generally perceived in terms of water-resource management at the basin scale). The focus should be

redirected from a blue-water perspective toward considering the full water balance as "manageable," including vapor flow, or green-water flow. To this end, a necessary conceptual advancement of IWRM is to incorporate land use, that is, to emphasize integrated *land* and water resource management (ILWRM). A land-use decision is also a water decision. Currently, IWRM plans are implemented at the country level, in line with the guidelines from the World Summit for Sustainable Development (WSSD) in Johannesburg in 2002. They conclude that it is urgent that the "L" in IWRM be incorporated in strategic planning of water for livelihoods and sustainability, since evidence clearly shows that the freshwater legacy of the past is definitely inadequate to enable us to face the challenges ahead of us.

Considering those concerns together with Allan's water paradigm, we use the notion of a land and water paradigm in the understanding that a paradigm structures our perception and appreciation of the social and natural environment cognitively as well as normatively.

The traditional or pre-modern land and water paradigm in Iran can be characterized by its key technical system (the *Quanat* system of underground irrigation channels), its main governance institution (the *Buneh* cooperative organization of agricultural production) and its ethico-religious belief system (Zoroastrianism and Islam). The current paradigm of industrial modernity can be identified by the partial replacement of *Qanats* by deep wells and large dams, the substitution of the *Buneh* by a system of smallholding, and the emergence of a mechanistic worldview with important ethical ramifications. In the North, since the 1960s and the 1970s, industrial modernity has gradually given way to what has come to be known as reflexive or second modernity.

2.2.1. Pre-modern (traditional) land and water management paradigm

The Qanat irrigation system

More than 3000 years ago, the inhabitants of the dry, mountainous regions of Iran perfected a system for conducting snowmelt through underground channels, the so-called *Qanat*, which began in the mountains and carried water downwards to the plains by gravity, to farms, country gardens and towns (Foltz, 2002). The conduits – which are usually 50 to 80 centimetres wide and 90 centimetres to 1.5 meters high – vary between several hundred meters to more than 100 kilometres in length. In Iran alone, there are some 22.000 of them, comprising more than 273.500 kilometres of underground channels.

The *Qanat* irrigation system rests on indigenous knowledge and experimental hydrology. It was widely used for several reasons. First, unlike other traditional irrigation devices, such as the counterpoised sweep, *Qanats* require no power source other than gravity to maintain a

flow of water. Second, water can be moved over substantial distances through these subterranean channels with minimal evaporation losses and little danger of pollution. Finally, the flow of water in a *Qanat* is proportionate to the available supply in the aquifer and, if properly maintained, these irrigation canals could provide a reliable supply of water for centuries (Haeri, 2006).

Buneh – the Qanat system as a socio-technical system

Technological systems cannot be separated from the human activities and social institutions that make them work. In other words, technology is part of a nexus that also includes governance. The *Qanat* system is a socio-technical system. It is not only an engineering wonder, but also a remarkable social phenomenon. *Qanats* reflect collective and cooperative work. Because individual peasants possessed neither the capital nor the manpower that was needed for construction and maintenance of the *Qanat* system, independent production was at a disadvantage compared to other systems of production such as the multi-family collective or the *Buneh* in Iran. The major function of the *Buneh* was the efficient exploitation of productive land and the careful use of scarce water resources. Although *Buneh* had some disadvantages (e.g., an internal unequal division of labour and crop), it strengthened the socio-economic position of the peasants (Lahsaeizadeh, 1993).

Ethico-religious frameworks: Zoroastrianism and Islam

To complete our sketch of the pre-modern land and water paradigm, we should draw attention to the belief systems that have supported the traditional socio-technical irrigation system morally as well as legally, Zoroastrianism and Islam.

Zoroastrianism, the dominant religion in the pre-Islamic era, rests on three pillars: *Humata* (Good Thoughts), *Hûkhta* (Good Words) and *Hvarshta* (Good Deeds). By ‘Good Thoughts’, a Zoroastrian is able to concentrate his mind in divine contemplation of the Creator, and live in peace and harmony with his fellow man. By ‘Good Words’, he is obliged to observe honesty and integrity in all commercial transactions, to prevent hurting the feelings of others, and to engender feelings of love and charity. By ’Good Deeds’, he is directed to relieve the poor, to irrigate and cultivate the soil, to provide food and fresh water in places where needed, and to devote the surplus of his wealth in charity to the well-being and prosperity of his fellow man.

Nature is central to the practice of Zoroastrianism and many important Zoroastrian annual festivals are in celebration of nature; new year on the first day of spring, the water festival in summer, the autumn festival at the end of the season, and the mid-winter fire festival (Jafarey,

2004). In the *Avesta*, the holy book of Zoroastrianism, there is strong emphasis on the protection of water and soil.

Like Zoroastrianism, from its very origins fourteen centuries ago, Islam offers a basis for ecological understanding and stewardship. According to the *Qur'an*, the universe and everything in it has been created by God and is considered a sign (*āyāt)* of God. Human beings, although at the top of creation, are only members of the community of nature. Humankind is just considered as a trustee for the planet: humans are entitled to live on the Earth and benefit from it but they are not entitled to pollute or destroy the environment. Any behaviour that can jeopardize the future of the natural resources is seen as an act against God and His creation (Abdel Haleem, 1989).

Nature has been created in order and balance, and with extraordinary aesthetic beauty, and all these aspects of nature, while enhancing humankind's life should be honoured, developed and protected accordingly. All patterns of human production and consumption should be based on this overall order and balance of nature. The rights of humankind are not absolute and unlimited: we should not simply consume and pollute nature as we wish, carelessly (Özdemir, 2003).

Water is a pivotal issue in Islam, not surprisingly since it is a religion that originated in a desert area and spread mainly to other arid or semi-arid territories. It is evident from numerous verses in the *Qur'an* that water is a major theme in Islamic cosmogony and iconography as well as a recurrent topic in liturgy and daily life (Gilli, 2004). One of the most famous verses pertaining to water is taken from the '*Sura* of the Prophets' and it states, 'We made from water every living thing'. This is not the only verse where the word *Ma'* (water) appears, since it occurs more than sixty times in the *Qur'an*.

Islamic law, the *Shari`ah*, goes into great detail on the subject of water to ensure its fair and equitable distribution within the community. The word 'Shari`ah' itself is closely related to water. Originally it meant 'the place from which one descends to water'. Before the advent of Islam in Arabia, the *Shari`ah* was, in fact, a series of rules about water use. The term later evolved to include the body of laws and rules given by Allah. There are two fundamental precepts that guide the rights to water in the *Shari`ah*: *shafa*, the right of thirst, establishes the universal right for humans to satisfy their thirst and that of their animals; *shirb*, the right of irrigation, gives all users the right to water their crops.

It should be obvious by now that the technical, social and ethical aspects of the traditional system of land and water management were highly interconnected. The *Qanat* underground irrigation system was dependent on the social institution of the *Buneh* to operate properly,

while Zoroastrianism and Islam can be considered as an adequate ethico-religious framework for this socio-technological arrangement. But around the middle of the twentieth century the 'Age of *Qanats*' came to an end.

2.2.2. Industrial modernity land and water management paradigm

The hydraulic mission - the replacement of Qanats by deep wells and large dams

From the late nineteenth century until the 1970s, the Northern industrialised economies were dominated by the vision and politics of what has been termed the 'hydraulic mission' (Allan 2002). This mission, involving hydraulic mega-projects like gigantic dams and large-scale irrigation systems, was inspired by the belief that nature, including water, can be controlled and should be subjected to the mastery of science and industry. This mission was implemented in liberal western economies, first and foremost in the United States (Worster, 1992; Reisner, 1986), but also in the centrally planned economies of the Soviet Union.

In the second half of the twentieth century, the hydraulic mission was introduced to the developing countries of the South, especially in India but also in Egypt and other countries of the MENA region. In Iran too, it was assumed that arid regions could be industrialized by making the necessary water resources available through building dams, pumping up groundwater and bringing in water from remote sources in order to 'make the desert bloom'. To pave the way for industrial modernity, the Iranian authorities tried to belittle all traditional irrigation and production systems. Most Iranian scholars and politicians exaggerated the technical deficiencies of the *Qanats* to justify their own programs and to convince farmers to use pump extraction instead of *Qanats* (Khaneiki, 2007).

At first, modern devices such as pumps and drilling machines received no warm welcome, but after some pumped wells were drilled, farmers started to express their admiration for these new technologies. After all, while the construction of a *Qanat* would sometimes take tens of years, drilling a well took less than one month. If the farmers wanted to increase the discharge of a *Qanat* even a little bit, they had to extend the tunnel which would take two or three years, whereas it was easy to increase the discharge of a pumped well by two times just through changing the diameter of the pump or adding some units or parts (Yazdi and Khaneiki, 2007).

Electric and diesel-pumped wells offer advantages over *Qanat* irrigation by allowing water to be brought to the surface on command, but over-pumping has caused water tables to fall, aquifers to be depleted and *Qanats* to be abandoned at an accelerating pace. The role of *Qanats* in securing all the functions of water in Iran has decreased from 70 per cent prior to 1950, to 50 per cent around 1950 and to 10 per cent in the year 2000 (Haeri, 2006).

The substitution of the Buneh by a system of smallholding

The use of mechanically-pumped wells was heavily encouraged as a result of the Land Reform Act of 1962, which broke up the large estates and re-distributed land to the peasants. The general pattern of land ownership in Iran prior to the land reform was a combination of large-scale feudal landownership with small-scale absentee and peasant proprietorship (Lahsaeizadeh, 1993). Because of the importance of artificial irrigation to Iranian agriculture, sharecropping (*muzara-eh*) was dominant among the different types of relation between the peasant and landowner. This traditional system of land ownership and tenure, and the socio-economic organization of villages (*Buneh*) were well adapted to the optimal use of the *Qanat* system. The land holdings given to the peasants following the Land Reform were too small to maintain the *Qanats*, yet many landowners and farmers now widely prefer pumped wells and allow their *Qanats* to languish. In effect, the traditional sense of water resources management for the benefit of the community seems to be giving way to an 'every man for himself' mentality. In addition to the mostly privately owned and constructed wells, the public sector is engaged in the construction of many large-scale dams.

The emergence of a mechanistic worldview

The new water resource management regime of deep wells and large dams is more in tune with a mechanistic worldview than with the *ethico-religious* frameworks of the past. Critics of the mechanistic worldview fear that if man sets himself up as the measure and master of all things, nature will appear solely as 'material' that he can control and command as he pleases. Nature, including water, ceases to be an independent source of value and turns into a mere resource to be disposed of at will instead. To quote Donald Worster's 1992 book *Rivers of Empire* on the advent of the hydraulic society in the American West:

> 'The most fundamental characteristic of the latest irrigation mode is its behaviour towards nature and the underlying attitudes on which it is based. Water in the capitalist state has no intrinsic value, no integrity that must be respected… It has now become a commodity that is bought and sold and used to make other commodities… It is in other words, purely and abstractly a commercial instrument. All mystery disappears from its depths, all gods depart, all contemplation of its flows ceases… Where nature seemingly puts limits on human wealth, engineering presumes to bring unlimited plenty. Even in the desert, where men and women confront scarcity in its oldest form (…) every form of growth is considered possible' (52).

Modern water technologies have deeply affected the way people perceive, value and use water. In her paper on the conversion of rainwater into tap water, Nicole Stuart argues that industrial technologies dissociate people from the natural environment upon which they

depend. 'Urban water infrastructure allows people to "take water for granted"… The urban water infrastructure provides an "illusion of abundance"– enabling twenty-four hour access to clean and potable water, seven days a week' (Stuart, 2007: 419).

Based on four years of field research in 11 countries of the MENA region, Francesca de Châtel (2005b) came to a similar conclusion with respect to public awareness of water scarcity. The sheer size of dam reservoirs and the huge amount of water that is transported through pipelines leads the general public to believe that water supplies are endless and conceal the reality of water scarcity. Moreover, through the development of modern water distribution systems, the link that used to exist between the individual user and his water is severed. As soon as water starts flowing from a tap, it is taken for granted. People forget that a fluctuating river or an erratic weather system lies at its origins. 'By making its source invisible, water's existence is divorced from the elements and the seasons, and it becomes paradoxically omnipresent. The user can comfortably assume that it flows from an endless supply' (Châtel, 2005a).

2.2.3. Reflexive land and water modernity paradigm

The ideas underpinning industrial modernity were challenged during the 1960s and 1970s, when some of its disastrous effects - 'the hydraulic society's worsening headaches' (Worster, 1992: 324) -, such as salinity, sedimentation, pesticide contamination, diminishing hopes of replenishment, and the dangers of aging, collapsing dams, begun to appear, not only in the U.S. and other Northern countries but also in Southern countries like Iran, where, over the past four decades, farmers and others close to the land have watched water tables drop as one well after another dried up, and formerly fertile lands were inevitably taken out of production (Foltz, 2002).

As a response to these challenges a new paradigm has emerged, the paradigm of 'reflexive modernity.' As already mentioned, reflexive modernity does not imply a break with modernity, but refers to a radicalization within modernity - a 'modernization of modernity'. Radicalized or reflexive modernization is a process whereby modernization has become directed at itself, at the destructive and continually expanding side-effects and risks that are systematically produced by industrial society. While nature in 'first' modern societies is conceived of as a neutral resource, which can and must be made available without limitation, nature in 'second' modern societies 'is no longer solely perceived as an outside that can be adapted to one's purposes, but increasingly as part and parcel of society' (Beck *et al.*, 2003: 7). Beck argues for 'ecological enlightenment', which requires a reorientation from a focus on economic growth to one of sustainable development (Beck, 1995).

According to Tony Allan (2006), reflexive modernity in the area of water management can be shown to have three phases. In the first phase, from the 1960s until the 1980s, changes in water policy were inspired by the growing awareness of the *environmental* costs of the hydraulic mission. In the second phase, from the early 1990s onward, the idea that water is an *economic* resource gained currency, paving the way for the concept of the water market. In the third phase, which emerged at the turn of the century, the notion that water management is a *political* process seized the North. This notion is central to the concept of Integrated Water Resource Management (IWRM). IWRM is an intensely political process which includes stake holder consultation and participation to enable the mediation of conflicting interests of water users and water management agencies.

Allan believes that, by and large, the semi-arid North can be shown to have passed through all three stages of water management and water policy. In the South, by contrast, the professional community generally, and all water users and politicians have resisted the adoption of the paradigm of reflexive modernity. Especially in the MENA region, the hydraulic mission of industrial modernity is still alive and flourishing. 'The big players, Egypt, Turkey and Iran, are all engaged in major hydraulic projects' (Allan, 2002: 145).

Allan's sketch of the course of reflexive modernity in water policy in the North is not only meant as a purely empirical description, but also as a normative prescription for water policy reform in the South. This is, however, very problematic on two accounts. In the first place, it seems to place too much faith in a unilinear model of institutional evolution. According to Frances Cleaver (2002), such a model fails to recognize that decision-making and cooperative actions are deeply embedded in the web of local livelihood networks and practices. To understand the complex and dynamic nature of institutional change we should see it as a process of 'bricolage', i.e., a process operating by trial and error and using a diverse range of social and cultural resources.

In the second place, Allan fails to recognize that the course that second modernity has been taken within a European constellation will differ considerably from its course within non-European constellations, where the dynamic of reflexive modernization displays its effects not on first modern societies but rather on the distorted constellations of post-colonialism. '*Different non-European routes to and through second modernity still have to be described, discovered, compared and analysed*' (Beck *et al*., 2003: 7).

Therefore, the main question is what could be a non-European route to reflexive land and water management for Iran and the other MENA-countries. To accomplish a successful transition to sustainable land and water management would require a framework that is context dependent and sensitive to the specific features of the region.

2.3. Refinement of the six research questions

The main aims of this PhD thesis are to ascertain the causes and consequences of the environmental crisis and to search for trends and tendencies that suggest a way out of this crisis in the direction of truly sustainable land and water management, which is especially urgent for the MENA region.
In section 1.4 (see Chapter 1) we formulated six research questions:

1. *What are the causes and consequences of the environmental crisis Iran is confronted with, in particular degradation of land and the depletion of water resources?*
2. *What kind of (reflective) framework and paradigms are needed to comprehend these causes and consequences?*
3. *What kind of technical system is needed in the reflexive modernity paradigm in Iran?*
4. *What are the institutional requirements for a reflexive modernity paradigm in Iran?*
5. *What kind of ethics is needed that fits in the reflexive modernity paradigm for Iran?*
6. *What kind of soil and water science is needed within the reflexive modernity paradigm for Iran?*

On the basis of our conceptual framework (answering question 2) we can now refine and specify our other questions. The brief narration of Chapter 2 provided us with the starting position to formulate more concrete research questions that would elaborate the central question of what could be a non-European route to reflexive land and water management for Iran and other MENA-countries. It should be a framework that is context dependent and sensitive to the specific features of the region. The 'technology-governance-people' nexus and the notion of a land and water paradigm provide the building blocks of the required framework. It gives the outlines for the detailed narrative covering the three periods of Iran's land and water development and thus helps us to understand how we arrived at the current crisis situation and to determine where we should be going from here. The more precise formulation of the first research question is therefore:

1. *How can the causes and consequences of the environmental crisis Iran is confronted with, in particular degradation of land the depletion of water resources, be conceptualized in terms of the technology-institution-culture nexus?*

Secondly, as was emphasized above (see section 2.2), an important aspect of 'reflexive' modernity is the reevaluation and rehabilitation of the tradition. Regarding this, the following research questions are to be seen as more specific formulations of the other research questions earlier introduced.

2. *How can the technology-institution-culture nexus take into account the revitalization (rehabilitation) of the traditional paradigm and the integration of this paradigm with industrial modernity, in such a way that the benefits and advantages of both will be maintained as much as possible?*
3. *What technology is required according to the technology-institution-culture nexus that will fit the transition to such a reflexive paradigm?*
4. *What institutional requirements are needed according to the technology-institution-culture nexus to accommodate this transition?*
5. *What ethics is required according to the technology-institution-culture nexus that will fit the transition to such a reflexive paradigm?*
6. *What role should science and technology play in this transition according to the technology-institution-culture nexus?*

2.4. Refinement of the research methodology

In chapter 1.4 we stated that we need a triangulation of methods and resources: a combination of research of relevant documents, participant observation, and in-depth semi-structured and open-ended interviews. We can now refine our methodology as well.

Literature review to find items for 'the reflexive framework of land and water management'

In the previous section the three historically successive paradigms were briefly sketched. We will do literature research on the pre-modern and industrial modernity paradigm. The resulting elements can be used as input for the next empirical phase as the emerging paradigm of reflexive modernity will have to deal with the legacy of problems, dilemmas and opportunities generated by the earlier paradigms. Three aspects of these paradigms (technology, social system, ethical framework) are important to be studied:
A) To reconstruct the pre-modern paradigm we need to answer the following questions:
1- What was the land and water technical system of the pre-modern paradigm?
2- What was the social system of pre-modern paradigm?
3- What was the ethico-religious framework (Zoroastrian and Islamic value systems) with regard to land and water?

B) What are the advantages and disadvantages of the industrial modernity paradigm?
We will do the same study on the three aspects that have been mentioned in the pre-modern paradigm.

C) General conclusion with respect to the (provisional) postmodern reflexive framework

The results of this study are discussed in part II containing Chapters 3, 4 and 5.

Exploratory interviews: To find more input items (dilemmas) for 'the reflexive framework of land and water management'

As discussed above, we need additional evidence and we have to delve deeper if we want to know what the chances are that the shift to reflexive modernity will be successfully completed. One way to get a better grasp of the problems and perspectives of a reflexive turn in Iran is to conduct a stakeholder analysis. What are the attitudes of relevant stakeholders towards a more sustainable and reflexive land and water management, and how do they evaluate the chances for a turn towards such a reflexive land and water management within the current situation in Iran?

To answer these questions we have identified three stakeholder groups:

1. Farmers and village informants
2. Soil and water experts
3. Policy makers

With respect to the main objectives and questions of this PhD study specific questions on the following issues were formulated for each group.

1. Current perspective of land and water resources management regime and roots of land degradation and water scarcity in Iran

2. Sustainability: opportunities and constraints

3. Integration possibility of traditional and modern land and water resource management

4. Science, research and technology: part of the problem and part of the solution

5. Stakeholders participation, government role, land consolidation and rural institutions: challenges and hopes of participation issue

6. Stakeholders' perception of nature and environmental and agricultural ethics

To collect data needed for answering those questions four large-scale qualitative–quantitative surveys were designed with different instruments including questionnaires, semi-structured interviews and open-ended interviews. These empirical investigations were carried out in 2007-2008 in Iran. 156 Iranian farmers and 40 villages' informants from villages, which were chosen among 14 provinces out of 31 provinces around the country, took part in the semi-structured interview the outcomes of which is the subject of Chapter 6. Also, a questionnaire was completed by 94 Iranian soil and water experts who took part in several international and national conferences, held in Iran on subjects related to sustainable use of land and water resources, and also by those who work at Iranian organizations. The results of this questionnaire are discussed in Chapter 7. Next, building on the findings of those large-scale

researches and the theoretical parts of the PhD project, open-ended interviews were held with 12 policy makers/high level informants. The results of the interviews with policy makers will be outlined in Chapter 8. In Chapter 9, finally, we will compare the findings of our four empirical surveys to extract points of agreement and difference. This will yield a list of elements that have to be incorporated in a new reflexive framework of land and water management in Iran.

In Chapter 10 we will formulate the reflexive framework for land and water management in Iran more extensively, including its technical system, institutional requirements, ethico religious system and the new requirements for the soil and water sciences. This framework is based on the results of the historical background studies in part II and of the stakeholder analysis in part III and on the reworking and redefinition of some key concepts. Figure 2.1 shows the research design and the integration of its various parts.

2.5. Concluding remarks

In this chapter we showed that an exploration of the causes and consequences of the environmental crises of land degradation and water scarcity calls for the adoption of integrated framework that is capable of doing justice to the complexity of the issues involved. Murphy's notion of a technology-governance-people nexus was presented as offering a potential answer to this demand. It highlights the contextual character of technologies, the tension between consensus and conflict in governance and the multiple identities of the human actors involved and thus promises a realistic approach to sustainability problems. In addition, this chapter adopted Tony Allan's notion of water paradigm as a more precise concept for referring to historically specific modes of land and water management; in broad outline, a traditional, a modern and a reflexive-modern paradigm can be distinguished. A central task of this thesis is to develop and specify a reflexive framework for land and water management in Iran. In discussing this aim we also could refine the main questions of this PhD project and the methodologies that are needed to answer those questions.

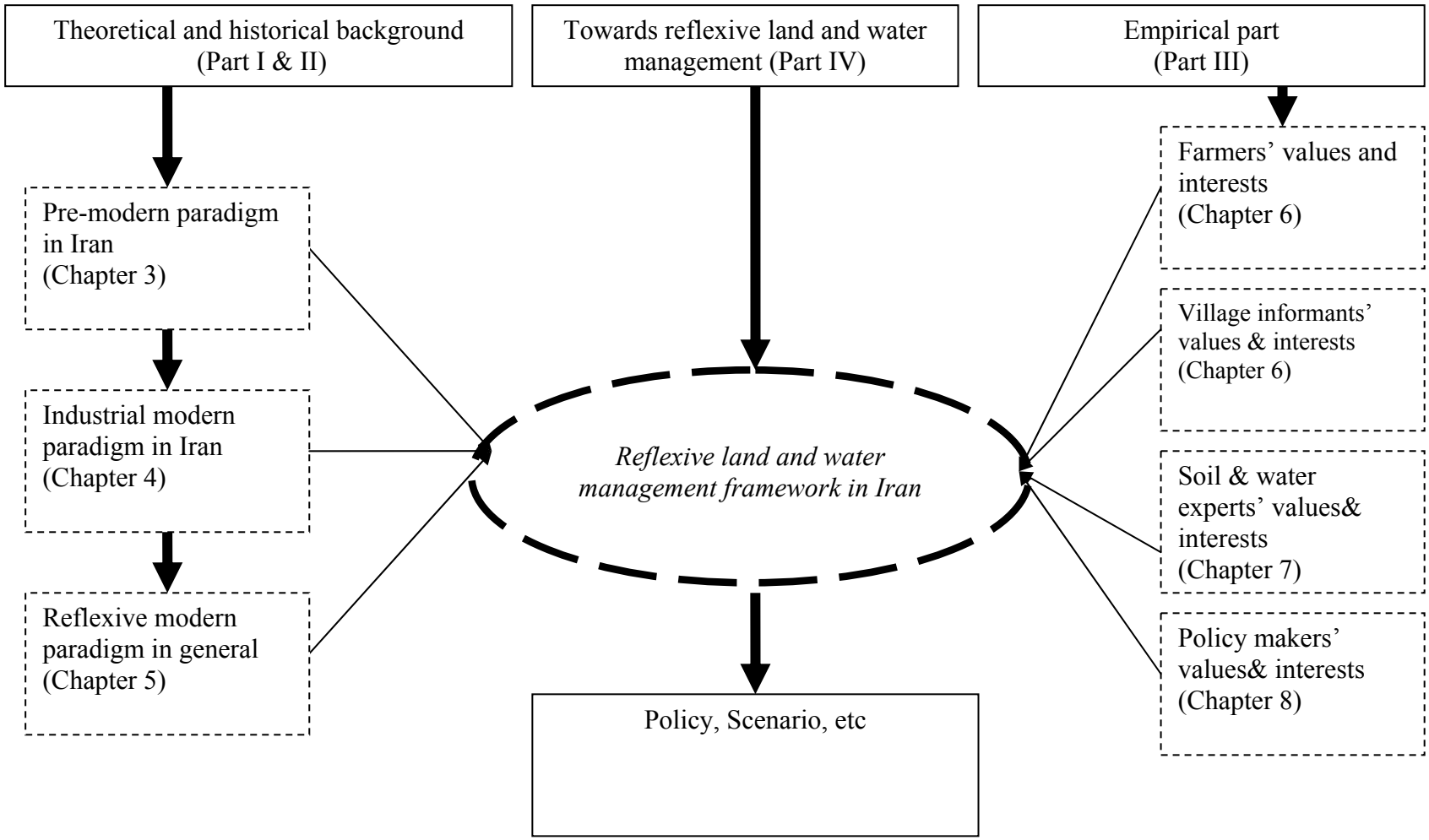

Fig2.1. Research design and integration of its different parts aiming at developing 'reflexive land and water management framework in Iran'

Part II
Historical background: past, present and future of land and water resource management

Chapter 1 started, after a short narrative of land and water issues in Iran, with the concept of sustainability and the main research questions of this thesis. In Chapter 2 the three paradigms of land and water management including pre-modernity (traditional), industrial and reflexive modernity were briefly sketched. A provisional *reflexive framework of land and water management* was constructed and developed taking into account the Iranian context covering two issues: the revitalization (rehabilitation) of the traditional paradigm and the integration of this paradigm with that of industrial modernity which maintains the benefits and advantages of both as much as possible.

According to this approach we will put technological, institutional and cultural aspects of land and water management in context. In this historical part we will do literature research to find items that can be helpful in analysing pre-modern and industrial modernity paradigm and that can be used as input in the next part on empirical matters.

In our reconstruction in Chapter 3 of the pre-modern (traditional) paradigm of land and water management in Iran we will answer the following questions:

1- What is the land and water technical system of the pre-modern paradigm?
2- What is the social system of the pre-modern paradigm?
3- What is the ethico-religious framework (Zoroastrian and Islamic value systems) with regard to land and water?

In Chapter 4 we will study these three aspects with respect to the industrial modernity paradigm. Together Chapter 3 and 4 explore the past and present features of land and water resource management in Iran. Finally, in Chapter 5 the idea of reflexive modernization will be explored; it emerged as a new paradigm in response to the challenges of industrial modernization during 1960s and 1970s. This paradigm covers a holistic approach that includes participation, consultation and inclusive political institutions enabling the mediation of the conflicting interests of land and water users and of the agencies of land and water management.

Chapter 3
The pre-modern (traditional) land and water management paradigm in Iran

In this chapter the technology-governance-people framework will be used in sketching the main features of the premodern Iranian land and water management paradigm. In the pre-capitalist society of Iran the sector of land and water management can be characterized by its key technical system (the *Qanat* system of underground irrigation channels) (3.1), its main governance institution (the *Buneh* cooperative organization of agricultural production) (3.2) and its belief system (first Zoroastrianism and later Islam) (3.3). These three different aspects of the framework will be explored in detail in this chapter.

3.1. The main technical system: Qanat

More than 3000 years ago, the inhabitants of the dry, mountainous regions of Iran perfected a system for conducting snowmelt through underground channels and the discharge that "is fixed by nature", the so-called Qanat (Fig 3.1), which began in the mountains and carried water downwards to the plains by gravity, to farms, country gardens and towns (Foltz, 2002). The conduits – which are usually 50 to 80 centimetres wide and 90 centimetres to 1.5 meters high – vary between several hundred meters to more than 100 kilometres in length. In Iran alone, there are some 22.000 of them, comprising more than 273.500 kilometres of underground channels. About 73.5% of *Qanats* were located in the eastern half of the country; whereas the western part was mostly dependent on rivers and rainfall (Lahsaeizadeh, 1993).

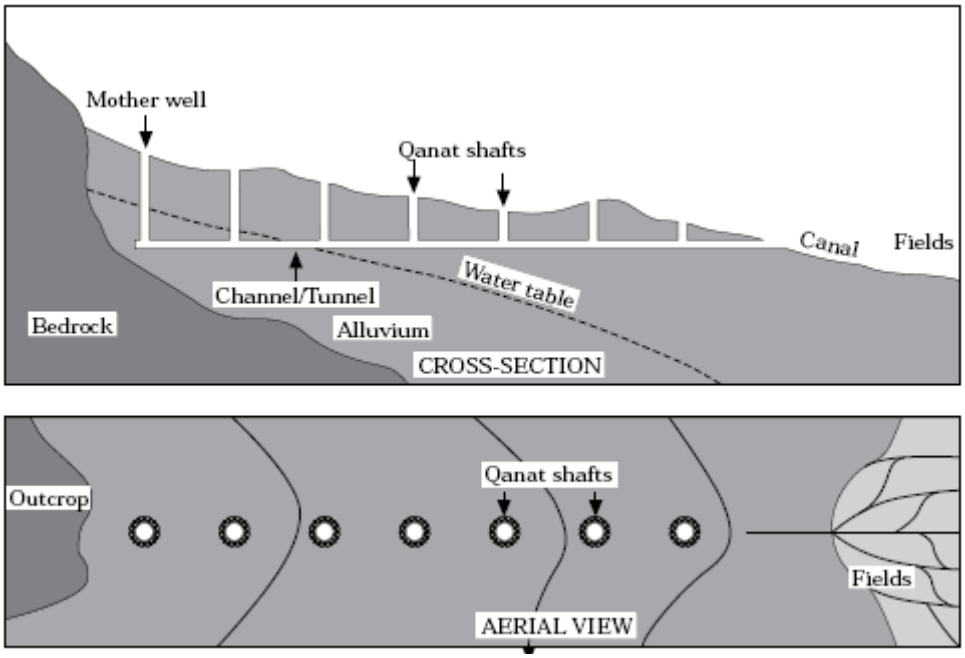

Fig 3.1. Qanat irrigation system (Lightfoot, 1996)

The Qanat irrigation system rests on indigenous knowledge and experimental hydrology. It was widely used for several reasons. First, unlike other traditional irrigation devices, such as the counterpoised sweep (a hand driven device for raising water out of shallow pits), Qanats require no power source other than gravity to maintain a flow of water. Second, water can be moved over substantial distances through these subterranean channels with minimal evaporation losses and little danger of pollution. Finally, the flow of water in a Qanat is proportionate to the available supply in the aquifer and, if properly maintained, these irrigation canals could provide a reliable supply of water for centuries (Haeri, 2006).

Qanats are built by specialists called muqanni (Qanat diggers), who transmitted their knowledge from father to son. A windlass is set up at the surface and the excavated soil is then hauled up in leather buckets. A vertical shaft of about three feet in diameter is dug out, one man working with a mattock and the other with a short-handled spade. A gently sloping tunnel is thus constructed which conducts water from an infiltration section beneath the water table to the ground surface by gravity flow. The Qanat works were built on a scale that rivalled the great aqueducts of the Roman Empire, but, whereas the Roman aqueducts now are only of historical interest, the Qanat system is still in use after 3000 years. The advantage of the Qanats over the Roman open air aquaducts is that less water is lost by evaporation on the way from hill to plain.

The historians do not doubt that in ancient Iran (Persia) the origin the Qanat can be found. The Greek historian Polybius credits the Achaemenids (550 to 331 BC) for bringing water to remote areas throughout the Persian Empire through the use of Qanats. The Achaemenid rulers provided a major incentive for Qanat builders and their heirs by allowing them to retain the profits from newly-constructed Qanats and the right of cultivating the previously unirrigated land for five generations. As a result of this water supply, thousands of new settlements were established and others expanded.[19] Because of the qanat many major cities were established and developed into centres of civilization. For this reason, the civilization associated with utilization of the kariz (qanat) may be referred to as “kariz civilization” or “hydraulic civilization” (Pazwash, 1983).

Three centuries later, when the Parthians invaded Iran, Qanats were in widespread use on the Iranian plateau. To the west, Qanats were constructed from Mesopotamia to the shores of the Mediterranean, as well as southward into parts of Egypt and Arabia. To the east of Iran, Qanats came into use in Afghanistan, the Silk Road oases settlements of Central Asia, and the Chinese province of Sinkiang (now Xinjiang) (English, 1997).

[19] The largest known *Qanat* is in the Iranian city of Gonabad which after nearly 2700 years still provides drinking and agricultural water to nearly 40.000 people. Its mother well is 360 metres deep and the channel is 45 km long (Kobori, 2007).

The Romans adopted the qanat systems and established in the Middle East during the Roman-Byzantine era (64 BC to 660 AD) many Qanats, in particular in Syria and Jordan. Probably the Romans took the technology with them to northern and western Europe; even in the present Luxembourg traces of qanats can be found (Fig 3.2).

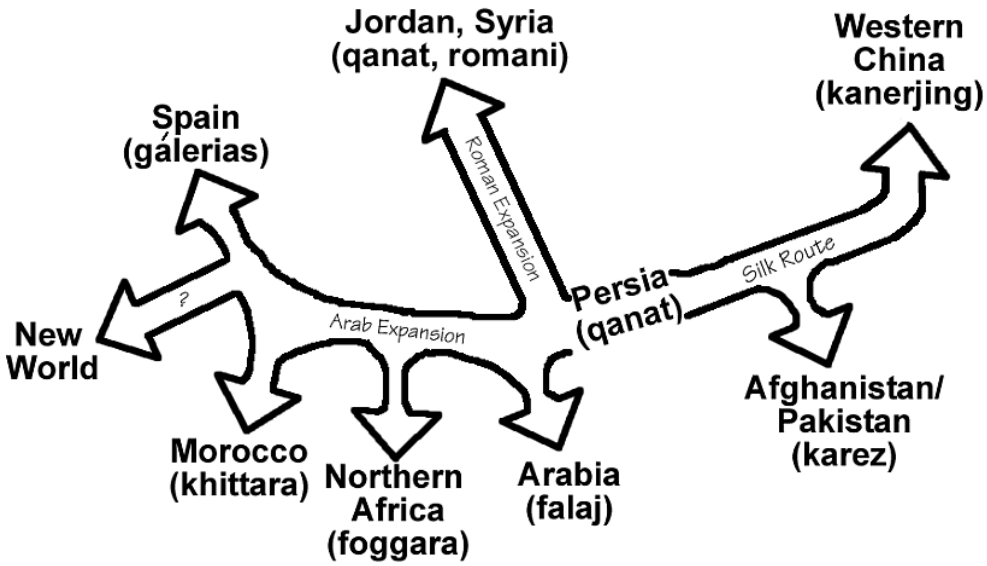

Fig 3.2. Qanat technology diffusion (Qanat, waterhistory.org)

When the Arabs brought Islam to the West and East they also stimulated the construction of Qanat technology. The early Arab invasions spread Qanats across North Africa into Spain, Cyprus, and the Canary Islands. Although some say that the Qanat system in America (Western Mexico, the Atacama regions of Peru, and at Nazca and Pica in Chile) has been brought there by the Spanish conquistadores, there is also evidence that qanats were already in use before the Spanish came to Western Mexico.[20]

3.2. The main social institution: Buneh - the Qanat system as a socio-technical system

The *Qanat* system is a socio-technical system and as such it cannot be separated from the human activities and social institutions that make it work. In other words, technology is part of a nexus that also includes governance. Qanat is not only an engineering wonder, but also a remarkable social phenomenon that has been holding strong in the past centuries despite changing socio-economic, and climate conditions, even though it has kept a low profile.

[20] The system has been variously named – *Qanat* in Iran; *Qanat Romani* in Syria and Jordan; *Karez* in Afghanistan, Pakistan and Turkmenistan; *Kahn* in Baluchistan; *Kanerjing* in China; *Falaz* in Oman and other parts of the Arabian Peninsula; *Foggera* in Algeria and other North African countries; *Khattara* in Morocco; and *Galleria* in Spain (Kobori, 2007).

Qanats reflect collective and cooperative work and in areas where *Qanats* are constructed there are employment opportunities for the local community. In other words, the most vital point relative to *Qanat* is to recognize and understand that *Qanat* systems are closely linked to the local community and its ability in planning and managing their own water resources, especially for agriculture. It has been claimed that before the land reform of 1962, the life of about 70% of Iranian villages was totally or partly dependent on the *Qanat* system (Lahsaeizadeh, 1993). Because individual peasants possessed neither the capital nor the manpower that was needed for construction and maintenance of the *Qanat* system, independent production was at a disadvantage compared to other systems of production such as the multi-family collective or the *Buneh* in Iran. The management system is such that the water is distributed according to the rules of the community. As a result, water security and water access are supporting the foundations of the local community (Haeri, 2006). These cooperative units of production were developed in Iranian villages[21] in response to the challenges posed by a harsh natural environment and the environmental constraints arising from the scarcity of production factors, especially water. The *Buneh* evolved as a complex social organization for agricultural production with distinct cultivation and water rights and semi-structured farm management.

In the agrarian society of Iran the pattern of landownership and the relation between peasant and landowner that played an essential role in the process of agricultural production was to a large extent determined by the circumstance that approximately 90% of Iran is arid and semi-arid. The annual evaporation loss is high, ranging from about 700 mm to over 4,000 mm, amounting to 16 times the annual average rainfall of 250 mm (Moameni, 2000). The general pattern of land ownership in Iran prior to the land reform of 1962[22] was a combination of large-scale feudal landownership with small-scale absentee and peasant proprietorship (Lahsaeizadeh, 1993). Because of the importance of artificial irrigation to Iranian agriculture, sharecropping (*muzara-eh)* was dominant among the different types of relation between the peasant and the landowner. In the arid and semi-arid areas of the country, a cooperative form of organization of agricultural production, *Buneh*, prevailed[23].

Basically, each *Buneh* has six main members. It was under the charge of one peasant known as the *sarbuneh* (buneh head) or *abyar* (irrigator). He was chosen by the landowner or his bailiff. Experience and expertise in agricultural affairs were necessary qualifications for the *sarbuneh or abyar.* Each *sarbuneh* had two assistants, known as *varbuneh*, chosen by the

[21] The common unit of landownership was "the village" (*deh*) – an imprecise concept since villages vary considerably in area and population. Village sizes range from ten families in the mountain valleys to over 400 families in large villages on the plain (Lahsaeizadeh, 1993).
[22] The size of private holdings was limited to 20 ha of irrigated land, as a result of which large areas could be distributed to landless laborers (Lahsaeizadeh, 1993).
[23] In rainy parts of the country, the dominant unit of production was the peasant household, *khanevar* (Lahsaeizadeh, 1993).

sarbuneh from among his friends and relatives. Finally, sharecroppers formed the foundation of a buneh structure. The main director of the buneh was the landlord. His orders were passed to the *sarbuneh* through the bailiff or village headman (*kadkhoda*). The *sarbuneh* transferred those orders to his *varbuneh* and sharecroppers.

At the beginning of each agricultural year, all the *sarbunehs* of the village gathered to decide how the field should be distributed among *bunehs*. Once these basic decisions had been made, the important tasks of each *sarbuneh* included marking off the boundaries of his buneh's field and plot, determining the type of crop for each plot, assigning the task of each member, coordinating the irrigation, sowing the seed, contracting with seasonal labour if necessary, supervising threshing the grain, controlling the division of crops, and, finally mediating between a buneh's members and the landlord.

The *Buneh* also included some groups other than peasants. The first group consisted of those craftsmen who produced directly for the *Buneh*. Members of this group included *muqanni* (well and qanat diggers), *ahangar* (blacksmiths), and *najjar* (carpenters). They were paid in kind at harvest time and carried out repairs for the *Buneh* throughout the year. The second group were barbers and bath keepers. Members of the *Buneh* were allowed to go to the public bath regularly without payment during one agricultural year. Also, the village barber went to the buneh field weekly and cut buneh members's hair and shaved their beard free of charge. In return, both bath keepers and barbers received a share of the crop at harvest time (Safinejad, 1989). Finally, each *Buneh* needed some extra hands during harvest time. For this purpose, daily wage labourers were hired. They were temporarily employed by *Bunehs* and paid either in cash, in kind, or a combination.

In conclusion, the major function of the *Buneh* until the land reform of 1962 was the efficient communal exploitation of productive land and the careful use of scarce water resources. The Qanat system and the *Buneh* system are constantly interacting. As can be seen from Figure 3.3, they developed mainly in the same localities in the center and eastern half of the country. Although *Buneh* had some disadvantages, for instance the unequal division of labour and unequal distribution of yields, it strengthened the socio-economic position of the peasants (Lahsaeizadeh, 1993).

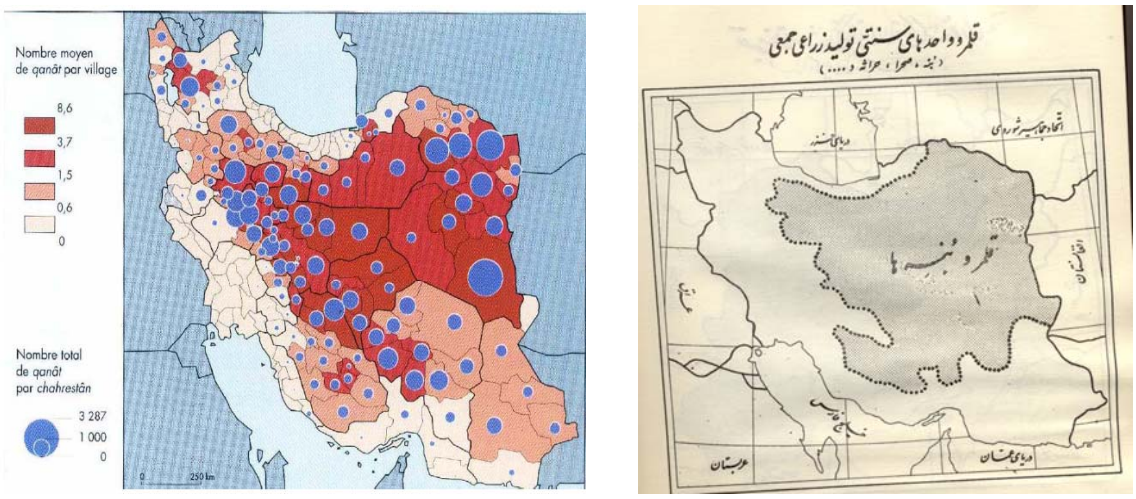

Fig 3.3. Distribution of Qanats (Haeri, 2006) [left] and Realm of Buneh (Safinejad, 1989 : 570) [right-gray part] in Iran

As indicated, because of the agro-environmental constraints, the preparation of land, the supply of irrigation water, and the organization of necessary labor power for tillage and cultivation, provision and allocation of water were beyond the working and administrative capacity of the individual family. As a result, independent production was at a disadvantage compared to collective systems of production. Accordingly, it is believed that this was the driving force behind the emergence and formation of the Buneh or the multi-family collective, which has affected almost everything in rural communities. This resulted in a traditional integrated farming system that was a complex system of interrelated activities which includes three main components: crop farming, animal husbandry and handicraft production (Fig 3.4). The output of one activity may be the input to another one, leading to an increasing transformation of the primary farm products (vegetal and animal) either for auto-consumption or for sale. Functional integration and temporal distribution of the activities ensure that all family members participate full-time all year around. The large variety of products generated helps mitigate all kinds of risk, from climatic (drought, late frost) to economic (market price fluctuations, product scarcity). Such integration is the result of an enduring co-evolution between ecosystems and social systems (Farshad and Zink, 1997).

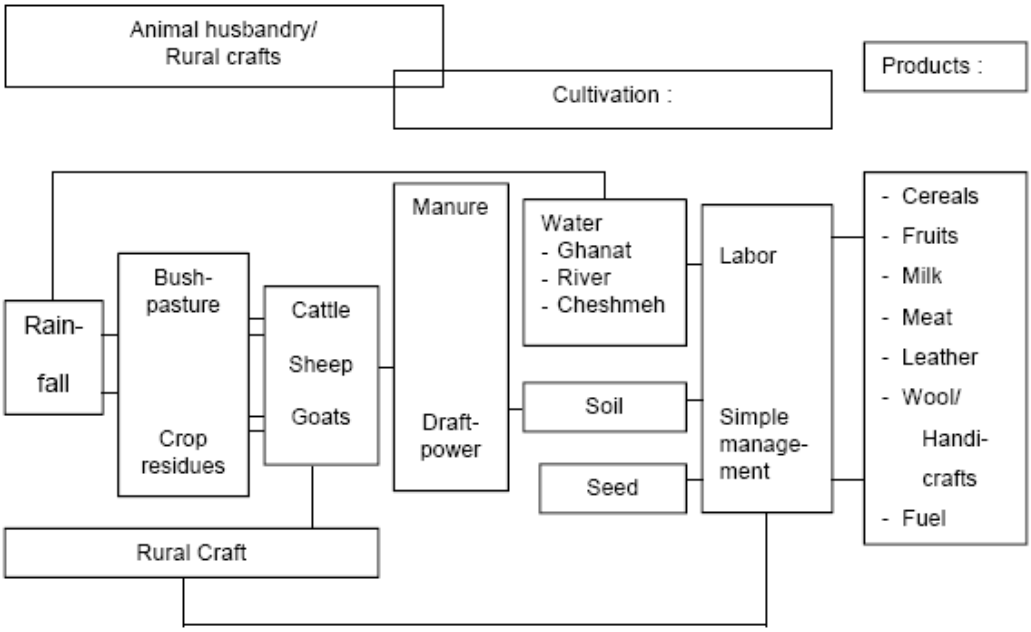

Fig 3.4. Model of a traditional agricultural system (Farshad and Zink, 1997)

3.3. The ethico-religious frameworks: Zoroastrianism & Islam

To complete our sketch of the pre-modern land and water paradigm, we must draw attention to the two belief systems that have supported the traditional socio-technical irrigation system morally, culturally as well as legally, Zoroastrianism and Islam. From an ethical point of view, Iranian civilization recognized both the ecological realities of the plateau's desert climate and the social imperative of conserving and distributing water in a way that ensures its availability to all. This ethical system which is rooted in the two religious value systems, namely Zoroastrianism and Islam, can be considered indigenous. Over the past fourteen hundred years, since Islam has entered into Iran, these two belief systems have co-evolved to a large degree and are profoundly interconnected. The *Qanat* system, for example, which originated long before the Islamic period, was incorporated into the developing Islamic legal code (Foltz, 2002). These two ethico-religious systems will be discussed in the following sections.

3.3.1. Zoroastrianism: the dominant Iranian religion in the pre-Islamic era

Zoroastrian ethics

Zoroaster or Zarathushtra lived approximately 3770 years ago in the north-eastern area of ancient Persian territory. He is the founder of Zoroastrianism, the dominant religion in the pre-Islamic era. He composed 241 stanzas that together make up 17 songs, the so-called *Gâthâ* ("Sublime Songs") (Jafarey, 2004), which is collected in the *Avesta* as the

Zoroastrian's holy book. Zarathushtra's message is primarily ethical and rationalistic (Williams, 2000). His songs define what is good and what is bad. Moreover, the songs urge everyone to study him/herself, the society, the environment, and the universe and provide guidance to this inquiry. By developing a good mind, one should become aware of the Wisdom that creates, regulates, maintains and promotes the Cosmos. That Wisdom, a reality, an essence, is the Creator, Maintainer, and Promoter of the Universe. Zarathushtra coins a name for IT, *Mazdâ*, which means Super-wisdom and since it is a reality, it is also *Ahura*, the Essence, the Being. He has two words to describe what we call 'God': Mazdâ Ahura or Ahura Mazdâ – The Super-wisdom Essence. With Mazda Ahura in mind, the songs become simultaneously loving Prayers to God and kindly Guidance to mankind. Zarathushtra uses some twenty abstract terms such as *Vohu manah* (the good mind) and *Asha* or *arta* (law of "truth, precision, righteousness"). He also refers to "the Primal Principles of Life" to prescribe the way of promoting mental and physical faculties of the soul to achieve perfection and immortality. They are the universal principles of existence, the natural way of living.

Zoroastrianism rests on three pillars: *Humata* (Good Thoughts), *Hûkhta* (Good Words) and *Hvarshta* (Good Deeds). By 'Good Thoughts', a Zoroastrian is able to concentrate his mind in divine contemplation of the Creator and live in peace and harmony with his fellow men. By 'Good Words', he is obliged to observe honesty and integrity in all commercial transactions, to prevent hurting the feelings of others, and to engender feelings of love and charity. By 'Good Deeds', he is directed to relieve the poor, to irrigate and cultivate the soil, to provide food and fresh water in places where needed, and to devote the surplus of his wealth in charity to the well-being and prosperity of his fellow men. A good mind helps one to discriminate between good and bad. It defines the sources of happiness and sorrow.

Zarathushtra observes the universe as a good creation of God and sees no evil in it. It is a cosmos – an orderly, harmonious system. However, there are indications that he considers the universe as still being in its infancy, complete in every form but growing to perfection and immortality. Good and evil are not attributes of the cosmos, but pertain only to the human mind. Man thinks and thinks constantly. His thoughts are good or bad, beneficial or harmful. When translated into speech or action, they yield a result that is either good or bad. The two represent a duality that only holds in the human mind and in human society. The dualism in the *Gâthâs* is pure ethical in nature. The criterion for "better" or "more progressive" thoughts, words, and deeds is the beneficial effect on human society in particular and on the world in general. If they lack such beneficial effect, they are "bad" or "retarding". The human world is divided into two camps: the righteous, truthful, and progressive ("*asha*") and the wrongful, retarding and destructive ("*druj*"). The Gathas advocate a free, peaceful, prudent, and progressive society, both in spirit and matter. Spirituality makes people realize the divine in creation, and envision the force and order – the wisdom – behind it. It makes them conceive

God. It promotes them to commune with God, and be godlike. Materiality makes people understand their social environment and the living world. It teaches them the philosophy of living and letting others live, and of living in harmony with nature. Only responsible men and women make up the Gathic society. Careless and parasitic people have no place in it. Every person, whether wise, naive, strong, or weak, has his or her own responsibilities in society (Jafarey, 2004). There is a strong emphasis on the social and environmental factors in the Zoroastrian approach to happiness. Concern about other people's self-actualization, and even the protection of the environment, is intrinsically connected with the individual's rational pursuit of happiness. Happiness, according to Zoroastrianism, is not considered a merely inner state of mind, something that can be achieved through contemplation or ecstasy. It is actualized through the struggle of human beings against dishonesty, destructiveness, necrophilia, etc (Sakhai, 2004).

Water and earth/soil in Zoroastrianism

In Zoroastrianism the four classical elements (fire, water, air and earth/soil) are sacred. Water as the second element after fire is more important than the others. In Zoroastrian cosmogony, the waters (*Aban*[24]) are the second of the seven creation of the material universe, after that of the sky. There is a guardian for every element. The guardian of the earth is Sepandar Maz who as Lady Goddess brings fertility. Aredvi Sura Anahita (*Arədvī Sūrā Anāhitā*) (Fig 3.5) is venerated as the divinity of the waters and hence also associated with fertility, healing and wisdom (Pour Davoud, 1998).

The earthly waters are held to originate from the world river. The cosmological qualities of the world river are alluded to in *Yasht* 5 known as the *Aban Yasht*, a hymn to the waters in Avestean and one of the longer and better preserved of the devotional hymns. Aredvi Sura Anahita is not only a divinity, but also the source of the world river that encircles the earth and the (name of the) world river itself. All the waters of the world created by Ahura Mazda originate from the source Aredvi Sura Anahita, the life-increasing, herd-increasing, fold-increasing, who brings prosperity to all countries The association between water and wisdom that is common to many ancient cultures is also evident in the Aban *Yasht*, for here Aredvi Sura is the divinity to whom priests and pupils should pray for insight and knowledge.

[24]Apas (*āpas*) is the Avestean language term for "the waters", which—in its innumerable aggregate states—is represented by the Apas, the hypostases of the waters. Avestan *apas* (from singular *āpō*) is grammatically feminine, and the Apas are female. The Middel Persian equivalents are *ābān*/Ābān (alt: *āvān*/Āvān). In *Yasna* 38, which is dedicated "to the earth and the sacred waters", *apas*/Apas is not only necessary for nourishment, but is considered the source of life ("you that bear forth", "mothers of our life"). In a development of a cosmogonical view, *aban* is the essence of a "great gathering place of the waters" upon which the world ultimately rested. The great sea was fed by a mighty river (*Ardvisur*). Two rivers, one to the east and one to the west, flowed out of it and encircled the earth where they were then cleansed by *Puitika* (Avestan, middle Persian: *Putik*), the tidal sea, before flowing back into the *Vourukasha*.

Fig 3.5. In this picture Ahura Mazda in the middle is giving the kingship ring to King Khosrow Parviz. The woman is Anahita, one of the Persian divinities (Taq-e-Bostan, Kermanshah province)[25]

Here is just one example of the strong emphasis on the protection of water and soil. In the Vendidad, one of the chapters of the Avesta, Zoroaster asks Ahura Mazda (God): What are the places where the earth feels most happy? This is part of Ahura Mazda's answer:

> **"**O Maker of the material world, thou Holy one! Which is the third place where the Earth feels most happy? Ahura Mazda answered: 'It is the place where one of the faithful sows most corn, grass, and fruit, O Spitama Zarathushtra! Where he waters ground that is dry, or drains ground that is too wet.**"**
> "O Maker of the material world, thou Holy one! Which is the fourth place where the Earth feels most happy? Ahura Mazda answered: 'It is the place where there is most increase of flocks and herds."
> "O Maker of the material world, thou Holy one! Which is the fifth place where the Earth feels most happy? Ahura Mazda answered: 'It is the place where flocks and herds yield most dung." **(**Avesta, 2006)

The prominent position of nature encompassing land and water in Zoroastrianism is also reflected in the many important Zoroastrian annual festivals celebrating nature; new year on the first day of spring, the water festival in summer, the autumn festival at the end of the season, and the mid-winter fire festival. In the Zoroastrian calendar, the tenth day of the month is dedicated to the divinity of the waters, who also grants protection to that day. Furthermore, in the Zoroastrian calendar, *Aban* is the name of the eighth month of the year; it is also the name of that month in the Iranian calendar of 1925, which follows Zoroastrian month-naming conventions. The Zoroastrian name-day feast of *Abanagan*, also known as the *Aban Ardvisur Jashan* by Indian Zoroastrians, is celebrated on the day that the day-of-month

[25] Encyclopedia Mythica, http://www.pantheon.org/areas/gallery/mythology/middle_east/persian/anahita.html, (last accessed 2 June 2009)

and month-of-year dedications intersect, that is, on the tenth day of the eighth month. The celebration is accompanied by a practice of offering sweets and flowers to a river or the sea.

It is also important to remark that there is a strong connection between water and the establishment of Iranian villages. Such villages are generally called *Abadi*. The word *Abad* used as a suffix after the name of the village (as in *Ibrahim Abad*) shows respect to water.

We can conclude that in arid and semi-arid regions this belief system with regard to water and soil most likely motivated people and supported them to deal with the problem of how to manage water scarcity from ancient times on. The importance of this vision on water is stressed in Darius' (549 BC - 486/485 BC) famous prayer – 'God protect this country from foe, drought and falsehood'.

3.3.2. Islamic doctrine

Islam and ancient Iranian culture

Zoroastrian views on the importance of water, nature and the place of humankind within the cosmos have greatly influenced later Islamic thought. From the early era on, Islamic thinkers accepted the ideas of eastern and ancient Iranian philosophers (*fahlavion*) which are commonly referred to as *hekmat-e khosravani* (Muhaqqiq Damad, 2004).

According to Islam, Allah is the Creator, Sustainer, and Owner of all creation. Islam continued to provide the cultural, ethical and religious underpinning of the buneh and Qanat system. Islam stresses the role of humankind as the trustee on Planet Earth and considers each man and woman, as such, accountable to Allah for his or her actions on the earth and towards its creatures. Every created thing has inherent values, an ecological value, and a utilization value for humankind, both as spiritual sustenance and material resource. Humankind's rights over nature are rights of sustainable use - of usufruct - based on moderation, balance, and conservation; future generations have a similar and equal right. Nature's rights (*haq*) over humankind include the rights to protection from misuse, degradation and destruction. Greed, affluence, extravagance, and waste are considered a tyranny against nature and a transgression of those rights.

The Zoroastrian influence can be documented in the Illuminationist philosophy (*Eshraq philosophy*) of Shahab al-Din Suhrawardi (1155-1191), who attempted a synthesis of Zoroastrian, Platonic and Islamic ideas. The fundamental constituent of Suhrawardi's

philosophy[26] is pure immaterial light, of which nothing is more manifest, and which unfolds from the Light of Lights in emanations through the descending order of the light of ever diminishing intensity; through complex interaction, then in turn give rise to horizontal arrays of lights, similar in concept to Platonic Forms, which govern the species of mundane reality. Suhrawardi also elaborated the idea of an independent intermediary world, the imaginal world (*alam-e-mithal*). His views have exerted a powerful influence down to this day, particularly through Mulla Sadra's (1571-1640) adoption of his concept of intensity and gradation to existence (*tashkīk al-wujūd*), wherein he combined peripatetic (*Mashae*) and illuminationist description of reality which is called Transcendent Theosophy (*al-hikmaht al-muta'liyah)*. The analogical gradation of existence (*tashkīk al-wujūd*) is a pivotal idea around which his entire philosophy revolves and which grounds the key-notion of the 'unity of being' (*wahdat-al-wujūd)* (Ešots, 2007). From his cosmological point of view, the world of nature is part of this gradation of existence.

For Muslims an important qualification is found in the divine revelation of the Qur'an, where one reads, "In whose hand is the dominion of all things" (22:38). From this it is sometimes inferred that the natural order "is not an independent domain of reality, which is Divine". Ibn 'Arabi (1165-1240), who influenced Mulla Sadra, writes that "[t]here is no property in the cosmos without a divine support and lordly attribute". He found support for his concept of *wahdat al-wujūd*, or "unity of being," in the Qur'anic verse (2:115), which states that "Whithersoever you turn, there is the Face of God" (Foltz, 2003).

Moreover, we also have the level of pure knowledge and understanding. This level is that of the contemplative, the gnostic (*'arif*), the level that has been recognized throughout Islamic history as the highest and most comprehensive. The gnostic is *Muslim* in that his whole being is surrendered to God; he has no separate individual existence of his own. He is like the birds and the flowers in his yielding to the Creator; like them, like all the other elements of the cosmos, he reflects the Divine Intellect to his own degree. But while the birds and the flowers reflect it passively, he reflects it actively; his participation is a conscious one. Thus

[26] According to his teaching, God (or, more correctly, the creative principle of the cosmos) is "the Light of Lights" (*nūr al-anwār*), inaccessible and infinite in its intensity, while the cosmos consists of the hierarchy of lights, which are either pure (*mahd*) and disengaged (*mujarrad*) or accidental (*'ārid*) (by the latter Suhrawardī means the physical lights which, to him, are shapes or forms of something else (i.e., higher spiritual lights), while pure spiritual lights are lights in themselves). There is horizontal (or: latitudinal) (*'ardī*) and vertical (or: longitudinal) (*tūlī*) organization present in the hierarchy of lights. The first one deals with the lords of (different) species (*arbāb al-anwā'*), i.e., their angels or luminous archetypes. These archetypes or angels do not relate to each other as cause and effect, which is the case with the parts of the vertical order. Different levels of the vertical order, from the Light of Lights to the weakest possible light, share the reality of light (*haqīqat al-nūr*), but differ from each other by the degree of intensity which this shared reality possesses in every particular case. This difference, allegedly present in the single reality of light, is called "the analogical gradation of light" (*tashkīk al-nūr*). Four centuries later, in the relevant chapter of his *Asfār* ("Journeys"), Mullā Sadrā repeated Suhrawardī's arguments in favour of the analogical gradation of the essence in terms of intensity and weakness almost verbatim, only changing *nūr* ('light') to *wujūd* ('existence/ finding') (Ešots, 2007).

"knowledge" and "science" are defined as basically different from mere curiosity and even from analytical speculation. The gnostic is from this point of view "one with Nature"; he understands it "from the inside," he has become in fact the channel of grace for the universe. His Islam and the Islam of Nature are now counterparts (Nasr, 1968).

Qur'anic perspective on nature and the position of human being as khalif (steward) and abd-Allah (servant of God) in relation to Allah and the rest of the creation

The Qur'anic perspective on nature can be best understood from the first revelations to the prophet Mohammad, which he received in the cave Hira on Mount Jabal al Nur. The first verse was a command from God, "Read! (or Recite!)", to which Mohammad immediately responded, "I do not know how". And the angel Gabriel, the bearer of revelation, insisted, "Read!". Then Gabriel iterated the command a third time, saying, "Read! In the name of your Lord and Sustainer who created …" (Qur'an 96:1)

The point is that Mohammad was not literate, and there was not yet a text in any form to be read. So, what was the meaning of this first holy command, "Read!"? The answer suggested by Özdemir (2003) is that "reading" here means a completely new way of looking at the world. The key notion is that this reading should be in the name of our Sustainer. So at the very beginning it is taught that God, as Sustainer and Creator, gives existence and meaning to everything else. A careful examination of the early verses of the Qur'an reveals an invitation to examine and investigate the heavens and the earth, and everything that can be seen in the environment: all natural phenomena. Accordingly, the universe and everything in it has been created by God and is considered a sign (*āyāt)* of God:

> "But to Allah belong all things in the heavens and on earth: And He it is that encompassed all things" (Qur'an 4: 126).[27]
> "Soon will We show them our Signs in the (furthest) regions (of the earth), and in their own souls, until it becomes manifest to them that this is the Truth. Is it not enough that thy Lord doth witness all things?" (Qur'an 41: 53).

Moreover, nature has been created in order and balance *(mīzān)*, and with extraordinary aesthetic beauty, and all these aspects of nature, while enhancing humankind's life should be honoured, developed and protected accordingly.

> "The sun and the moon follow courses (exactly) computed;
> And the herbs and the trees - both (alike) bow in adoration.

[27] The English translation of the Qur'anic verses has been chosen from the site http://www.searchtruth.com/list.php ,(last accessed 2 June 2009)

> And the Firmament has He raised high, and He has set up the Balance (of Justice),
> In order that you may not transgress (due) balance
> So establish weight with justice and fall not short in the balance" (Qur'an 55:5-9)

In addition, man is God's *Khalif* on earth, which according to the Qur'an includes his role as *Abd-Allah* (servant of God). Of the nine times the word *khalifa* and its plural are found in the Qur'an, it is used seven times in conjunction with the prefix *fil'-al-ardh* – on earth, on this planet. In each case it refers to a person, people, or mankind in general, to whom Allah has entrusted part of His power on earth. The term has been variously translated into English as a successor, deputy, viceroy, and trustee. Lubis (1998) added another translation, that of the role of stewardship. In that, we humans are more than "Friends of the Earth" – we are its guardians. Although we are equal partners with everything else in the natural world, we have added responsibilities. What we are not is its lord and master. In brief, human beings, although at the top of creation, are only members of the community of nature. Humankind is just considered a trustee for the planet: humans are entitled to live on the earth, to improve and benefit from it but they are not entitled to pollute or destroy the environment. In other words, the *Qur'anic* view holds that everything on the earth was created for humankind as God's bounty (*ni'amah*) to be exercised with care as a trusteeship (*amana*). Any behaviour that can jeopardize the future of the natural resources is seen as an act against God and His creation (Abdel Haleem, 1989). Human beings have responsibilities towards the whole environment, just as they have responsibilities towards their families:

> "I will create a vicegerent on earth." (Qur'an 2:30).
> "It is He Who hath produced you from the earth and settled you therein to build it" (Qur'an 11:61).
> "There is not an animal (that lives) on the earth, nor a being that flies on its wings, but (forms part of) communities like you. Nothing have we omitted from the Book, and they (all) shall be gathered to their Lord in the end" (Qur'an 6:38).

In Sunna also the role of human beings is defined by Prophet Mohammad and *Ali ibn Abi-Talib:*

> Created beings are the dependents of God, and the creature dearest unto God is he who does most good to God's dependents. – *The Prophet Muhammad*
> Partake of it gladly, so long as you are a benefactor, not a despoiler; a cultivator, not a destroyer. – *Ali ibn Abi-Talib, the fourth Caliph* (Brown, 2006).

All patterns of human production and consumption should be based on an overall order and balance of nature. Finally, the rights of humankind are not absolute and unlimited: we cannot simply consume and pollute nature as we wish, carelessly (Özdemir, 2003).

Qur'an and *Hadīth* describe the spiritual journey of the *'abd'* as one of increasing perception of *nūr-un 'ala-nūr*, or the "light" of Allah. The development of the faculty to perceive this light is a function of the spiritual development of *'abd'*. The development of this faculty in turn allows an individual to begin the perception of true interrelationships between himself, the Divine, and all creation. With this perception, the *'abd'* recognizes the depth of his commitment to the communities of creation around him – all living and inanimate creations are perceived as part of a unified whole. The balance of life, death and survival of all species enters into the consciousness of the *'abd'*. The spiritual journey of the *'abd* is a continuous and unending process of spiritual development and corresponds to an increasing level of awareness. Accordingly, most can perceive at least some degree of the interrelationship between humankind, the Divine, and creation. Such awareness can come in the form of beauty perceived in natural surroundings, a kinship felt for other living species, or perhaps even a simple awareness of the community of humankind taking precedence over the individual.

The doctrine of unity (*tawhid*), stewardship (*khalif*) and trust (*amana*) situates us in the area of a moral relationship with the rest of the creation which demands both self-restraint as a control over greed and an awareness of the needs of others, which in its best manifestation is generosity. Moreover, the unity of all reality (*tawhīd)* and the balance of nature *(mīzān)* constitute an important basis for religious ecology and ethics (Amin, 2003).

Water and earth/soil in Islam

Islamic reflections on the metaphor of the garden and on images of water provide a fertile resource to think about human relationships with the natural world. The earth (land) is mentioned some 453 times in the Qur'an, whereas the sky and heavens are mentioned only about 320 times. Islam does understand the earth to be subservient to humankind but it should not be administered and exploited irresponsibly. There is a strong sense of the goodness and purity of the earth. Clean dust may be used for ablutions before prayer if clean water is not available. The prophet Mohammad said that "the earth has been created for me as a mosque and as a means of purification" (Denny, 1998).

Water is a pivotal issue in Islam, not surprisingly since it is a religion that originated in a desert area and spread mainly to other arid or semi-arid territories. It is evident from numerous verses in the Qur'an that water is a major theme in Islamic cosmogony and iconography as well as a recurrent topic in liturgy and daily life (Gilli 2004). One of the most famous verses pertaining to water is taken from the Sura of the Prophets and it states, "*We made from water every living thing*" (21:30). But this is not the only *Ayah* (verse) where the word *Ma'* (water) appears since it occurs more than sixty times in the Qur'an. "*And His [i.e. God's] Throne has been resting on water*". Paradise is described as "*Gardens beneath which*

rivers flow" [47: 12]. Water is a source of life: "*And Allah has sent down the water from the sky and therewith gives life to the earth after its death*" [16:65]. Water is a source for purification and its quality has a special importance in Islam since before performing any prayer ablution is necessary and after each sexual contact bathing is required. So water has a psychological dimension in Muslim's daily life. Several other words related to the semantics of water and hydrology, such as rivers, sea, fountains, springs, rain, hail, clouds and winds, are also frequent (Abdel Haleem, 1989).[28]

In Islam, all water is sacred and sent as a gift from Allah. Equitable right to water is entrenched in Islamic faith. In addition, water is so vital that it is considered a common property as narrated by Abo Dawood, tradition number 3470: "*Muslims have a common share in three [things]: grass (pasture), water and fire (fuel)*" (Hashemi *et al*., 2007). Water should be freely available to all and any Muslim who withholds unneeded water sins against Allah. Mohammad attached great importance to the moderate use of water and forbade its excessive use even when performing ablutions, saying that to do so was 'detestable' (*makrūh*). He even prevented people from using too much water for ablutions when preparing to enter the Divine Presence for prayer.

Islamic divine law or Shari'ah: objective and structure

The Qur'anic and Sunna view of nature including land and water forms the basis of the *Shari'ah* out of which Islamic law (*Figh*) evolved. The word '*Shari`ah*' itself is closely related to water. Originally it meant 'the place from which one descends to water' and designates not only the true guiding path for its society, but also the pure source of drinking water that must be preserved on an irrigation system (Wilkinson, 1990). Before the advent of Islam in Arabia, the *Shari`ah* was, in fact, a series of rules about water use. The term later evolved to include the body of laws and rules given by Allah which influenced land rights, tenure systems and water rights in Muslim societies. An appreciation of the distinctive features and sources of Islamic law, its methodologies and diversity in application and its dispute resolution would contribute towards strategies aimed at enhancing land and water policy (Siraj and Lim, 2005).

Among Muslim scholars of jurisprudence there are three approaches to the Shari'ah. The first says that Allah revealed such a legislative system or Shari'ah in order to achieve justice. Other jurists say it is for the purpose of achieving happiness. And still others, especially al-Ghazali (1058-1111), say it is only for the achievement and the realization of the very benefits

[28] Other teachings linked to the protection of natural resources and their availability to all can be found in the *Sunnah* (statements or practices undertaken or approved by the Prophet considered as legally binding precedents).

of man on earth. A closer look at these three approaches to the Shari'ah shows, as Al-Allaf (2003) points out, that they complement each other: the happiness of mankind cannot be achieved at large without justice, and justice is one of the essential benefits and interests of people on earth.

Maslaha in Arabic language, which literally translates as benefit or interest, is defined by Imam al-Ghazali as that which secures a benefit or prevents harm. However, benefits mentioned in the Islamic Divine Law are of three kinds: *accredited benefits* (*Masalih Mu'tabarah*), which are regulated by The Lawgiver in the sense that a textual authority from the divine law could be found to prove their validity. *Nullified benefits* (*Masalih Mulghat*): there are also other kinds of benefits and interests that the Shari'ah rejects because they lead to harm and hardship (*Mafsadah*), such as stealing or usury. *Unregulated benefits* (*Masalih Mursalah*), since the benefits of people can be as numerous as their public interests, we find that the divine law did not regulate a number of these benefits. So it provides no indication as to their validity. In the principles of jurisprudence these kinds of benefits are called the *unregulated benefits*, and it is left for legal scholars or jurists to work on them (Hashemi, 2002, Al-Allaf, 2003).

Benefits (*Masalih*) should be harmonious and consistent with the objective (*Maqasid*) of the Shari'ah, since the basic purpose of legislation (*tashri'*) is to protect the interest of the people against harm. In regard to their importance and priority, benefits are divided by Muslim scholars intro three kinds: the essentials (*Da.ru.riy.yat*), the complementary (*Ha.jiy.yat*), and the embellishments (*Tah.seen.niy.yat*). Together with the Shari'ah, these benefits make up a model which consists of four circles (Fig 3.6), three of them orbiting around the central one which represents the Islamic creed and the main source of legislation. "The circles are not only concentric, but all of them beyond the center may also be regarded as orbiting the center – the core. They orbit in the manner of a solar system. Moreover, if we consider the radiuses as representing the pull or force of gravity toward the center, then the pull of gravity will be inversely proportional to the length of the radius; the shorter the radius the greater the pull of gravity and the longer the radius the less the pull." (Al-Allaf, 2003: 84)

The circle of the Shari'ah in the center which represents the Islamic belief especially the Creed ('*Aqidah*) is "the source of legislation and practicality of preserving existence. Human beings should use their maximum rationalization to understand the wisdom and the benefits of such Divine legislation" (Al-Allaf, 2003: 86). The second circle which represents the essentials (*Da.ru.riy.yat*) includes five basic and universal necessities or priorities (*religion, life, intellect, procreation* and *property*) "on which the lives of people depend, and whose neglect leads to total disruption and chaos." (Quoted by Al-Allaf, 2003:86 from Kamali, 1991:271) Accordingly, every society should preserve and protect these five necessities which are derived from the Shari'ah as necessary and basic for human existence; otherwise human

life would be harsh, brutal, poor, and miserable here and in the hereafter. For instance, with regard to property, "which is very beneficial and necessary to the human life, divine law facilitates all lawful means for its acquisition, and secures it by defending the right of ownership through penalizing theft." (Al-Allaf, 2003: 88)

The complementary benefits (*Ha.jiy.yat*) represented by the third circle include the things that "people need in order to remove restrictions and difficulties in applying the five necessities." (Al-Allaf, 2003: 90). In The Qur'an:

> "Allah does not want to place you in a difficulty, but He wants to purify you, and to complete His favor to you, that you may be grateful." (Qur'an, 5:6)
> "Allah intends for you ease, and He does not want to make things difficult for you." (Qur'an, 2:185)

Finally, the embellishments (*Tah.seen.niy.yat*) of the fourth circle "are intended to render human affairs or conditions more suited to the requirements of the highest standards of moral conduct. They denote interests whose realization leads to improvement and the attainment of that which is desirable. Thus, the observance of cleanliness in personal appearance and in spirituality, the cultivation of moral virtues, the avoidance of wastefulness in consumption, and moderation in the enforcement of penalties, fall within the scope of embellishments." (Al-Allaf, 2003: 91)

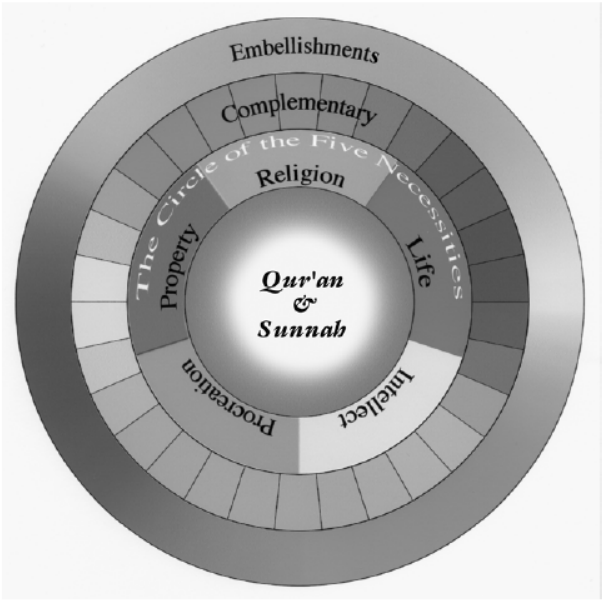

Fig 3.6.The Maqasid Model (Al-Allaf, 2003:85)

From thinking about these benefits "a systematic set of legal rules and principles [has been] deduced, such as: Harm is removed, public harm or loss is averted by the private assumption of loss, the greater of two harms is averted by assumption of the lesser, averting harm is to be

preferred over procuring benefits, cases of necessity make permissible what is normally forbidden or restricted, necessity is determined by the particular circumstances, hardship secures lenience, it is not permissible to do what will harm one's self." (Al-Allaf, 2003:92)

Accordang to this system, first, the elements that compose the natural world are common property. Second, the right to benefit from natural resources is a right held in common. Finally, no damage shall be inflicted on future users (Khalid, 2007). As an extension of this foundational code Muslim legalists have over the centuries established the following principles. A person invalidates his rights over a particular natural resource if by exercising it he causes detriment to another, or if he causes detriment to another without corresponding benefit to the other, or if he causes general detriment to society. Moreover, every member of society is entitled to benefit from a common resource to the extent of his need so long as he does not violate, infringe or obstruct the equal rights of other members of society. Moreover, accountability rests with the user. In addition, in return for benefits derived from a renewable resource the user is obliged to maintain its value. Finally, if the user causes destruction, impairment or degradation he is held liable to the extent of putting right the damage caused.

The Islamic state consists of several institutions that have the mandate to protect land and water such as *hima* (special reserves, setting aside land for common good)[29], *al-harim* (inviolable zones)[30] and *awqaf* (charitable endowments)[31]. The head of these institutions, the *hisba*, mostly a jurist, acts as an environmental inspector.

The development and application of these principles and institutions have seen a decline over the past two centuries as the modern world view based on the exploitation of natural resources for profit gradually overtook this model (Khalid, 2007).

Framework of Islamic land and water rights

Rights to land and water are part of a broader set of property rights. Land and water belong to the five essential values of Islamic law (*Shari`ah)* and must be protected as a matter of priority. The Islamic property rights framework considers land and water as a sacred trust but promotes individual ownership with a re-distributive ethos.

[29] Special reserves (*hima*) may be established by a community or the state for use as conservation zones
[30] The state may establish inviolable zones (*al-harim*) where use is prohibited or restricted. People have a right in the Shari'ah to create such zones managed by themselves and where use is severely restricted. Additionally, it is permitted to establish these zones adjacent to sources of water (i.e. around Qanat) and other utilities like roads and places of public resort
[31] Charitable endowments (*awqaf*) may be established with specific conservation objectives

> "The concept of dual ownership [human being-God] is one of the special features of the Islamic doctrine of economics. Islam protects and endorses the personal right to own what one may freely gain, through legitimate means….It is a sacred right. Yet, human ownership is tempered by the understanding that everything, in the last analysis, belongs to God…What appears to be ownership is in fact a matter of trusteeship, whereby we have temporary authority to handle and benefit from property." (Abdul-Rauf 1984:19 quoted by Siraj and Lim, 2005:8)

The *Shari`ah* goes into great detail about the subject of water to ensure its fair and equitable distribution within the community. There are two fundamental precepts that guide the rights to water in the *Shari`ah*: *shafa*, the right of thirst, which establishes the universal right for humans to satisfy their thirst and that of their animals; and *shirb*, the right of irrigation, which gives all users the right to water their crops.

Property relationships in Islam are considered to be social relations, "which under Islamic law are called *mu'amalat* (as distinct from *ibadat*, matters relating to worship). Islam potentially impacts on all stages of the property cycle from acquisition, to management and to transmission." (Siraj and Lim, 2005:9)

Land and water are referred to in the *Qur'an* several times. They are seen as the objects of property rights that need to be respected. This is also emphasised by Prophet Mohammad in his last sermon according to which 'Nothing shall be legitimate to a Muslim which belongs to a fellow Muslim unless it was given freely and willingly'. Property and housing fall within the private domain in Islam and are therefore fully protected. Private property rights are well established but constructed as a sacred trust based on the doctrine of unity (*tawhid*), stewardship (*khalifa*) and trust (*amana*). Accordingly, "property and land are vested in God, but are temporally enjoyed by men and women through responsibility or trust. However, for the most part it is not seriously contested that the rights to own (*raqaba* or full ownership), enjoy or alienate land exist in Islam. Nevertheless, their legitimacy is derived from compliance with Islamic principles." (Siraj and Lim, 2005:10)

3.4. Concluding remarks

In this chapter we have argued that the technical, social and ethical aspects of the traditional, premodern system of land and water management were highly interconnected. The *Qanat* underground irrigation system was dependent on the social institution of the *Buneh* to operate properly, while Zoroastrianism and Islam can be considered as a cultural and ethico-religious framework for this socio-technological arrangement. The traditional land and water paradigm and its strong interconnection of 'technology, governance, and people' assumed that there was

an intimate relationship between humans and nature. The premodern dominant way of land and water management was community based. The stewardship model incorporating a caretaker (steward), the object of care, and the owner of the object, was the foundation of the ethico-religious system.

As a dominant religion in Iran and the MENA region, the Islamic contribution to this model can be summarized as follows: Starting with the general principle that Allah is the Creator, Sustainer, and Owner of all creation, humankind is considered to be the trustee of the Earth. Every created thing has inherent values, an ecological value, and a utilization value for humankind, both as spiritual sustenance and material resource. Humankind's rights over nature are rights of sustainable use - of usufruct - based on moderation, balance, and conservation; future generations have a similar and equal right. Islamic land and water law includes Nature's rights (*haq*) over humankind, to wit, the rights to be protected from misuse, degradation and destruction.

The cultural and ethico-religious framework motivated people to use water and soil, and provided the legal and governance structure to handle these scarce resources and their concomitant technologies. Drawbacks were the social inequality and lack of individual freedom that the community structure entailed and the emphasis on existing technologies instead of innovations. Recognition of these disadvantages helped to pave the way towards the modern paradigm.

Chapter 4
The impact of modern land and water management in Iran

In the previous chapter, the perspectives and problems of traditional land and water management were outlined. In this chapter we will discuss the shift from tradition to modernity. Since the 17th Century, the idea of modernity gradually took hold of Western societies. At the end of the 19th Century and the beginning of the 20th Century this idea was introduced as a model of development to traditional societies such as Iran. To gain a better understanding of the successes and failures of current land and water management, it is important, firstly, to have a closer look at the idea of modernity in general (4.1), and, secondly, to examine the course of the modernization process in the specific context of Iran (4.2), especially with respect to the technological systems, the social institutions and the ethical frameworks that determine land and water management (4.3).

4.1. Modernity as idea and developmental model

"Nature has set no limit to the realization of our hopes"
Condorcet (1795)

Modernity is a shorthand term for modern society or industrial civilization. It is associated with a certain set of attitudes towards the world, the idea of the world as open to transformation by human intervention; a complex of economic institutions, especially industrial production and a market economy; a certain range of political institutions, including the nation-state and mass democracy. The Scientific Revolution of the 17th century gave way to a secular view of the universe and acted as midwife of modernity. The philosophical framework of modern secular science can be identified by six dominant traits (Kalin, 2001).

- The first trait is the secular view of the universe that sees no traces of the Divine in the natural order and denies any *telos* or purpose at work in the universe. Consequently, the teleological view of the universe, shared by most traditional civilizations, is rejected by modern science.

- The second feature of modernity concerns the 'mechanization of the world-picture' (Dijksterhuis, 1961) upon the model of machines and clocks as the favorite images of the deists of the 18th and 19th Century. In order to lend itself to the precise methods of analysis and measurement of modern physical sciences, the universe had to be constructed as a machine.

- The third feature of modernity concerns rationalism and empiricism as the only reliable methods of arriving at truth. While modern rationalism constructs a world-picture within the limits of reason alone, empiricism reduces reality to sense experience.

- The fourth trait of modernity is the legacy of the Cartesian dualism that presupposes a complete separation between *res cogitans* and *res extensa*, viz., between the subject and object of knowledge. According to critics of modernity, the Cartesian dualism is responsible for the alienation of man from nature and the destruction of the natural environment.

- The fifth characteristic of modernity is the 'Promethean view of man', which understands man as the measure of all things, and which contrasts with the 'Pontifical man', i.e., man as a bridge between heaven and earth.

- The last trait of modern secular science is the exploitation of nature as a source of power and domination, which was the driving force behind the Industrial Revolution and the rise of capitalism.

Modernity is closely connected to the so-called Enlightenment Project which is defined by Adorno and Horkheimer as 'the progressive liberation of the human self from a series of impositions and restrictions, which come under the headings of "myth" and "nature"' (Cahoone, 1988: 182). The Enlightenment Project promised control over nature through science, material abundance through superior technology and effective government through rational social organization. In other words, 'the Enlightenment Project with its zealous belief in reason and science and the ideal of liberating humanity from the determination of all natural forces, transformed nature into something that needs to be conquered as a potentially serious constraint to human development. In this scenario water resources form part of the (perceived as) unlimited natural input, which is essential for the realization of the Project of Modernity' (Brouma, 2003: 8).

Especially in the water sector, the Enlightenment Project gained firm ground, together with notions of engineering capacity and of science and investment initiatives of the state and the private sector. Industrial modernity became manifest as the 'Hydraulic mission' in the mid-twentieth Century (Allan, 2006). This mission, involving hydraulic mega-projects like gigantic dams and large-scale irrigation systems, seized both liberal western economies, especially the United States federal government (Worster, 1992; Reisner, 1986), as well as the centrally planned economies of the Soviet Union.

At the end of the 19th Century the process of modernization turned into the main developmental model for the less developed parts of the globe. This model is defined in

Eurocentric terms with the direction of change more or less predetermined. 'The main assumption of modernization is that its subject societies have no history, culture or developed set of social or environmental relations, which puts forward a profoundly racist view of the world' (Brouma, 2003: 7). The 'Hydraulic mission', for instance, was introduced in the second half of the twentieth century to the developing countries of the South, especially to India but also to Egypt and other countries of the MENA region, including Iran. In Iran too, it was assumed that arid regions could be industrialized by making the necessary water resources available through building large dams, pumping up groundwater and bringing in water from remote sources in order to 'make the desert bloom' (Foltz, 2002).

4.2. Iran's march to modernity

Around the middle of the 19th Century, modernity took off in Iran with a variety of activities in the sphere of scientific learning. In 1851, the first modern institution of higher learning, the Foundation of Skills House (*Dar al-Funun*), was established. In this polytechnic college that eventually would become the University of Tehran upper-class Persian youth was being trained in medicine, engineering, military science and geology. In the 1920s, a system of public education was established to break away from the traditional system of cleric-controlled *maktabs*. Furthermore, 100 top secondary school students were sent abroad annually to acquire a university education.

With the Constitutional Revolution (*Engelabe mashroteh*), that took place between 1905 and 1911, Iran also embarked on the path to modernity in the sphere of political institutions. In December 31, 1906 Mozzafar-al-DinShah from the Qajar Dynasty that had ruled Persia since 1781 signed the constitution, which was based on the 1830 Belgian constitution. The constitution curbed the power of the Shah by granting extensive powers of representation to the parliament (*Majlis*).

The *Majlis* was given extraordinary rights that were in direct violation of traditional social hierarchies. The parliament, for example, could propose any measures which it regarded as 'conducive to the well-being of the government and the people' (Article 15). All the laws of the nation had to be approved by the *Majlis* (Article 16). No part of the nation's resources could be sold without *Majlis* authorization (Article 22). No foreign treaties could be enacted or foreign debts acquired, without similar authorization (Article 24). And so on.

The system of constitutional monarchy that was established in Persia as a result of the Revolution ultimately came to an end in 1925 with the dissolution of the Qajar dynasty and the ascension of Reza Shah Pahlavi to the throne. Reza Shah launched an ambitious program of economic modernization and cultural westernization, inspired by Mostafa Kemal Atatürk's modernization projects in neighboring Turkey. He aimed for a society with secular

educational institutions comparable to those in Europe, a strong centralized government, and a modern economy with industries, banks, roads, railways, automobiles, and telephones. But the implementation of his modernization projects went hand in hand with oppression and corruption. Reza Shah censored the press and curtailed the power of the *Majlis*, reducing it to a rubber stamp organization. He established an authoritarian government and brutally crushed the opposition, secular or religious. 'Westernism and repression presented two sides of the same coin in Reza Shah's state-building efforts' (Sedgi, 2007: 64).

During World War II, Britain and the USSR were concerned by Reza Shah's friendly relations with Germany. In 1941 the two countries invaded and occupied large areas of Iran. They forced Reza Shah to abdicate, and in the absence of a viable alternative, permitted his son Mohammad Reza to assume the throne. He would reign Iran until his overthrow by the Iranian Revolution of 1979. Technically still a constitutional monarchy, the regime of the new Shah was highly authoritarian – he ruled with virtually absolute powers. His program called for the further modernization of Iranian society along Western lines.

The regime of the new Shah was supported by The United States of America, which emerged as the most powerful nation in the western world since WWII, and which used its new strength to promote democracy and capitalism and combat the growing strength of the USSR and the Communist bloc. On January 20, 1949, United States president Harry S. Truman delivered his inaugural address, also known as the Four Point Speech because it sketched 'a program for peace and freedom' based on four major courses of action. The United States were ready, first, to continue to give unfaltering support to the United Nations and related agencies, second, to continue its programs for world economic recovery, third, to strengthen freedom-loving nations against the dangers of aggression, and fourth, to embark on a bold new program for making the benefits of its scientific advances and industrial progress available for the improvement and growth of underdeveloped areas.

Iran, with its shared 1,200 mile boundary with the Soviet Union, its valuable oil resources and a government that favored westernization, became the first beneficiary of this policy. In 1950, both countries signed an agreement on technological assistance and the U.S.A. started sending technicians to Iran. Part of this 'Point Four' agreement was supervised by Utah University that had already since 1912 sent technicians to Iran to teach and train students in agricultural methods. After the agreement, the number of Utah technicians involved in the 'technical collaboration work in Iran' increased significantly (Embry, 2003).

In 1963, in response to pressure for reform from the Kennedy administration, the Shah launched a series of reform policies that he called the 'White Revolution'. A crucial aspect of the Shah's White Revolution was a land reform program that eventually would redistribute about one-half of private agricultural land to peasants holding traditional sharecropping rights.

About half a million peasants obtained land, but about 73 percent got less than six hectares, an amount sufficient only for subsistence farming. Moreover, one-half of all rural families acquired no land at all, and, having lost their employment, had to migrate to the cities.

The major thrust of the land reform program was the creation of large-scale, state-sponsored farm corporations and private agribusiness. Farm corporations required peasants to pool their lands and take shares in the larger enterprise, often with the result that farms were mechanized and cultivators driven from the land. Private agribusiness also favored capital-intensive mechanized farming and forced peasants from the land. In accordance with the promotion of capital-intensive agriculture, nomads were forced to settle, and pastoral livestock herding was replaced with mechanized meat and dairy farms. 'The result was falling per capita production and large-scale movement of rural people to the big cities, especially Tehran.' (Lapidus, 2002: 481)

An extremely important milestone in Iran's water resource development was reached with the enactment of Nationalization of water resources on 29 July 1968. This Act stated that all water within the country was considered natural wealth and belongs to the nation. As a result the future development of water resources is to be supervised and controlled by the Ministry of Water and Power, which will also issue permits for the use of water. With this law in operation it was hoped that the efficiency of water use would be greatly increased throughout the country, and the mismanagement of scarce resources would end. Prior to the Act the utilization of water resources had been governed by a complex body of Islamic laws and local costumes (Beaumont, 1974).

4.3. Industrial modernity and the end of the Age of Qanats

4.3.1. The hydraulic mission - the replacement of Qanats by deep wells and large dams

In Iran, modernization was based on the theory of dual economy: the resources required for industrial development should be supplied from the surplus resources lying ineffective in traditional agriculture. The agriculture sector was supposed to provide significant capital for investment in industries, deliver adequate food for industrial workers, and contribute to the mitigating of the nation's trade deficit. In order to reach this goal, the government encouraged the use of modern inputs such as chemical fertilizers and machinery through subsidies and cheap bank credits, plant breeding, optimization of water use, farmers training, extension, and welfare improvement, and promotion of producer cooperatives.

Under the Point Four agreement on 'technical collaboration work in Iran', Utah State University technicians trained farmers in using better cultivation, irrigation, and harvesting methods. For example, through demonstration projects Utah experts wanted to show better

ways of growing crops. They planted plots, some using controlled planting and furrow irrigating to water cotton and sugar beets; others using the Iranian methods of broadcasting the seed and flooding the water in. Most demonstration plots showed that the American farming methods increased production, but sometimes the irrigation was not done properly so the yield was not as great as expected.

At first, modern devices received no warm welcome. For instance, Utah technicians in 1951 helped to establish cooperatives and made arrangements to purchase farm machinery that could be used by all the farmers. The reaction to modern machinery was described by one of the technicians:

> "When 'a progressive landlord' bought a tractor to plow, the peasants reasoned that the tractor would put 40 men out of work… They didn't want that to happen so to rectify the situation they broke the tractor into small pieces beyond all hope of repair."

Another technician agreed,

> "There were too many people out there anyway. If you displace a man with a machine, then what did he do? He went to Tehran and begged."

Moreover, another question was who would use the machinery.

> "There were no trained operators, and finding people to train was very difficult. With the accepted caste system, those who were educated and could read instructions did not believe that they should be required to do manual work. Most peasants could not read and while some were successfully trained to operate the deep wells, it was almost impossible to find people to drive and maintain the farm machinery. In addition, companies often sent outdated models with little consideration of whether a tractor could be connected to a plow, harrow, or baler." (Embry, 2003)

Pumps and drilling machines also received no warm welcome, but after some pumped wells were drilled, farmers started to express their admiration for these new technologies. After all, while the construction of a Qanat would sometimes take tens of years, drilling a well took less than a month. If the farmers wanted to increase the discharge of a Qanat even a little bit, they had to extend the tunnel, which would take two or three years, whereas it was easy to increase the discharge of a pumped well by two times just by changing the diameter of the pump or adding some units or parts (Yazdi and Khaneiki, 2007).

Electric and diesel-pumped wells offer advantages over Qanat irrigation by allowing water to be brought to the surface on command, but over-pumping has caused water tables to fall, aquifers to be depleted and Qanats to be abandoned at an accelerating pace. The role of Qanats in securing all the functions of water in Iran has decreased from 70 per cent prior to

1950, to 50 per cent around 1950 and to 10 per cent in the year 2000 (Haeri, 2006)[32]. At present, there are more than 350,000 deep and semi-deep water wells throughout the country, many of which are being exploited without permit. The excessive exploitation of water through these wells has resulted in a negative water balance in most areas, and has accelerated the trend towards desertification. Moreover, the existence of high chain of mountains, sediment plains and so on has led people to use both surface and underground water resources. Also, the ease of digging in the sediment plains of the country (due to particular conditions) has resulted in major damages to these areas (FAO, 2008). Likewise, control of the land and water resources has been transferred from religious endowments to government bodies. These changes have been brought about as a result of the adoption of development models imported from the West (Foltz, 2002).

As a result, the [land] and water resources management system has become primarily technology oriented (construction oriented) since the 1960s (Ardekanian, 2005). Moreover, the governmental vision to implement and manage irrigation and drainage projects in the past has been exclusively oriented to the physical aspects, and the participation of farmers or nongovernmental organizations has been neglected. The results of such a one-dimensional vision have been the dissociation of cultural and social relations between farmers and their system of irrigation. Developing countries are suffering from the consequences of improper use of technology more than developed countries despite the fact that developing countries are expected to have learned from the experience in industrial countries. The situation in developing countries stems from the fact that modern technology originated outside their boundaries, and with the import of technology the indigenous social system has also been intruded upon (Alizadeh and Keshavarz, 2005). The experiences of the Utah technicians who were involved in the 'technical collaboration work in Iran' can serve to illustrate this issue.

Among these technicians some were satisfied with the results of their efforts, such as Helen Milligan who was pleased that the 150 deep wells that her husband Cleve had developed were still operating 'the last time that Bruce Anderson went back over there to close out the final accounts.' However, some of the technicians were negative, such as Bertis Embry who explained that 'in some respects, [the project in Iran] was a lost cause. There was an awful lot of money spent, and some good done, but not nearly as much as they could have obtained from it.' Historian Nikki R. Keddie argued that 'bringing in machinery, especially tractors, destroyed a thin top soil that was better cultivated by a wooden plow.'[33] Moreover, the cooperatives that the Point Four program established were disbanded in 1978 because they did not fit the Iranian lifestyle.

[32] However, it is important to know that today the traditional *Qanat* systems continue to provide water for as much as one third of irrigated land (Foltz, 2002).
[33] The heavy wheeled plough, which was innovated for heavy soil, was useless for the thin top soil of most Middle East countries (Keddie, 1968).

It should be noted that we should distinguish between traditional and modern cooperative systems. Traditional cooperative systems such as *Buneh* are more hierarchical. As Ajami (1985) has pointed out:

> "The *Buneh* system cannot be viewed as a purely voluntary institution that has been developed by the peasant farmers, mostly sharecroppers in an attempt to adapt to irrigation problems in arid and semi-arid regions. However, one should not underestimate its impact on the peasants' participation in the agricultural production and on rural social stratification."

New cooperative systems like the one that Utah technicians have established is more voluntary and egalitarian (see the quotations from Mahdavy and from UN reports in the next section).

According to Embry (2003), the experiences of Utah State University technicians show the problems that are typical for transferring technology and ideas from one culture to another. While there are some initial successes, the changes are rarely permanent. The Americans and the Iranians saw the world completely differently. Americans valued private land; Iranians had lived for years under a system where the rich owned the land. Americans focused on cooperative efforts to share cost and experience. Working together was foreign to the Iranians. They could not see the advantages. Foreigners had dominated Iran for years, and the people assumed that the Americans were no different. They were supposed to want something back for their advice.

In other words, much of the United States aid to underdeveloped countries such as Iran failed because they imposed foreign standards, ignoring age-old religious, economic, and cultural aspects. They introduced machinery, modernized irrigation methods, and improved seeds and farming methods which had temporary success. However, the Americans did not understand the Iranian way of life and therefore could not adapt their scientific knowledge to the situation.

4.3.2. The substitution of the Buneh by a system of smallholding

As was indicated in chapter 3, the general pattern of land ownership in Iran prior to the land reform was a combination of large-scale feudal landownership with small-scale absentee and peasant proprietorship (Lahsaeizadeh, 1993). Because of the importance of artificial irrigation to Iranian agriculture, sharecropping (*muzara-eh*) was dominant among the different types of relationship between the peasant and landowner. This traditional system of land ownership and tenure, and the socio-economic organization of villages (*Buneh*) were well adapted to the optimal use of the *Qanat* system and cultivated land. In other words, rural Iran before land

reform was composed of thousands of villages which were extended self-sufficient socio-economic units (Ghorayshi, 1981). The nature of the system and of governance was such that the people themselves undertook the bulk of rural infrastructure and services development work (Kazemnejad, 2003).

The Land Reform Act of 1962 changed the whole organization of the production system. Land and water that had belonged to landlords was given to peasants. But by giving equal rights to peasants, the special role of *Buneh* members in the hierarchical structure of the *Buneh* organization was also terminated (Safienejad, 1989).

The landholdings given to the peasants were too small; some were even too small to economically support individual families.[34] They were also too fragmented.[35] The use of machinery on these small scattered holdings was often inefficient, and cultivating these tiny fields required long journeys. Furthermore, every farm needed separate equipment for land preparation, sowing, harvesting and irrigation. Below a certain size, the use of new technologies was not feasible for the farmers (Momeni, 1999)[36].

The land reform strongly encouraged the use of mechanically-pumped wells and modern inputs, such as chemical fertilizer and farming machinery. As a result more newly irrigated land was brought under cultivation. However, the land holdings given to the peasants were too small and too fragmented to maintain the *Qanats*, so many landowners and farmers now widely preferred pumped wells and allowed their *Qanats* to languish. In addition to the mostly privately owned and constructed wells, the public sector was engaged in the construction of many large-scale dams.

As a result of the rapid fragmentation and disintegration of the pre-capitalist collective organization of production (*Buneh*), sharecropping (*muzara-eh)* gave way to individualism and a system of smallholding. Moreover, the indigenous knowledge acquired through *Buneh* systems was neither used by nor transferred to the new generation. The traditional sense of land and water resources management for the benefit of the community seems to have been

[34] According to the agricultural censuses, the number of farms smaller than 10 hectares increased from 1,573 centers in 1960 to 2,026 in 1974 and 2,301 units in 1982. In these years the average farm size was, respectively, 2.9, 2.7, and 2.5 hectares, which are indicative of a trend toward smaller farm size. In farms larger than 10 hectare, the average size was 21.7 hectares in 1960, which decreased to 20.9 hectares in 1982 (Nowrouzi, 2003).

[35] The degree of fragmentation varied from one region to another. In Arak, for instance, 97 percent of the households received 16 plots of land. In Bandar Abaas, 80 percent of the households received 4 (Ghorayshi, 1981).

[36] Again we should distinguish between different technologies. Some modern technologies, such as the tractor, cannot be efficient in farmland that consists of small plots. However, some other modern technologies, such as wells, are usable for exploiting water and do not relate to the size of the land. Regarding Qanats, the distribution of land has caused the eradication of collective action, but if the smallholders would be able to establish cooperatives they would be able to manage the Qanat irrigation system in spite of the small size of their land. Hopefully, in the future it will be possible to bring individual smallholders within the new cooperative systems that are not hierarchical but more voluntary and egalitarian.

giving way to an 'every man for himself' mentality. Consequently, the average cultivation area of 37 hectare under the collective *Buneh* system (Safinejad, 1989, 74) was reduced to less than 10 ha., and, consequently, the water use efficiency on farms was also reduced. In addition, the destruction of *Buneh* caused a rapid process of social and economic polarization and stratification within the village population. The disintegration opened the way for stronger elements among the peasantry to concentrate more and more social and economic power in their hands at the expense of others. In conclusion this transformation and dissolution had an effect on both resources and agricultural production (Lahsaeizadeh, 1993: 162-163).

It is worth mentioning that Hossein Mahdavy, an Iranian economist who participated in the study of the early effects of the land reform, has noted that:

> "The communal open-field system of agriculture, prevalent in Iran, is by nature more amenable to a cooperative form of production than to a system of production based on individual enterprise. In cooperative systems, the over-fragmentation of lands and the grazing problems can be overcome by introducing production plans for the entire village. The need for enclosures on tiny plots of land will thus not arise. The incompatibility of the communal form of production organization with a land system based on individual initiative and enterprise is not yet fully appreciated or perceived in Iran for an obvious reason: there has been little time for any intended change to encounter difficulties. But this difficulty will increase proportionally with the attempt on the part of the village *bourgeoisies* to break away from the communal and traditional patterns and undertake more profitable farming in cash crops, fruits and vegetables" (Keddie, 1968: 80).

This issue was also addressed in the United Nations report on the progress of land reform in1966:

> "The third immense problem is to find some rapid substitute for the organizational and physical services formerly provided by the landlords and their agents. It is not clear how effective the new cooperatives will be in this respect, in view of the fact that Iranian farmers have very little experience of egalitarian cooperatives… By December 1963 nearly 2000 cooperative associations had been formed, but it is certain that many of these were cooperatives in name only, their sole function being to enable the tenant recipients of redistributed land formally to conform with the requirements of law" (Keddie, 1968:87-88).

In the early 1970s, in order to solve this problem and to increase the production of the small and fragmented production units Agricultural Production Cooperatives (APCs), namely *Sahamizeraie*, *tavoni tolid* and *kesto-sanat*, were introduced. But this introduction was not

very successful. The peasants were hesitant to turn to government officials against the old landlord. After centuries of landlord protection against government agents, the peasants refused to trust those who now claimed to come to help them. The land reform, which had substituted government agents for the landlord, had thrown the villager into the uncomfortable situation of not knowing where he stands with the new group. With the old landlord, the peasant always knew when he could push and how he could get what he needed. He had become an expert in dealing with the landlord and in living according to the traditional pattern. The villagers who had been told that they were to begin new lives, in fact saw themselves victimized by government agents (Bill, 1970).

In addition, the sudden surge in oil revenue in 1974, enabled Iran to neglect its agriculture and avoid the need encountered in other countries to fund industrialization from the rural sector (Halliday, 1981). This meant that peasants who had lost the support of landlords since the land reform were now also losing the governments' attention. As a result, many of the peasants who could not survive on their small holdings moved to the cities in search of work leading at once to the depopulation of the countryside and the creation of a vast, depressed urban proletariat - a process Fritz Schumacher referred to as 'mutual poisoning' (Goldsmith and Hildyard, 1984).

After the Islamic revolution of 1979, because of the revolutionary socio-political conditions and without precise study (Hamedi, 2004: 91; Purghanji, 2004: 277), part of the previously agricultural capitalist enterprises (*Sahamizeraie, tavoni tolid* and *keshto-sanat*) were dissolved and new collective ownership of agricultural land (*Mosha*)[37] was established (Lahsaizadeh, 1993: 251).

Rural poverty alleviation became a fundamental duty of the new government. The main national objectives for rural development were laid down in the Constitution of the Islamic Republic of Iran.[38] As the Islamic Revolution is based on Islamic values and more attention is paid to human generosity, new organizations emerged to assist the construction of the rural areas. Following the charter issued by the Founder of the Islamic Revolution, the *Jihad Sazandeghi* (the Construction Crusade) was established in 1979 and was changed to the Ministry of Jihad-e Sazandeghi in 1983 by the Act which was ratified by the Islamic parliament. The objectives were: moving towards self-sufficiency and independence; creating a basis for the growth of dignity of rural people; and encouraging the participation of local

[37] A new joint productive cooperative is a society of peasants (usually between 5 and 15 peasants) who jointly own a piece of land and work in partnership. They cultivate the land according to the state agriculture plans and priorities. In reality, a joint productive was a new mode of agriculture production which has emerged as a result of the revolutionary atmosphere and initiation of the government. Each joint productive cooperative has three potentialities: 1) land which is a sum of all the members' shares; 2) water resources all the costs of which should be paid by members; and 3) agricultural machineries which all members can equally use.

[38] *Inter alia*, Articles 3, 45, and 48 of the Constitution deal with the rural community and agricultural sector issues. http://www.iranonline.com/iran/iran-info/Government/constitution-4.html , (last accessed 5 June 2008)

people in the construction of villages. A large number of university graduates participated in this movement, contributing to the construction of remote rural and tribal areas.

During 1979-88, considerable credit and investment were allocated by the government for the development and renovation of villages. The *Jihad Sazandeghi* performed a range of activities for improvement of socio-economic conditions in the rural areas. These activities included water supply, construction of rural baths, schools, health centers and many other activities. It can be concluded that, after the Islamic Revolution, the process of modernization in the rural area was continued with an emphasis on physical development.

By the end of the war with Iraq in 1988, a new planning era started which was called the 'Reconstruction period' (*Doran-e- Sazandeghi*). The government adopted five year development plans to reconstruct the economy in the light of relative post-war political and economic stability. Different authorities advocated different approaches to development. Some promoted liberalization and economic adjustment policies, referring to the governmental nature of Iran's economy and the recommendations of international organizations. Others favored indigenous strategies to tackle social and economic problems. In spite of widespread criticisms, the former approach was adopted by decision-makers as the basis of the First Five-Year Plan (1989-93) (Kazemnejad, 2003). The broad goals for the agricultural sector included: increased production and higher self-sufficiency in staple foods; improved nutritional indicators; conserved and rehabilitated natural resources; increased per capita income of agricultural manpower; and improved balance of income between agricultural and other sectors.

The establishment of Agricultural Production Cooperatives (APCs)[39] in the Second Five-Year Plan (1995-99) became a major strategy of the Ministry of Agriculture in its efforts to achieve agricultural development and increase production. As a result, APCs rapidly grew in terms of sheer numbers (Karami and Rezaei-Moghaddam, 2005). The new APC is a relatively comprehensive model that takes into account socio-cultural, economical and natural factors.

Although it was believed by the land reform officials that rural cooperative societies could replace the *Buneh* system and would fill the gap that resulted from its destruction, no village-level institution has ever taken over its function (Lahsaeizadeh, 1993: 165-169). A recent study by Karami and Rezaei-Moghaddam (2005) on APCs from 1975 till 2000 around the country also showed that APCs were unsuccessful in achieving land consolidation and group

[39] According to the laws and regulations governing APCs, they are established with the aims of consolidating the land of voluntary farmers who become members; increasing the productivity of soil and water resources by providing modern irrigation infrastructure; leveling of agricultural land; familiarizing farmers with modern methods of production and harvesting; efficient use of agricultural machinery; facilitating establishment of agricultural industry; and finally improving the income and living conditions of rural households (Karami and Rezaei-Moghaddam, 2005).

work, which were the main reasons for their establishment. They argued that the new APCs are not as successful as their predecessors were, because due to the rapid expansion, the government has not been able to provide as much support and leadership to them as it did to earlier APCs.

4.3.3. The emergence of a mechanistic worldview

The new agricultural system and new land and water resource management regime is more in tune with a mechanistic worldview than with the ethico-religious frameworks of the past. Critics of the mechanistic worldview fear that if man sets himself up as the measure and master of all things, nature will appear solely as 'material' that he can control and command as he pleases. Nature, including land and water, ceases to be an independent source of value and turns into a mere resource to be disposed of at will instead.

The mechanicist view of nature promulgates a specific economic model of human-nature interactions: the farmer is to produce as much food as possible, and neither the producer nor the consumer should make value judgements about the non-economic worth of the land. After all, values are epiphenomena of human subjectivity and human activity; they are not embedded in the land.[40] Modern agriculture has become highly industrialized in order to reliably produce the largest amount of plant and animal product possible while minimizing labour inputs. Under the industrial production paradigm, the prime objective is to improve the productivity of a select set of plants and animals. At the heart of the production paradigm is the realization of the greatest possible quantity of agricultural product. Agricultural systems based on the production paradigm do not recognize ecologically important values that are hard to quantify. Thus, the design of agricultural systems is based on commodity production and its attendant economics, while the importance of modelling farming systems after natural systems, based on ecological principles, is widely overlooked.

The American ecologist Aldo Leopold named the schism between the economic and ecological models of farming the 'A-B cleavage' (Leopold, 1949). The economic model (A) considers the value of the land to be its resource or productive potential. Conversely, the ecological model (B) considers the land to be a living thing, comprised not only of soil but also of the plants and animals that live in or on it and the water and energy that flows through it. In model (B), ecosystem components have values that are above and beyond direct economic value alone. The production paradigm of current agricultural systems clearly espouses model (A). Some adherents of the production paradigm reject outright the values suggested in model (B), while others admit their existence but consider them only to the

[40] The English philosopher John Locke (1689) persuasively argued that nature itself has no inherent value, but that human beings, through their labour, can transform the latent extrinsic (or resource) value of land into useful products.

extent that they do not interfere with the production of agricultural commodities (Keller *et al*., 2002).

To quote Donald Worster's 1992 book *Rivers of Empire* on the advent of the hydraulic society in the American West:

> 'The most fundamental characteristic of the latest irrigation mode is its behaviour towards nature and the underlying attitudes on which it is based. Water in the capitalist state has no intrinsic value, no integrity that must be respected… It has now become a commodity that is bought and sold and used to make other commodities… It is in other words, purely and abstractly a commercial instrument. All mystery disappears from its depths, all gods depart, all contemplation of its flows ceases… Where nature seemingly puts limits on human wealth, engineering presumes to bring unlimited plenty. Even in the desert, where men and women confront scarcity in its oldest form (…) every form of growth is considered possible' (52).

Modern water technologies have deeply affected the way people perceive value and use water. In her paper on the conversion of rainwater into tap water, Nicole Stuart argues that industrial technologies dissociate people from the natural environment upon which they depend. 'Urban water infrastructure allows people to "take water for granted"… The urban water infrastructure provides an "illusion of abundance" – enabling twenty-four hour access to clean and potable water, seven days a week' (Stuart, 2007: 419).

Based on four years of field research in 11 countries of the MENA region, Francesca de Châtel (2005b) came to a similar conclusion with respect to public awareness of water scarcity. Two issues are at stake here: in the first place there is the issue of scale. 20th century technology brought large-scale engineering schemes with it. All have one thing in common: their dehumanizing scale. The sheer size of dam reservoirs and the huge amount of water that is transported through pipelines leads the general public to believe that water supplies are endless and conceal the reality of water scarcity. The second issue is distance in which through the development of modern water distribution systems, the link that used to exist between the individual user and his water is severed. As soon as water starts flowing from a tap, it is taken for granted. People forget that a fluctuating river or an erratic weather system lies at its origins. 'By making its source invisible, water's existence is divorced from the elements and the seasons, and it becomes paradoxically omnipresent. The user can comfortably assume that it flows from an endless supply.' (Châtel, 2005a)

De Châtel emphasizes, however, that this review of dangerous modern myths is not a condemnation of modern technology or a nostalgic eulogy of traditional water wheels and hand-dug wells. The point is that modern engineering projects through their impressive scale

and grand allure conceal the reality of water scarcity. This reality needs to be urgently acknowledged. While a new dam can alleviate the immediate effects of water scarcity, it does not change the geographical conditions of the region. It does not transform desert climates to temperate ones or guarantee abundant rainfall levels. It is just one component among many that can help in confronting the problem of water scarcity.

4.4. Concluding remarks

The process of modernization evolved as the main developmental model for the less developed parts of the globe. In Iran, both the rulers and the new middle class that emerged in the 1950s considered the traditional system as backward and accepted large-scale modernization as the model for progress.

By sending the younger generation to the West as students to learn modern science and bringing foreigners in as advisors Iran tried to prepare the agents that were needed for the implementation of the new development model. To implement modernization, some modern institutions were established, such as a planning and budget organization that helped to provide the basis for a systematic planning approach for the country. Modernization brought some advantages such as increasing cultivation areas and growing production. But on the other hand, some elements of the traditional system that were important for natural resources management such as community-based organizations were ignored, due to the lack of understanding of the native context by both foreign and new domestic agents, and the speed of change compared to that of the modernization process in the West.

After the eradication of the *Buneh* system and the replacement of landlords by government agencies, the people were no longer able to collectively maintain the rural infrastructure and became dependent on the state for the necessary services. Regarding water, people became alienated from the source of supply, as the responsibility for mobilizing, treating, distributing and protecting water became somebody else's problem. In other words, the traditional sense of land and water resources management for the benefit of the community seems to be giving way to an 'every man for himself' mentality. Instead of being a vital source of life that was provided by the local environment to which people had an intimate linkage, water now became a commodity that flowed from a tap with the origin of that water being remote and someone else's business to provide.

The commodification of [land] and water was a key part of the paradigm of industrial modernization that was based on Newtonian physics and underpinned by Baconian and Cartesian philosophy. This paradigm, which led to reductionism and the desire to control nature, was propagated by engineers who increasingly became instruments of state policies and at the same time became increasingly elitist and distant from mainstream society,

ultimately losing touch with changing groundswells of grassroots opinion (Turton and Meissen, 2000).

In spite of the advantages of modernization, many studies show that development policies have produced negative impacts such as uneven development, poverty and environmental degradation. The concern for environmental problems was a major contributing factor to the loss of faith in this path to development (Rezaie-Moghadam and Karami, 2006). However, the value system of industrial modernity is still at work in contemporary Iranian natural resource management and dominates decision-making on natural resource policies (Foltz, 2002).

There are, however, signs of change. In the Second Five-Year Plan (1995-99), for instance, an important goal was to attain 'sustainable economic growth'. The plan emphasized that all economic and social activities should be performed within the constraints of environmental and biodiversity conservation and management. All major development projects (productive and infrastructure) will require an Environmental Impact Assessment; any major industrial and mining activities must be conducted in conformity with ecologically sustainable development principles and within the framework of environmental standards and regulations; exploitation of the country's natural resources must be sustainable in the long-term, balancing the need for economic value, environmental protection and inter-generation equity; and domestic energy consumption must aim to minimize adverse environmental effects (e.g. pollution, move from oil to gas, or preferably to renewable sources such as solar energy).[41]

In the next chapter this change will be discussed along with the emergence of reflexive modernity around the globe.

[41] http://www.caspianenvironment.org/biodiversity/iran/forth.htm , (last accessed 2 June 2009)

Chapter 5
The shift from industrial modernity to reflexive modernity

The previous chapter has outlined the idea of modernity in general and the emergence of modern land and water management in the specific context of Iran. After the Second World War, some negative consequences of industrial modernity such as land degradation and water scarcity became manifest, which culminated in what has become known as the environmental crisis. In this chapter, firstly the various responses to this crisis, ranging from the radical anti-modernism of the first wave of environmentalism to the notion of reflexive modernity of the second wave will be discussed (5.1). Secondly, the notion of reflexive modernity with respect to land and water resource management, including Tony Allan's three stages model of reflexive modernity will be discussed (5.2). Thirdly, attention will be paid to some significant signs and indicators of a reflexive turn in Iran (5.3). Fourthly, the question will be examined how a system of reflexive land and water management in the MENA-region, including Iran, should take shape (5.4). In order to assess the viability of this system of management, a lot of empirical research was carried out, the outcomes of which is the subject of the next chapter.

5.1. Anti-modernism and reflexive modernity

> *'In traditional societies, nature was seen as one's "wife", but the modern West turned it into a "prostitute"' (Seyyed Hossein Nasr, 1968)*

Modernity was initiated as a project dedicated to the liberation of humanity from the forces of myth and nature. On the assumption that nature has set no limits to the realization of our hopes, "harnessing the forces of nature for the benefit of mankind" (Allan, 2006: 4) was the main goal of the project of modernity. However, by the 1950s some disastrous effects of industrial modernity – 'the hydraulic society's worsening headaches' (Worster, 1992: 324) – such as salinity, sedimentation, pesticide contamination, diminishing hopes of replenishment and the dangers of aging, collapsing dams, began to appear, not only in the U.S. and other Northern countries but also in Southern countries like Iran, where, over the past four decades, farmers and others close to the land had watched water tables drop as one well after another dried up, and formerly fertile lands were inevitably taken out of production (Foltz, 2002). With the manifestation of the environmental crisis, the idea underpinning industrial modernity that nature, including land and water, could be conquered and controlled *ad libitum*, became more and more challenged.

In response to this crisis most industrialized countries were confronted with a rising tide of environmental awareness, activism and advocacy. In fact, environmentalism came in two

waves. The 'first wave' of environmentalism began in 1962 with the publication of Rachel Carson's *Silent Spring* and culminated in the publication of the 1972 Club of Rome report *Limits to Growth*. First-wave environmentalists argued that exponential growth of populations and industrial activity could not be continued forever without exhausting the planet's resources and overloading its capacity to deal with pollution and waste (Beder, 1994). Environmentalists of the time, with their many distinct theories and practices and widely varying tactics, shared an anti-modern attitude.

> "Whether they were small-is-beautiful adherents, Club-of-Rome critics, neo-Malthusians, or neo-Marxists, these environmental movements seemed "united" in attacking the basic institutions of modernity, such as capitalism, industrialism, modern science and technology, and the bureaucratic nation-state" (Mol, 2003: 303).

Some radical critics of modernity within the environmental movement like Murray Bookchin, Ivan Illich and Wolfgang Sachs claimed that environmental and ecological deterioration could be held as proof of the modernization project being a dead end. These critics shared the belief that a solution can only be found by at least partially dismantling the existing systems of production.

The first wave culminated with the "UN Conference on the Human Environment," held in Stockholm in 1972. The so-called Stockholm Declaration states as its first principle a moral imperative: "Man…bears a solemn responsibility to protect and improve the environment for present and future generations." Environmental policy during this period was mainly top-down and did proceed through 'command and control' methods for ordering and enforcing environmental protection in an ongoing struggle against economic development. Accordingly, "most environmental ministries and departments, as well as many environmental laws and environmental planning date from this era." (Mol, 2003: 310)

After decades of anti-modernism, however, "the landscape of 'green' philosophical position has become far more complex and decidedly less hostile towards modernity." (Misa, 2003: 22) The 'second wave' of modern environmentalism, which began with the 1987 publication of the so-called Brundtland report *Our Common Future*, initiated a new approach to dealing with environmental problems. The concept of 'sustainable development' was introduced in the belief that economic development and ecological sustainability are not incompatible by definition. 'Ecological modernisation' and 'pollution prevention pays' became the new slogans. End-of-pipe solutions, which focus on waste disposal, gave way to systematic attention to environmental impacts in the early design stages, moving upstream in the pipe.

This wave came of age with the "UN Conference on Environment and Development", held in 1992 in Rio de Janeiro. The Rio declaration, UNCED's list of principles, defines in its first

principle the economic concept of 'sustainable development.' National authorities are encouraged "to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution" (Principle 16). Unlike the Stockholm Principles, the Rio Principles are directed at Finance Ministries, Trade Ministries, and Tax Authorities.

An important approach that came with the second wave of environmentalism is 'reflexive modernity'. Reflexive modernity does not imply a break with modernity, but refers to a radicalization within modernity – a 'modernization of modernity' (Beck *et al*., 1994). Radicalized or reflexive modernization is a process of self-criticism whereby modernization has become directed at itself, at the destructive and continually expanding side-effects and risks that are systematically produced by industrial society. According to Ulrich Beck, "reflexive modernization means not less but more modernity, a modernity radicalized against the paths and categories of the classical industrial setting." (Beck, 1992: 14) And according to Anthony Giddens, "only societies reflexively capable of modifying their institutions in the face of accelerated social change will be able to confront the future with any confidence." (Giddens, 1987: 21)

While nature in 'first' modern societies is conceived of as a neutral resource, which can and must be made available without limitation, nature in 'second' modern societies "is no longer solely perceived as an outside that can be adapted to one's purposes, but increasingly as part and parcel of society." (Beck *et al*., 2003: 7) Beck argues for 'ecological enlightenment', which requires a reorientation from a focus on economic growth to one on sustainable development (Beck, 1995).

5.2. Reflexive land and water resource management

Tony Allan (2006) has divided the reflexive response to the challenges of industrial modernity in the water sector into three sub-phases. In the first sub-phase, water policies were inspired by the growing awareness of the *environmental* costs of the hydraulic mission. The idea that natural resources such as water were being damaged rather than controlled by the impact of industrial modernity gained currency during the mid-1970s. It was not until the 1980s, however, that environmental activists succeeded in persuading governments in industrialized semi-arid regions such as Australia, California, Arizona and Israel to reallocate substantial amounts of water from agriculture to the environment. In the second sub-phase, economists began to draw attention to the *economic* value of water and its importance as a scarce economic input. The idea that water is an economic resource that paved the way for the concept of the water market gained currency in the early 1990s.

According to Allan, the environmental and economic sub-phases of reflexive modernity are still in train, but they are being supplemented by a third sub-phase**,** which is based on the notion that water management is a *political* process. This notion that emerged at the turn of the century is central to the concept of Integrated Water Resource Management, which requires a new holistic approach and an unprecedented level of political cooperation. The latest sub-phase of reflexive modernity "is bringing forward approaches which include participation, consultation and inclusive political institutions to enable the mediation of the conflicting interests of water users and the agencies which manage water." (Allan, 2006: 7)

The notion of Integrated Water Resource Management (IWRM) was introduced in Agenda 21, the global blueprint for sustainable development adopted at the United Nations Conference on Environment and Development (commonly referred to as the Earth Summit), held in 1992 in Rio de Janeiro. Chapter 18 of Agenda 21 states that "Integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good, whose quantity and quality determine the nature of its utilization". In 2002, at the Johannesburg World Summit on Sustainable Development, Integrated Water Resources Management was defined "as a process, which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." In this most cited definition of IWRM we can easily recognize the three so-called pillars of sustainable development: environmental protection, economic development and social justice and equity.

Like the concept of Integrated Water Resources Management, the concept of Sustainable Land Management (SLM) also emerged from the UNCED process since the Rio conference in 1992, following chapter 10 of Agenda 21 which stipulates the need for an "integrated approach to the planning and management of land resources". This concept also includes social, economic, and ecological dimensions. SLM "combines technologies, policies, and activities aimed at integrating socio-economic principles with environmental concerns so as to simultaneously maintain or enhance production, reduce the level of production risk, protect the potential of natural resources and prevent (buffer against) soil and water degradation, be economically viable, and be socially acceptable" (Smyth and Dumanski, 1993).

Taking an IWRM approach to water efficiency requires an integrated set of measures to improve efficiency that are selected strategically in terms of a country's overall development goals. Therefore, to start moving towards more water efficient solutions water efficiency strategies should be linked to a country's sustainable development goals. In addition, we should look at opportunities to improve water efficiency that lie outside the water sector, such as land management (Rahman and Varis, 2005).

However, the integration of different sectors related to water management is very challenging. Moreover, the problems and solutions associated with IWRM implementation in different regions may not be universal. Normally, the objectives of many land and water users are to 'maximize production and/or net profit' and to 'reduce costs and labour.' Equally important to land and water users, planners and policy makers alike is the aim to 'conserve the environment.' Therefore, national and local governments, interest groups, and specifically the land and water users are asked to make efforts in which to meet criteria of SLM and IWRM. That is why Allan emphasizes that water users could adopt IWRM "if the innovation of 'integration' is appreciated as a political process and not just as a technical investment or information sharing process" (Allan, 2006: 1). Therefore, IWRM requires a new holistic approach with much stakeholder consultation and public participation to enable successful conflict resolution and consensus building among water users and water management agencies.

To avoid overly general or universal policies and guidelines for implementing IWRM, which may become counterproductive, Rahman and Varis (2005) believe that some points and approaches need to be addressed by water professionals far more carefully than in the contemporary guidelines to successfully implement IWRM, such as government's presence in the processes of water sector privatization, doing "more discussion, analysis, study, and commitment in deciding whether water is a common or an economic good" (Rahman and Varis, 2005: 19), and taking into account water's spiritual and cultural dimensions.[42]

Although there are activities at the global level to implement Sustainable Land Management and Integrated Water Resource Management, some scholars such as Allan are sceptic about the possibilities for reflexive modernity in the South. Allan believes that, by and large, the semi-arid North can be shown to have passed through all three stages of water management and water policy. "In the South, by contrast, the professional community generally, and all water users and politicians, have resisted the adoption of the paradigm of reflexive modernity" (Allan, 2006: 8). Especially in the MENA region, the hydraulic mission of industrial modernity is still alive and flourishing. "The big players, Egypt, Turkey and Iran, are all engaged in major hydraulic projects" (Allan, 2002: 145).

Allan's sketch of the course of reflexive modernity in water policy in the North is not a purely empirical description, but also as a normative prescription for water policy reform in the

[42] The Universal Declaration on Cultural Diversity (UNESCO, 2001) elaborates the concept by stating that "...cultural diversity is as necessary for humankind as biodiversity is for nature"; it becomes "one of the roots of development understood not simply in terms of economic growth, but also as a means to achieve a more satisfactory intellectual, emotional, moral and spiritual existence". In this vision, cultural diversity is the fourth policy area of sustainable development, http://portal.unesco.org/education/en/ev.php-URL_ID=16964&URL_DO=DO_TOPIC&URL_SECTION=201.html (last accessed 10 May 2009)

South. This is, however, very problematic on two accounts. In the first place, it seems to place too much faith in a unilinear model of institutional evolution. According to Frances Cleaver (2002), such a model fails to recognize that decision making and cooperative action are deeply embedded in the web of local livelihood networks and practices. To understand the complex and dynamic nature of institutional change we should see it as a process of 'bricolage', i.e., a process operating by trial and error and using a diverse range of social and cultural resources.

In the second place, Allan fails to recognize that the course that second modernity has taken within a European constellation will differ considerably from its course within non-European constellations, where the dynamic of reflexive modernization displays its effects not on first modern societies but rather on the distorted constellations of post-colonialism. "*Different non-European routes to and through second modernity still have to be described, discovered, compared and analyzed*" (Beck *et al*., 2003: 7).

In the next sections, first the question whether there are any signs and indicators of a reflexive turn in Iran will be examined (5.3), and second a non-European route to reflexive land and water management for Iran and other MENA-countries will be sketched (5.4).

5.3. Signs and indicators of reflexive turn in Iran

Although classical industrial modernization still seems to be the dominant strategy in Iran, there are nonetheless also signs and indicators of a turn to reflexive modernity. This trend has successively become manifest in three domains, namely administrative competencies, legislation and regulations, and policies.

In 1972, in the wake of the Stockholm Declaration, which focused on creating national institutions for environmental planning, the government of Iran established the Department of the Environment. This department has the responsibility to "guarantee wise and permanent use of the environment in compliance with sustainable development" as well as "preventing the destruction and pollution of the environment, and taking decisive action to control critical environmental situations including extreme pollution" (Eeltink, 2000). In the following years, two important laws were ratified and enacted: the *Environmental Protection and Enhancement Act* (1974) and the *Law of Protection of the Sea and Internal Water Bodies Against Oil and Oil-products Pollution* (1975).

Since the Islamic Revolution of 1979, greater importance has been accorded to environmental laws and regulations; indeed, Iran is one of the few countries in the world to have included a special article on environmental protection in its constitution.[43]

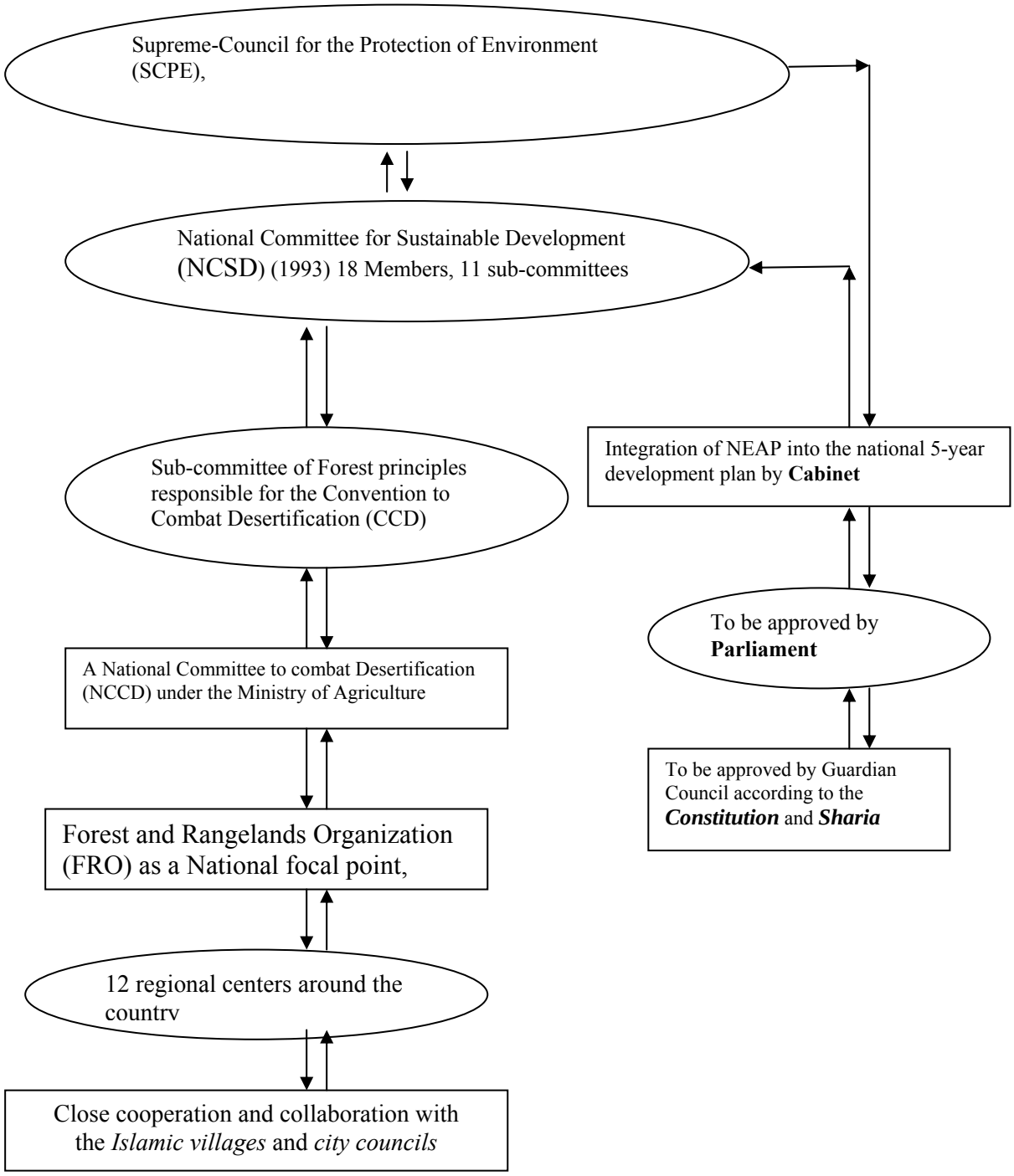

Fig5.1. Implementation structure of sustainable development's goals in Iran: Vertical & horizontal level

[43] "In the Islamic Republic protection of the natural environment, in which the present and future generations must lead an ever-improving community life, is a public obligation. Therefore all activities, economic or otherwise, which may cause irreversible damage to the environment, are forbidden" (Article 50 of the Constitution)

Since the UN Conference on Environment and Development in 1992 the government of Iran has launched various initiatives to promote and support the implementation of Agenda 21. Among these initiatives are the efforts to coordinate all environmental activities in the country by the Supreme Council for the Protection of Environment (SCPE) under the auspices of the President of Iran, which is an inter-ministerial council, and the formulation of a National Environmental Action Plans (NEAPs). In 1996, the religious leaders in Iran found the principles of environmental conservation compatible with the general guidelines of the holy religion of Islam, and the Department of the Environment introduced National Environment Action Plans (NEAPs) as guideline for all governmental sectors in 1997.

According to the outcomes of the Rio Summit, the National Committee for Sustainable Development (NCSD) was established by SCPE in 1993, which is the key national sustainable development coordination mechanism and comprises 11 sub-committees. These sub-committees are instituted according to international and regional conventions, such as the Convention of Climate Change, the Convention on Biological Diversity, both from 1992, and the Convention to Combat Desertification from 1996.

"The primary goals of the NCSD are policy making and integration of environmental concerns into the country's social and development plans."[44] Based on Articles 45 and 50 of the National Constitution, the regular five-year development plans, adopted by the National Parliament, also take fully into account the sustainable development principles. The Second, Third and Fourth Development Plans took this integrated approach.

The process of integration as shown in Figure 5.1 is such that the program prepared by the responsible subcommittee under NCSD and in collaboration with the relevant Ministry (i.e. for Convention to Combat Desertification the subcommittee of Forest principles and the Ministry of Agriculture) should be incorporated in the NEPA and approved by SCPE. The NEAP as said should be integrated with the National 5-year development plan of the Cabinet, which in turn should be approved by Parliament. Finally, this integrated national 5-year plan should be also approved by the Guardian Council[45], which is the link between Supreme leader

[44] http://ncsd.irandoe.org/establish.htm (last accessed 10 April 2009)

[45] Iran is an Islamic Republic, modelled largely after the late Ayatollah Khomeini's notion of the Rule of Jurisprudence or *Velayat-e Faqih*. The underlying idea of this system is that a learned religious scholar is to watch over the system of government until the appearance of the 12th Imam, the *Mahdi*, or messiah, under Shiite belief. The rest of the system of the Islamic Republic includes an executive, judiciary and legislative branch. The President who is elected by the people heads the executive and supervises the implementation of the Constitution. The Parliament (*Majlis*), of which the members are elected by direct vote is referred to as the Islamic Consultative Assembly. There is a Judiciary with parallel judicial courts and revolutionary courts of which the head is appointed by the Supreme Leader.
The Guardian Council of the Constitution is an appointed and constitutional 12-member council that is composed of six Islamic jurists, "conscious of the present needs and the issues of the day to be selected" by the Supreme Leader of Iran, and six jurists, "specializing in different areas of law, to be elected by the Majlis from

and the other parts of the state (executive, judiciary and legislative branch) and is charged with interpreting the Constitution of Iran and "ensuring ... the compatibility of the legislation passed by the Islamic Consultative Assembly [i.e. Majlis] ... with the criteria of Islam and the Constitution".

The *Second Five-Year Development Plan* (1994-1999) was aiming at sustainable economic growth and development centered on agriculture (Kazemnejad, 2003). To this end, the plan promoted the implementation of Environmental Impact Assessments (EIAs) for major development projects, the performance of major industrial and mining activities in accordance with ecologically sustainable development principles, the sustainable exploitation of natural resources in the long-term, and the transformation of consumption patterns of domestic energy aiming at the reduction of adverse environmental effects (National CBD Reports)[46].

In line with the Second Plan's emphasis on environmental protection and sustainable utilization of natural resources, the *Third Five-Year Development Plan* (1999-2004), which has incorporated the by-laws (Article 104-C)[47], aimed to prevent the pollution of air and of underground as well as aboveground water sources, and specified the related penalties for violations. Accordingly, the plan obligated production units to perform environmental impact assessments during feasibility studies of large projects and plans prior to their implementation, an to adapt their technical specifications to ecological standards, penalizing units that refused to comply (National CBD Reports).[48]

A separate section (including chapters 5 and 6) of the *Fourth Five-Year Development Plan* (2004-9) is devoted to environmental protection and land use planning, highlighting their role in the country's development. Article 61 of chapter 5 emphasizes the need to reduce the use of chemical fertilizers and to increase the use of compost, the importance of biological control of pests and diseases, the protection, rehabilitation and sustainable utilization of natural resources, and the destocking of livestock from forests and rangeland (Dehghan, 2006). The plan also formulated six qualitative and 19 quantitative goals for the water sector and encouraged an integrated approach to management, the consideration of economic aspects of

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among the Muslim jurists nominated by the Head of the Judicial Power". http://en.wikipedia.org/wiki/Guardian_Council (last accessed 10 May 2009)

[46] http://www.caspianenvironment.org/biodiversity/iran/forth.htm (last accessed 12 April 2009)

[47] Article 104- In order to protect the environment and to secure sustainable exploitation of the country's natural resources the following tasks are to be performed:

> C- To reduce the environmental polluting agents, especially those polluting the country's natural and water resources, the manufacturing units are obliged to take measures to conform their technical specifications with the environmental criteria, and to reduce the extent of the pollution. To this end, the performance expenditure shall be considered as tax deductible costs for these units. http://www.salamiran.org/content/index.php?option=com_content&task=view&id=85&Itemid=136 (last accessed 25 May 2009)

[48] http://projects.wri.org/sd-pams-database/iran/third-5-year-development-plan (last accessed 10 April 2009)

water supply, sustainable development, raising finance, and strengthening public contributions (Hashemi, 2007).

Along with the articulation of environmental and sustainability concerns mainly in the national five year plan, considerable stress has been placed recently on strengthening civil society as a key strategy for social, political and economic progress. Strengthening the role of major groups including woman, NGOs, indigenous people and their communities, farmers etc is emphasized in the section III Agenda 21. Realizing that limited participation or involvement of people may be a major constraint to integrated sustainable development, the government has adopted measures to facilitate extensive participation of people in development projects and programs. This has led to the establishment of various participatory institutions in different subsectors. Examples are the Carpet Cooperatives, Beekeepers Cooperatives, Rural Services Cooperatives, Women's Cooperatives, Development Groups, Rural Credit Funds, etc (Nowrouzi, 2003).

Non-governmental organizations are being promoted as partners for sustainable development. Setting aside a handful of mainly culturally motivated organizations that were established prior to 1978, the majority of the NGOs was established after the Islamic Revolution. Figure5.2 shows the increase in the number of NGOs (including environmental NGOs, for which the increase is about 500 percent)[49] in recent decades, particularly since 1990s (Hamyaran Iran NGO Resource Center, 2006: 79).

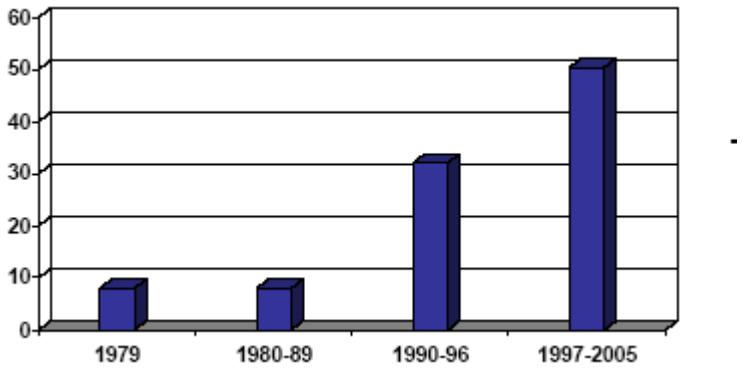

Fig5.2. Percent distribution of Iranian NGOs by year of establishment 1979 - 2005

It is clear by now that activities towards sustainability are increasing, especially since the 1990s. This trend is also continuing in the first decade of the 21st Century. For example, since 2002, Iran has joined the international Challenge Program on Water and Food (CPWF)[50] with a project in the Karkheh river basin. This project is dealing with the global priority that has

[49] The first registered environmental NGO in Iran (BoomIran) was founded in 1980.
[50] http://www.waterandfood.org/index.php?id=65 , (last accessed 26July 2009)

been identified by the Consultative Group on International Agricultural Research (CGIAR). CPWF is an international, multi-institutional research initiative with a strong emphasis on north-south and south-south partnerships. Its 5 themes are: 1) increasing crop water productivity, 2) multiple use of upper catchments, 3) aquatic ecosystems and fisheries, 4) integrated basin water management systems, and 5) the global and national food and water systems.

Other clear signs of a reflexive turn are the establishment in 2001 of the Chamber of Agriculture and the Farmers' House[51], and of the High Water Council which is responsible for water supply. Also important are the emergence of the Iranian Association for the Ethics of Science and Technology[52] in 2003, and of the International Center on Qanats and Hydraulic Structure (ICQHS)[53], which was founded in 2005 in collaboration with UNESCO.

5.4. Prospects of reflexive land and water management in Iran

The new paradigm is still in its first stage in Iran, and must be conceptualized and developed in terms of new technical systems of land and water management, of corresponding social institutions and of a new ethico-religious framework that is sensitive to the specific features of the region.

New technical systems: restoration and integration of traditional and modern technology

Reflexive or second modernity in the area of land and water management can be characterized firstly by the notion of sustainable development: development should be ecologically sound, economically feasible and socially acceptable. Secondly, it can also be characterized by the integration of traditional (indigenous, small scale) and modern (scientific, large scale) technology and infrastructure. This is emphasised at the Fourth World Water Forum of 2006 in Mexico in which there was general agreement that nations should consider both small-scale decentralized solutions and large-scale approaches involving dams and reservoirs to meet their needs at the lowest possible social and environmental costs. Furthermore, the forum remarked that, regrettably, local knowledge and adaptive technology development have been neglected historically, and recognized that knowledge coming from several sources could be complementary and might reinforce each other in solving water issues locally. In the context

[51] This chamber was established by agricultural producers, processors and distributors, with the purpose of collaboration and cooperation in increasing production, improving the quality, reducing losses, improving processing and marketing. The Farmers' House was established two years ago by farmers from across the country to advocate and protect the social, political and human rights of farmers. The charter of the Farmers' House includes 22 Articles and 10 Amendments (Nowrouzi, 2003).
[52] http://iranethics.irost.org/ (last accessed 26July 2009)
[53] http://www.qanat.info/ (last accessed 26July 2009)

of Iran's transition to reflexive water management the forum's recommendation to try for 'a proper mix of science, technology and local knowledge'[54] would imply the rehabilitation of the traditional Qanat underground irrigation system and its integration with modern water supply systems.

The rehabilitation of the Qanat system is important because this system represents one of the most ecologically balanced water recovery methods available for arid and semi-arid regions. Qanats tap the groundwater potential only up to, and never beyond the limits of natural replenishment and, as a consequence, do not upset the hydrological and ecological equilibrium of the region. As the Qanats are often dug into hard subsoil, there is little seepage, no rising of the water table, no waterlogging, no evaporation during transit – and hence no salinization in the area surrounding the conduits. Moreover, Qanats rely entirely on passive tapping of the water table by gravity only, whereas the extractive pumps consume an enormous amount of fuel per year.[55]

However, the rehabilitation of the Qanat irrigation system can only succeed with the help of modern technology. Modern mining technologies can be used to enhance the water efficiency of the Qanat system, whereas water productivity can be improved by combining Qanats and modern irrigations systems.[56] Such a revitalization of the Qanat system by modern technological means can result in a substantial decline of the dependency on deep wells.

What is required in addition to the restoration of the Qanat system is its integration in a modern environment. The rapidly increasing demand for water due to population growth and agricultural expansion in Iran cannot be accommodated by Qanats only. Therefore, what is called for is a complementary system of all three methods of water provision. Among other things, this implies that existing Qanat systems should no longer be ignored during the

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[54] The need for a reflexive turn, which integrates traditional and modern aspects, is captured in the following description of Iran's current situation by Iranian philosopher Souroush:

> "On the one hand Muslims, who are the majority of the population, like their religion, it is like their homeland, they would like to live in it and to be happy with it and to have a prosperous life in their intellectual or spiritual homeland, i.e. Islam. On the other hand, of course, they understand the necessities and the requirements of the modern age, the modernity, the post-enlightenment world system as we know it today"

Along with this general perspective, Souroush (2007) distinguished between modern rights-based culture and pre-modern duty- or obligation-based culture. Emphasizing that both cultures have their shortcomings, he stated that what we need is neither to combine nor to eliminate the two, but perhaps a third paradigm. Perhaps we should revalue the concept of virtue, which may do justice to both obligations and rights which should be considered in the ethical framework of reflexive land and water management

[55] In the Yazd area there are 4,340 wells with extractive pumps, which totally consume 205,854,880 liters of gas oil a year in order to obtain 926,350,000 cubic metres of water. But in the same area there are 2,948 Qanats, which withdraw 329,870,000 cubic metres of water a year without any fuel (Khaneiki, 2007: 81).

[56] In Syria Wessels and Hoogeveen (2006) have seen that combining ancient Qanats and modern drip irrigation systems for fruit trees might prolong the life of some Qanats and encourage the younger generation to commit to their upkeep. Another option they mention is to encourage eco-tourism based around Qanats to provide alternative income for the farmers.

building of large dams and the excavation of deep wells. Islamic water law ensures that new irrigation systems or wells are not constructed too close to an existing one. However, with the emergence of the pumped tube well, the traditional harim-area (usually between 100 and 300 meters) does not suffice any longer and should be enlarged considerably.

Fortunately, there is a revival of interest in several countries where ancient underground irrigation systems have been declared as national heritage. As was indicated in the previous section, the Government of Iran is lately giving much attention to the Qanat system. The first international Qanat Research Conference was held in Yazd in 2000. As a result of the recommendations of this conference, the Government of Iran has established the International Qanat Research Centre in Yazd in collaboration with Afghanistan and Pakistan, and with support from UNESCO. Another example is China, where the Song Yudong group, in close collaboration with Xinjiang local authorities, has come up with several practical suggestions to revitalize existing Karez systems, including an overall plan for protection and improvement of the existing system in Turpan Prefecture in China. Recently international organizations such as UNESCO, and the United Nations University (UNU) have also shown interest in promoting studies on the Qanat system through the International Hydrological Program and the Traditional Technology in Drylands Program that supports young researchers from countries with a long tradition and heritage of Qanat systems such as Syria, Oman, Tunisia and Yemen to undertake systematic studies (Kobori, 2005).

New participatory arrangements

Reflexive land and water management can also be characterized by participatory natural resources management in the form of multi stakeholder platforms or land- and water-user associations

Because the Qanat system as a socio-technical system can only operate within a suitable social context, its restoration is impossible without renewal of the traditional social infrastructure. The traditional organization of villages (Buneh) was well adapted to the optimal use of the Qanat system. A major disadvantage of the Buneh, however, was its hierarchical structure and the unequal division of labor and crops. The land reform of 1962 brought an end to this feudal situation, but at the same time it sounded the death-knell of the Qanat system.

What is needed in order to restore the Qanat system under present-day circumstances is some form of water resources management that encourages collective action with a participatory rather than a hierarchical character. Here, the concept of multi-stakeholder platforms, which has become popular as an institutional framework for resolving complex resource

management problems, could be helpful (Warner, 2007). The idea is that multiple stakeholders, who have different interests and needs with respect to water, should organize and arrange water use and conservation issues amongst them through some form of cooperation, including the building of capacity for collective learning and decision making. Today, such water-user associations are emerging in many countries of the Muslim world.

It should be noted that the planning system of the country is basically sectoral (compartmentalization). It is a top down planning, prepared by the government. Though the major parts of the plan are implemented by the people, they do not play any role in the planning process. Therefore, some of the necessary changes that have been suggested by Altieri (2002) are: a) a change of attitude and philosophy among decision makers, scientists and others to acknowledge and promote alternatives; b) a change of strategies of institutions encouraging equitable partnerships with local NGOs and farmers; a change from top-down transfer of technology to participatory technology development and to demand-driven, farmer-centred research, based on a bottom-up approach.

New ethico-religious framework: post-mechanistic ethics

As mentioned, the reflexive paradigm requires a holistic, inclusive and participatory approach to rethink land and water management within a post-mechanistic (rather than a mechanistic) framework that will provide the basis for the development, maintenance and improvement of sustainable agro-ecosystems. With respect to a post-mechanistic ethics, it is contended that the methods used to mechanistically dissect agriculture and its components need to be revised and that the non-mechanistic aspects of agricultural systems (i.e. ecological and qualitative values) need to be considered when constructing sustainable systems.

Accordingly, a possible pathway to a more reflexive land and water management in Iran and other countries of the MENA region needs to focus on the belief systems that could facilitate such a transition. As we have previously argued in chapter 4, with Francesca de Châtel (2005a; 2005b) and Nicole Stuart (2007), industrial water technologies tend to dissociate people from their natural environment. Restoration of the Qanat irrigation system could help to reconnect people with nature and to encourage greater ecological awareness and activism. To achieve this, however, more is needed than the purely technical restoration of the Qanat system and the creation of water-user associations. Presently, the general public in Iran tends to perceive this sustainable water supply system as outdated and backward.

Since religion still exerts a very big influence on Iranian society and because water plays a pivotal role within Islam, awareness campaigns based on religious principles could be very useful to counterbalance the mechanistic worldview underlying industrial modernity and the

undervaluation of water due to the influence of modern water supply technologies. As Holmes Rolston has recently remarked, 'Christianity, together with other faiths that influence human conduct, needs again to become "a land ethic".' (Rolston, 2006: 312)

According to Muslim teaching, water is a gift from God that should be freely available to all. At present, this creed leads to gross underpricing of water, which in turn results in widespread wastage. What seems to be forgotten is that the Quran also incites believers to use water sparingly. Mankind is not entitled to ruin, corrupt, pollute or destroy the environment. Any behaviour that can jeopardize the future of the natural resources, water included, is seen as an act against God and his creation. Preventing the corruption of natural resources or the pollution of water is not simply an ethical and civilized behavior but it is also an act of worship. In fact, saving water is a religious duty.

In the last decade these Islamic principles have been widely implemented in the Muslim world, including Iran, through awareness campaigns. Mosques were used as platforms for these campaigns, and imams have been properly trained in drawing the attention of the believers on water scarcity during the Khutbah, the Friday sermon. Posters, leaflets, booklets and stickers using religious terminology and imagery have also been used to promote awareness of water issues (Gilli, 2004).

New social contract between science and society, and shift to post-normal science

The reflexive turn not only asks for a reintegration of traditional and modern technologies, new participatory arrangements and a post-mechanistic ethics, but also calls for a new social contract between science and society**.** Such a contract is strongly needed not just as a procedural means to ratify the new arrangements but also as a necessary requirement to settle a concomitant crisis that is linked to the changing character of science and society in our times. It should be noted that there is a paradox in the existing relationship between science and society which is captured nicely in the following quote from Eric Hobsbawm:

> "No period in history has been more penetrated by and more dependent on the natural sciences than the twentieth century. Yet no period, since Galileo's recantation, has been less at ease with it" (Hobsbawm, 1995: 522).

On the one hand, science and technology constitute the heart of the economy and society, and arouse increasingly high expectations that they can make a positive and growing impact on society. On the other hand, advances in science and technology have been happening in such ways as to arouse equally growing scepticism or even alarming hostility. One reason is that techno-scientific expertise often fails to cope with social expectations or tends to neglect

public concerns about outcomes of techno-scientific developments that are vitally important for the whole society.

Together with the reconnection of science and society, the character of science itself should be changed in the academic arena as a consequence of the reflexive turn. The shift from certainty to uncertainty characterizes second modern society as risk society. In the wake of the 'discovery of complexity', dynamic simulation models have become widespread, guiding human interaction with complex systems, e.g. in ecosystem management, environmental decision-making and risk assessment. Therefore, epistemic uncertainty in environmental issues may call for a different type of science that differs from normal, positivist science (Haag, and Kaupenjohann, 2001:45). In other words, the image of science as an objective and impartial provider of empirical facts and rational explanations that can safely steer the course of policy and politics has fallen to pieces. Especially when very complex problems are involved like climate change, biotechnology or genomics, this traditional image of science does no longer correspond with reality.

As a consequence of the growing complexity within many scientific disciplines, uncertainties are also increasing, not only with respect to technical and methodological issues, but also with regard to epistemological and ethical questions. At the same time the decision stakes are becoming higher and higher, reflecting conflicting purposes between stakeholders. Under these conditions the puzzle-solving strategies of normal science (in the Kuhnian sense) are no longer appropriate. According to Silvio Funtowicz and Jerome Ravetz (1993), a new science is called for: 'post-normal science.'(Fig 5.3)

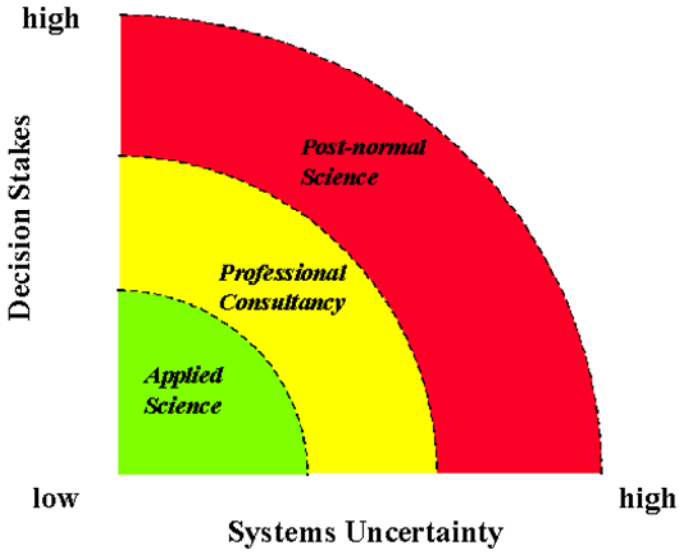

Fig 5.3. Typology of approaches to science (Funtowicz and Ravetz, 1993: 745)

The most prominent characteristic of post-normal science is the extension of the peer community. The recognition of the plurality of legitimate perspectives and ways of knowing and the inclusion of an ever-growing set of stakeholders, Funtowicz and Ravetz claim, has important implications for both society and science. 'With mutual respect among various perspectives and forms of knowing, there is a possibility for the development of a genuine and effective democratic element in the life of science' (ibid, 740/1). With the emergence of post-normal science, the practice of science 'is becoming more akin to the workings of a democratic society, characterized by extensive participation and toleration of diversity' (ibid, 754). In short: 'Post-normal science can provide a path to the democratisation of science' (ibid, 739).

The views of Funtowicz and Ravetz on normal and post-normal science are very much in line with the views of Helga Nowotny, Peter Scott, and Michael Gibbons (2001) on two types of science that they label 'mode 1' and 'mode 2' science. Mode 1 science is related to the classical view of 'pure', curiosity-driven, fundamental, or autonomous science, detached from society, and often organized on a disciplinary basis as in biology, chemistry, physics, etc. Mode 2 science on the other hand is strongly application-oriented, trans-disciplinary and intimately interwoven with society.

Current knowledge production, according to Nowotny *cum suis*, is increasingly carried out in the context of application, where problems are formulated from the beginning within dialogue among a large number of different actors and their perspectives. Because the context is set by a process of communication between various stakeholders with heterogeneous skills and expertise, mode 2 science is trans-disciplinary; it not only transgresses the boundaries between scientific disciplines but also blurs the distinction between science and society – it is hard to say where science ends and society begins. In mode 2 science and society are engaged in co-evolutionary processes. A fruitful communication between science and society is a precondition for the production of knowledge that is not only reliable but also 'socially robust.'

According to Funtowicz, Ravetz, Nowotny, and many others, science can no longer be seen as an impartial agency outside or beyond society that can supply objective measures and universal guidelines for policy making. However, as the boundaries between science and society are being increasingly blurred, societal conflicts will penetrate deeper and deeper into the heart of science itself.

5.5. Concluding remarks

This chapter has shown that the disastrous effects of industrial modernization became increasingly apparent since 1950s when the environmental crisis surfaced. In response to this

crisis, since the 1960s, the environmental movement emerged in the North. While the first wave of environmentalism had an anti-modernist stance, the second wave was less hostile towards modernity, and there was a shift to consensus and negotiation. An important approach that came with the second wave of environmentalism is 'reflexive modernity', which means not less but more modernity, a modernity radicalized against the paths and categories of the classical industrial setting. This second modernity considers nature as part and parcel of society and it is argued that 'ecological enlightenment' requires a reorientation from a focus on economic growth to one of sustainable development.

The second movement entered on the international level around 1992 when Sustainable Development and Agenda 21 as blueprints of action were embraced by the governments around the world. The notions of IWRM and SLM were adopted to achieve sustainable development and to deliberately move away from previously fragmented approaches of land and water resource management.

Scholars generally distinguish three phases in the development of land and water management since the1960s, from the passing of the high-water mark of industrial modernity via the emergence of environmentalism to the rise of reflexive modernity. Some scholars, however, believe that only the semi-arid North have passed through all three stages, while the South is still stuck in industrial modernity. However, there are also signs and indicators of a turn toward reflexive modernity in Iran, particularly since the1990s, a trend which can be documented by various changes in administrative competencies, legislation and regulations, and policies.

This reflexive turn has been further conceptualized and elaborated in this chapter in terms of new technical systems of land and water management, of corresponding social institutions and of a new ethico-religious framework that is sensitive to the specific features of the region. Towards the end of the chapter we also outlined a non-European route to reflexive land and water management for Iran and other MENA-countries. We argued that this reflexive turn not only asks for a reintegration of traditional and modern technologies, new participatory arrangements and a post-mechanistic ethics, but also calls for a new social contract between science and society and a shift from normal to post-normal science.

To elaborate this reflexive framework of land and water management, we need to know the attitudes and opinions of relevant stakeholders such as farmers and village informants, soil and water experts, and policy makers on the topics like sustainability, possibility integration of pre and modern land and water system, participation ,science and technology, nature and ethics. These attitudes and opinions will be the subject of the next part.

Part III
Empirical questions: stakeholders' opinions on the possibilities and constraints of a transition to reflexive land and water management

In Part II, the development of land and water management in Iran was sketched in terms of the technology-governance- people nexus, going from tradition through industrial modernity to reflexive modernity.

Chapter 3 has shown that the key technical system (the *Qanat* system of underground irrigation channels), the main governance institution (the *Buneh* cooperative organization of agricultural production) and the belief system (first Zoroastrianism and later Islam) of the traditional system of land and water management are highly interconnected. The traditional land and water paradigm and its strong interconnection of 'technology, governance, and people' assume that there is an intimate relationship between humans and nature. The dominant way of pre-modern land and water management is community-based. The stewardship-model, incorporating a caretaker (steward), the object of care, and the owner of the object is the foundation of the ethico-religious system. This cultural and ethico-religious framework motivated people to use water and soil, and provided the legal and governance structure to handle these scarce resources and their concomitant technologies. The social inequality and lack of individual freedom within the Buneh organization explain the appeal of the western model and the push towards the modern paradigm.

The shift from tradition to modernity was discussed in Chapter 4. Since WWII, the process of modernization evolved as the main developmental model for the less developed parts of the globe. In Iran, both the rulers and the new middle class that emerged in the 1950s considered the traditional system as backward and accepted large-scale modernization as the model for progress. Modernization brought some advantages such as increasing cultivation areas and growing production. But on the other hand, some elements of the traditional system that were important for natural resources management such as community-based organizations were ignored, due to the lack of understanding of the native context by both foreign and new domestic agents, and the speed of change compared to that of the modernization process in the West. The fact that in Iran modernization was implemented "from above", without being accompanied by democratization, resulted in further defects of "forced modernity".

The Qanat irrigation system was partly replaced by deep wells and large dams, the *Buneh* was substituted by a system of smallholding, and a mechanistic worldview emerged with important ethical ramifications. Due to the *Buneh* system's eradication and the replacement of

landlords by government agencies, the people were no longer able to collectively maintain the rural infrastructure and became dependent on the state for the necessary services. The traditional sense of land and water resources management for the benefit of the community seems to have given way to an 'every man for himself' mentality. Instead of being a vital source of life that was provided by the local environment to which people had an intimate linkage, water now became a commodity that flowed from a tap with the origin of that water being remote and someone else's business to provide. The commodification of land and water was a key part of the paradigm of industrial modernization that was based on Newtonian physics and underpinned by Baconian and Cartesian philosophy. This paradigm, which led to reductionism and the desire to control nature, was propagated by engineers who increasingly became instruments of state policies and at the same time became increasingly elitist and distant from mainstream society, ultimately losing touch with changing groundswells of grassroots opinion.

The disastrous effects of industrial modernization became apparent since 1950s when the environmental crisis surfaced. It has been outlined in chapter 5 that there were various responses to the environmental crisis in the North, ranging from the radical anti-modernism of the first wave of environmentalism to the notion of reflexive modernity of the second wave. Despite the claims of some scholars that the South has not passed beyond the stage of industrial modernity in the area of land and water management, we have shown that there are also some signs and indicators of a turn to reflexive modernity in Iran. Yet, this process has only just begun and has to be conceptualised and developed in terms of new technical systems of land and water management, of corresponding social institutions and of a new ethico-religious framework that is sensitive to the specific features of the region. In addition, the reflexive turn also calls for a new social contract between science and society and a shift to post-normal (or mode 2) science.

At the end of chapter 5, the prospects and contours of a reflexive land and water resources management in Iran were briefly outlined. We need, however, additional evidence and have to delve deeper if we want to know what the chances are that the shift from industrial to reflexive modernity will be successfully completed. One method to reach a better understanding of the problems and perspectives of a reflexive turn in Iran is stakeholder analysis. What are the attitudes of relevant stakeholders towards a more sustainable and reflexive land and water management, and how do they evaluate the chances for a turn towards such a reflexive land and water management within the current situation in Iran?

To answer these questions three stakeholder groups have been identified:

1. Farmers and village informants
2. Soil and water experts

3. Policy makers

To collect data needed for answering those questions four large-scale qualitative–quantitative studies were designed with different instruments including questionnaires, semi-structured interviews and open-ended interviews. These empirical investigations were carried out in 2007-2008 in Iran. 156 Iranian farmers and 40 village informants, who were chosen among 14 provinces around the country, took part in the semi-structured interview, the outcomes of which are the subject of Chapter 6. Also, a questionnaire was completed by 94 Iranian soil and water experts who took part in several international and national conferences, held in Iran on subjects related to sustainable use of land and water resources, and also by those who work at Iranian organizations. The results of this enquiry will be discussed in Chapter 7. Taking the results of those large scale studies into account, open-ended interviews were conducted with 12 policy makers/high level informants. The results of this research will be outlined in Chapter 8. Finally, in Chapter 9 the results of these empirical studies will be compared and some important elements for a reflexive framework of land and water management will be listed.

Chapter 6
Farmers and village informants

Drawing on the historical background sketched in the previous part, the contours of a reflexive land and water management framework in Iran have been outlined in Chapter 5. Because Iran is in a phase of transition from industrial to reflexive modernity, it is important to know the attitudes of relevant stakeholders such as farmers and villagers on topics like sustainability, technology and participation. After all, the nature and tempo of transition is dependent on these attitudes. Accordingly, to explore and examine the attitudes of farmers and villagers towards the current situation and the future possibilities of reflexive land and water management a semi-structured interview has been designed. 156 Iranian farmers and 42 Iranian village informants, who were chosen among 14 provinces around the country, took part in the interview. The results of this large survey will be discussed in this chapter in which the current perspective on land and water resources management will be sketched first (6.2.1). In section 6.2.2 the possibility of integrating traditional and modern land and water resource management will be discussed. In sections 6.2.3 and 6.2.4 the attitudes of farmers and village informants towards sustainability and technology will be explored respectively. In sections 6.2.5 and 6.2.6 the farmers' and village informants' attitudes towards science and research and towards rural institutions and farmers participation will be outlined. Finally, in section 6.2.7 the attitudes of farmers and village informants towards nature and environmental and agricultural ethics will be discussed.

6.1 Methodology

6.1.1 The village sample

In Iran, the village, not the farm is the unit of production. There are about 64,000 villages around the country and about 3,480,733 people working in these production units (Ministry of Jihad-e- Agriculture, 2002). The total of the country's cultivated land is about 15,500,000 ha. Of this area 7,000,000 ha (45%) is under irrigated agriculture (including fallow) and 8,500,000 ha (55%) is under dryfarming (Moameni, 2000). 94.25% of water withdrawal is used for agricultural purposes.

To capture the diversity of attitudes of Iranian farmers and village informants, various criteria were used to select respondents from around the country, such as climate, farming system, land and water issues, sub-culture and ethnic group. From among 31 provinces located within 10 Agro-Ecological Zones (AEZ) (Booker and Hunting, 1965), 14 provinces were selected. In each province the same criteria were used to select at least 3 villages (see Table 6.1).

Table 6.1. Distribution of villages over Agro-Ecological Zones and Provinces

	Agro-Ecological Zone(AEZ)	Province	Village
1	Central Zone	Markazi	*Noor Abad, Davoud Abad, Ghurchi bashi*
		Qom	*Gazran, Kohsefid, Malekabad*
2	Caspian Coastal Plain Zone	Golestan	*Salikandeh, Farsian, Yasaghi, Ilvar, Miandareh*
3	North-Western Zone	East Azarbaijan	*Duzduzan, Ajachi, Duzal, Gunchik, Bonab, Siahroud*
4	Central Zagros Zone	Ilam	*Ghalandar, Armo, Vali-e-Asr*
		Kermanshah	*Tang esmaiel Khan, Ghetak, Shirkavan, Ghaleh sefid sofla, Fash, Sartapeh, Marizvand olia, Kulejub*
5	Khuzestan Zone	Khuzestan	*Gelgir, Talghani2, Shavoor*
6	Arid Central Zone	Esfahan	*Shatoor, Ghalehsarban, Sharifabad, Damaneh, Garmsiri, Zavareh, Ziar*
		Yazd	*Ahmad Abad, Befruieh, Safar Abad*
7	Southern Zagros zone	Fars	*Kolahsiah, Doshmanziadi, Mahdiabad, Naresideh be sheshdeh, Murdi*
8	Southern Coastal Plain Zone	Hormozgan	*Shamil, Baghgalan, Khorchah*
9	Arid Southern Zone	Kerman	*Ghalehasgar, Negar, Zangiabad*
		Sistan& Baluchestan	*Milk, Gholkhani, Shekhlangi, Chahshor2,Urki-rasulbakhsh-bazar, Urki-osman-bazar, Urki-Abdolah-bazar*
10	Khorasan Zone	Khorasan	*Naman, Sharifabad, Asad Abad, Ahmad Abad, Farhad gard*

6.1.2. The demographic profile of the villages

The population per village is between 60 and 12500 (Mean=2372.8); the number of families is between 14 and 2300, with an average of 459.9. This demographic profile of the villages and the number of the inhabitant families confirm the account given previously by Lahsaeizadeh (1993) that villages vary considerably in area and population, from ten families in the mountain valleys to over 400 families in large villages on the plain. Total irrigated land

of villages is between 40 and 13000 hectare (Mean=1508.6), and the total rainfed land of the villages is between 20 and 7500 hectare (Mean=1450.3). It is important to note that the total irrigated land of 63.3% of the villages is less than 1000 hectare, while the total rainfed land of 72.2% of the villages is less than 1000 hectare. If we take into consideration that 45.2% of the people are crop producers and 26.2% crop and animal producers, and that 70.7% of the people own their land, we can conclude that the majority of the farmers are smallholders (see Table 6.2).

Table 6.2. Villages' demographic profile

Variable	%	Min	Max	Mean
Population of village		**60**	**12500**	**2372.8**
Less than 1000	42.1			
1000-3000	26.3			
3001-5000	18.4			
More than 5000	13.2			
Family number of village		**14**	**2300**	**459.9**
Less than 100	37.8			
100-500	27.1			
501-1000	21.6			
More than 1000	13.5			
Total irrigated land of village (hectare)		**40**	**13000**	**1508.6**
Less than 1000	63.3			
1000-3000	30.0			
More than 3000	6.7			
Total rainfed land of village (hectare)		**20**	**7500**	**1450.3**
Less than 1000	72.2			
1000-3000	11.1			
More than 3000	16.7			
People's basic activities in the village				
Crop products	45.2			
Fruits & Orchards	7.1			
Crop products and Animal products	26.2			
Above combination	21.5			
Dominant land ownership of village				
Renting	2.4			
Owning	70.7			
Partly renting and partly owning	14.7			
Owning & Sharing (*Sahmbary*)	2.4			
Above combination	9.8			

Note: %=percentage, Min=Minimum, Max=Maximum

6.1.3. Participants

The subjects of this study were 156 Iranian farmers and 42 village informants who took part in an interview, which was done by experts[57] from the Soil and Water Department branches of the Soil and Water Research Institute (SWRI) in every province. To select farmers and informants criteria such as land size, ownership, age, educational level and the farmer's place within the village were used (see Table 6.3).

Table 6.3. The participants' demographic profile

Farmers		**Informants**	
Variable	**%**	**Variable**	**%**
Level of education		**Level of education**	
Uneducated	29.2	Uneducated	16.7
Primary school	19.5	Secondary school	11.9
Secondary school	18.2	High school	2.4
High school	5.8	Graduate from high school	21.4
Graduate from high school	16.9	Associate and Bachelor	40.5
Associate, BS and MSc	10.4	MS & PhD	7.2
Age (years)		**Age (years)**	
Less than 40	32.5	Less than 40	45.2
41-60	49.3	41-60	47.7
More than 60	18.2	More than 60	7.2
Basic Activities		**Job**	
Crop products	56.5	Villager(*Dehyar*) & Rural service center associate	8.4
Fruits & Orchards	5.8	Agriculture and management expert	27.8
Animal products	0.6	Farmer	47.2
Above combination	37.1	Physician, social and office worker	16.6
Irrigated land size (hectare)		**Present living location**	
Less than one	6.3	Resident of Village	62.2
1 - 5	43.7	Out of Village	37.8
5-10	22.5		
Bigger than 10	27.5		
Rainfed land size (hectare)			
Less than one	16.9		
1 - 5	38.5		
5 -10	26.2		
Bigger than 10	18.5		
Land ownership			
Renting	4.5		
Owning	76.9		
Partly renting and partly owning	13.5		
Sharing(*Sahmbary*)	5.1		

[57] M. Dadivar, R. Vakil, G. Roshani, A. Baybordy, K. Siavashi, J. Ghaderi, M.H, Mousavifazl, M. Solhi, F. Dehghany, G. Moafpourian, J. Saleh, H. Naghavii, M.A, Ghanbarpuri, M.R, Pahlavan, P. Keshavarz

The majority of informants (69.0%) are highly educated (high school and higher); 36.2 percent work in agricultural governmental organizations in relation to the village; 47.2% are farmers who live in the village for most of the time; and 16.6 percent work in the other sectors. 62.2% of the informants are resident of the village while the rest were once resident in the village and still have contacts within the village. Given the distribution of levels of education, of age and of basic activities over the participants, the answers to our questions can be accepted as representative of the attitudes of Iranian farmers and villagers.

72% of the farmers' irrigated land and 81.5% of their rainfed land is less than 10 hectare, which confirms the domination of smallholding in the country. In addition, the majority of the farmers (76.9 %) are owner of their land, which is a consequence of the 1962 land reform. Momeni (1999) has indicated that smallholding has the following disadvantages:

- some farms are too small to economically support individual families;
- the use of machinery on small scattered holdings in irregular plots distributed over village territories is often inefficient;
- because land is worked individually, mobilization between the mosaics of tiny fields requires long journeys;
- because of fragmented land ownership and the distances between farms, it is difficult to introduce consolidation [58] and mechanization efficiently;
- every farm needs separate equipment for land preparation, sowing, harvesting and irrigation; and
- when farms are below a certain size, the use of new technologies is not feasible for the farmers.

This shows the importance of land consolidation and of new participatory rural institutions, which the government should promote in order to overcome the disadvantages of smallholding.

6.1.4. Instrument and data analysis

In order to collect data needed for answering the research questions, a semi structured interview was produced. Based on previous research in the field (Kulshreshtha & Brown. 1993; Schoon & Grotenhuis, 2000; James, 2004; Minteer *et al.,* 2004; Karbasioun, 2007) several items were formulated, which were validated through consultation with experts in the field and the supervision committee of the PhD study. The final semi structured interview for the farmers and informants included 35 and 46 open questions, 89 and 77 closed questions in 7 and 6 different parts respectively. In designing the closed questions, a 5-point Likert-type

[58] Land consolidation is reallocation of parcels to remove effects of fragmentation which is associated with broader social and economic reforms. http://www.fao.org/DOCREP/006/Y4954E/y4954e06.htm (last accessed 24 April 2009)

scale was applied. A quantitative method of data analysis was applied. Descriptive statistical analysis and non-parametric statistical methods were used.

6. 2. Results and discussion

The results of the study about respondents' attitudes which have been acquired through the semi-structured interview are presented below.

6.2.1. Current perspective on land and water resources management

The first cluster of questions was about water resources and irrigation methods. As can be seen from Table 6.4, underground water is the main water resource in the villages, with (semi-deep wells as its dominant technology of exploitation for agricultural use (46.4%) and non-agriculture use (52.0%). 61.6% the applied irrigation methods are flood irrigation, whereas modern irrigation systems such as sprinkler and drip irrigation are in the minority.

Table 6.4. Water resources and irrigation methods

Variable	**%**
Village water resources for agricultural use	
Qanat	3.3
Semi and deep well	46.4
Spring	1.3
River	28.5
Dam's irrigation network	3.3
Above combination	17.2
Village water resources for non-agricultural use	
Qanat	3.3
Semi and deep well	52.0
Spring	7.2
River	7.2
Dam (*irrigation network under dam*)	1.3
Tap water	22.4
Natural water storage (*makhazen chah nime*)	6.6
Conventional farm irrigation methods	
Flood irrigation	61.6
Furrow irrigation	7.9
Sprinkler irrigation	2.0
Drip irrigation	2.0
Flood irrigation & Furrow irrigation	21.2
Above combination	5.3

Table 6.5 shows that the majority of farmers (60.0%) have (semi-) deep wells. Moreover, except for some farmers who need no well because they are using water from the irrigation network of a river and a dam, all the others would also like to have (semi-) deep wells. But they are confronted with some constraints such as high costs of establishing, maintaining and repairing wells, the salinity of the underground water, and difficulties to get permission for well digging from the government[59]. Although (semi-) deep well technology increased the exploitation of water and thereby increased the farmers' independency, it also confronted them with the scarcity of water by the decline of the ground water table, by the reduction every year of the volume of effluent water, and by the salinization of water.

Table 6.5. Main advantages and disadvantages of (semi-) deep wells and the farmers' main reasons for not employing them

Having semi or deep well	Yes (60.0 %)	Main Advantages	*Increasing water exploitation* *Availability of water whenever is needed* *Water is in the hand of farmer(independency of farmers)* *Cost reduction* *Easiness of water transfer* *Easiness of work*
		Main Disadvantages	*Establishment, maintenance and repairing costs are high* *Lowering of ground water table level* *Reducing the volume of effluent water every year* *Salinization of water*
	No (40.0 %)	Main reasons of not having	*Using water from the irrigation network of a dammed river* *High costs of establishment (digging)* *Salinity of underground water* *Difficulty of getting permission for well digging from the government*

The majority of informants believe that village people participate in the protection costs of water resources in the village by paying administrative fees. Moreover, they stated that there are kinds of cooperation such as the planning of water distribution and the cleaning and protection of canals. Some of the farmers who have (semi-) deep wells, however, do manage to run their farm individually which makes them less willing to engage in cooperative action.

[59]According to governmental law, in some areas in the country which are confronted with serious water scarcity digging of wells is restricted.

The second cluster of questions about the current perspective on land and water management was about land consolidation. It appeared that 77.6 percent of farmers in our sample were familiar with land consolidation. However, only 28.1 percent of them participated in the land consolidation projects. This is also confirmed by the majority of informants. Disagreements are one of the main reasons for preventing farmers to participate in land consolidation (54.8%). Some of the main reasons, mentioned by the farmers as sources of disagreement are cultural differences, differences in soil fertility and land size, disputes among owners because of the increasing number of owners due to the division of land according to the family inheritance right, and the fear of owners that their private ownership could be violated,. As indicated before, smallholding is the dominant system of land use, whereas land consolidation is one of the main strategies of the Iranian government towards sustainable land use. To successfully implement land consolidation under present conditions of smallholding more cooperation is needed, but this is difficult to achieve because of the aforementioned disagreements.

Another set of questions about the current situation concerns the farmers' assessment of the soil fertility status and their suggestions for its improvement. The majority of farmers (52.5%) is using chemical fertilizer according to its availability and price; only 28.4% is using fertilizer according to the results of soil tests, which is the most important method of balanced fertilization. It is important to note that soil testing has been introduced at the national level during last decade[60].

Table 6.6. Current status of soil fertility compared to the past status

		%	Main reasons
Soil fertility	Increased	46.5	*Using chemical fertilizer* *Using manure and applying crop rotation* *Working with agriculture experts*
	Didn't change	13.2	*Method of cultivation has not been changed*
	Reduced	40.3	*Intensive cultivation* *Not using manure, not applying crop rotation and burning crop residual* *Overusing of chemical fertilizers* *Reduction of water for irrigation and water salinization*

[60] In Iran, regional experiments were done first; based on the findings of these experiments, some regional recommendations were prepared. Later on, fertilizer recommendations were introduced by the Soil and Water Research Institute (SWRI) based on soil testing or leaf analysis to improve soil fertility, so more than 50 private soil testing labs have been established all over the country. The current facilities allow extending soil testing and plant analysis over the whole country. To justify the agricultural activities, a committee (The High Council for the Promotion of Biological Materials and Optimal Use of Fertilizers and Pesticides in Agriculture) was established in 1995 at the Ministry of Agriculture, aiming at reducing the use of chemical pesticides by 40%, and promoting the combined use of chemical and organic fertilizer for the purpose of protecting the environment and agricultural resources through maintaining a desirable level of soil fertility (Balali *et al.*, 2003)

With regard to their views on the soil fertility status, farmers can be divided into 3 groups (see Table 6.6). The first group includes those who believe that soil fertility has increased compared to the past status (46.5%). The use of chemical fertilizer is mentioned as the main reason for increasing soil fertility by this group. The second group (40.3%) believes that soil fertility has been reduced. As the main reason for this decline of soil fertility, intensive cultivation is mentioned by this group. Not using manure, not applying crop rotation and burning crop residual are also mentioned by members of this group. If we take into consideration that most farmers are smallholders under severe economic pressure to cultivate their land every year or even twice a year, we can understand why crop rotation is no option and why they have to burn their crop residual. Using manure is the main alternative method for increasing soil fertility mentioned by these farmers (64.0%). However, the majority cannot afford this alternative because it is too expensive. Other important indications for the decline of soil fertility are the reduction of water for irrigation and the (human-induced) salinization of water. The third group of farmers (13.2%) believes that soil fertility has not changed. Their main reason is that the method of cultivation has not been changed.

In order to evaluate the findings about the current situation, a comparison with the past situation is helpful. In chapter 3, it was indicated that the general pattern of land ownership in Iran prior to the land reform of 1962 was a combination of large-scale feudal landownership with small-scale absentee and peasant proprietorship (Lahsaeizadeh, 1993). Because of the importance of artificial irrigation to Iranian agriculture, sharecropping (*muzara-eh)* was dominant among the different types of relationship between peasant and landowner. In the arid and semi-arid areas of the country, a cooperative form of organization of agricultural production, buneh, prevailed. These cooperative units of production were developed in Iranian villages in response to the challenges posed by a harsh natural environment and the environmental constraints arising from the scarcity of production factors, especially water. The buneh had evolved as a complex social organization for agricultural production with distinct cultivation and water rights and semi-structured farm management.

However, the current perspectives of the villages on land and water resources and their management reveal a drastic change. Regarding water resource use, the above-mentioned information confirms a regime change of underground water exploitation and the domination of (semi-) deep well technology, which has been introduced during the land reform of 1962 and has replaced the Qanat irrigation technology, which was the dominant traditional technology in many parts of country for the exploitation of water. This modern technology allowed farmers to cultivate more land and to increase their independency, but it also brought some drawbacks such as the decline of ground water tables because of overexploitation of water, the reduction of the volume of effluent water, and the salinization of water. As a result, since the 1960s, the volume of exploited groundwater has increased by 2.7 times (Ardekanian,

2005), confronting the country with a negative underground water balance. Although individual practice in relation to water management is growing, informants believe that people still share the protection costs of water resources by paying administrative fees and that they also still engage in cooperative activities regarding the management of water resources.

With respect to land use, our findings show that private ownership and smallholding is the dominant land use pattern, which is also a consequence of 1962 land reform. Whereas the majority of farmers are familiar with land consolidation - one of the main strategies of government towards sustainable land use - only a minority actually participates in land consolidation. The main reasons which prevent farmers to participate in the implementation of land consolidation are disagreement among the farmers themselves and their distrust of governmental agencies.

Regarding the use of agricultural inputs such as chemical fertilizers, farmers generally still use them according to their availability and price, although there is growing awareness of soil testing as the most important strategy for balanced fertilization.

Finally, the findings show that farmers differ in their perception of the current condition of soil fertility, one of the basic elements of global food security. Apart from a small group of farmers who believe that soil fertility has not changed, there are two groups, one that believes that soil fertility has increased, especially because of the use of chemical fertilizers, and another one that believes that soil fertility has declined because of intensive cultivation and overuse of chemical fertilizers. What is important to highlight here, is that with the prevailing land use pattern of smallholding, and with economic pressure on farmers, intensive cultivation is dominant and practices such as crop rotation, which are vital to sustainable land use, are being ignored. It is especially important to recognize that farmers have knowledge of these practices and also of the importance of manure. Economic factors are the main reason why farmers do not perform these practices any longer. This is what James (2004) had in mind when he tried to show that the use of machinery in agricultural production results in greater productivity per unit of human effort, thus lowering the average costs of agricultural production. This creates downward pressures on farm prices even as input costs have increased (consistent with inflationary norms). The downward pressure on prices resulting from increased production and productivity has been called a ‘technological treadmill’ by Cochrane (1958). As Thompson (1998: 108) has put it, ‘agricultural technology increases farm productivity, but this in turn lowers prices, forcing individual farmers to run faster just to stay in place.’ This is, as James (2004) has concluded, the *economic context of ethics in agriculture*: the industrialization of agriculture and the resulting technological treadmill on which farmers are increasingly being forced to run is a result of technological change as well as social preferences for low-cost, high-quality food.

In the next section, the attitudes of farmers and informants toward the integration of traditional and modern ways of agriculture, sustainability and so on, which must be considered in the conceptual framework of reflexive land and water management, will be discussed.

6.2.2. Traditional and modern land and water resource management and their possible integration

First, farmers and village informants were asked how they evaluate traditional and modern ways of using water and arable land in terms of sustainable land and water management. According to Table 6.7, they estimated the total costs of past methods to be lower than that of the new methods. On the other hand, the difficulties of working with past methods were assessed as being higher than with present methods. For instance, Qanat digging was hard and labor intensive compared to well digging that is driven by diesel or electricity instead of human muscle power. While income and efficiency of past methods were valued as lower than present methods, the sustainability of past methods was valued higher than the present methods by most farmers and informants. The volume of water that can be extracted and the salinization of water are some of the criteria for comparing sustainability by farmers and informants (see also Table 6.5).

Table 6.7. Farmers' and informants' comparison of past and present methods of water use

	Aspects	Past		Present	
		advantage	disadvantage	advantage	disadvantage
Farmers	Costs	84.3% =Low			85.4=High
	Difficulty of work		86.5%=High	86.5%=Low	
	Income and efficiency		87.4%=Low	88.1=High	
	Sustainability	79.7%= High			78.7%=Low
Informants	Costs	92.9%= Low			85.7%=High
	Difficulty of work		93.1%=High	90.3%=Low	
	Income and efficiency		93.8%=Low	94.1%=High	
	Sustainability	90.5=High			88.2%=Low

Next, farmers and informants were asked whether they were in favor of traditional or of modern methods of land and water management. With respect to this question there was a sharp division into two groups (see Table 6.8). While 49.3 % of farmers were in favor of the

traditional way of farming, 50.7 % believed the modern way to be better. It is important to note that it is difficult to continue using traditional methods because, although these methods are seen as more environmentally friendly and sustainable in the long run, in practice economic pressures force farmers to use more agricultural inputs to compensate for the costs of their daily life. The group who was in favor of the modern way of farming pointed out the need to increase production in order to have enough income; they felt that the protection of the environment was not their responsibility. Although both groups have different views on the traditional and modern way, in practice, however, they act in the same way.

Table 6.8. Farmers' opinions on traditional and modern agricultural methods with respect to environmental and production issues

Agricultural way	%	Main reasons
Tradition is better	49.3	*Without or less use of chemical fertilizer* *Low manipulation of nature* *Less irregular use of chemical fertilizer and pesticides* *Less environmental pollution* *Less use of technology*
Modern is better	50.7	*Increase of production and income* *Easiness of work because of using technology* *They are more scientific*

Finally, farmers and informants were asked if they see possibilities for the integration of traditional and modern land and water management systems.

Table 6.9. Farmers' opinion on the possibilities for integrating traditional and modern irrigation and cultivation methods

		Main reasons
Integration of traditional and modern irrigation and cultivation methods is possible	Yes (49.2 %)	*-Their integration can increase efficiency and productivity* *-Through integration some limitations of traditional methods can be compensated* *-In traditional methods there was a kind of cooperation such as distribution of water, which should be transferred to modern methods*
	No (50.8%)	*-Using traditional methods in large- scale cultivation systems is impossible* *-Modern methods are scientific and more efficient* *-With modern methods we do not need old methods* *-We are more familiar with traditional methods* *-Traditional methods are better than modern methods*

Tables 6.9 and 6.10 show that farmers and informants can be divided into more optimistic and more pessimistic groups with respect to the possibility of integration of traditional and modern land and water systems. The optimistic group of farmers believes that the disadvantage of traditional methods can be compensated by the right use of modern methods. To this end, they suggest that farmers and experts should work together in the field, and emphasize the need of scientists to communicate with farmers and share each other's knowledge in the whole process of farming (bottom-up approach) instead of using a top-down approach

Table 6.10. Informants' views on the possibilities of integrating traditional and modern land and water management systems

Integration of traditional and modern land and water systems is possible		**Main reasons**
	Yes 67.5% How	*-Through working together of farmers and experts in the field* *-Through efficient management in the village* *-Through integration of indigenous knowledge of farmers and expert knowledge* *-Through correction of old system such as revitalization of Qanat with modern technology, using flood irrigation in the first step of cultivation and continuation of irrigation by sprinkler in the saline soil and also minimum tillage* *-Using drip irrigation in the small field can be helpful* *-Through combination of organic and chemical agricultural inputs*
	No 32.5% why	*- They are irreconcilable* *-Using traditional methods in large- scale cultivation systems is impossible* *- Experts are not familiar with both systems therefore, integration can fail*

The more pessimistic group can again be divided into two clusters. Some farmers favor tradition because they are more familiar with traditional methods and consider traditional methods to be better than modern methods. Other farmers are in favor of the modern system because they believe that traditional and modern methods are irreconcilable, that using traditional methods in large-scale cultivation systems is impossible, and that modern methods are more scientific and efficient.

This section shows that farmers and informants are aware of the advantages and disadvantages of both past and present methods of water use. On the one hand the total cost of past methods is considered to be lower than that of the new methods, but on the other hand the present working conditions are seen as less harsh than the past working conditions. The farmers feel that in the long run the past methods were more sustainable and environmentally friendly than the present methods, but they also think that the past methods were less profitable and efficient than the present methods. Because of current economic pressures, they have to use more agricultural inputs to compensate the costs of their daily life, which makes it difficult to continue using traditional methods. Although traditional methods were well adapted to subsistence agriculture, they are not able to generate enough production for the current population which is far higher than in traditional times.

Regarding the possibilities of integrating traditional and modern methods, on the one hand there are optimists who believe that some of the disadvantages of traditional methods can be compensated by combining them with modern methods, and on the other hand there are pessimists who either favor traditional or modern methods.

6.2.3. Attitudes towards sustainability

This section is about the farmers' knowledge of concepts related to sustainable agriculture, their skills with respect to certain sustainable practices and their willingness to perform those practices.

Table 6.11. Familiarity of farmers with the concepts related to sustainability

Familiarity with the concepts in relation to sustainability (Cronbach Alpha=0.88) (Number of loaded Items=5)	**Farmers**		**Informants**	
	Mean 2.35	**SD**	**Mean 2.62**	**SD**
Biological control	2.06	1.102	2.12	.968
Biodiversity	2.04	1.029	2.29	1.088
Sustainable agriculture	2.38	1.075	2.74	1.106
Appropriate use of pesticides and chemical fertilizer	2.88	1.135	3.29	1.111
Organic agriculture	2.49	1.101	2.68	.986

Note: 1= nil, 2= low, 3= medium, 4=high, 5=very high, SD=Standard Deviation

Both farmers and informants consider the familiarity of farmers with the concepts related to sustainability generally as less than medium (Mean=2.35 and Mean=2.62) (see Table 6.11). They show, however, a higher familiarity with the concepts of '*sustainable agriculture*' (Mean=2.38 and Mean=2.74) and especially of 'a*ppropriate use of pesticides and chemical fertilizer*' (Mean=2.88 and Mean=3.29). This may have been induced by the activities initiated by the committee of *The High Council for the Promotion of Biological Materials and Optimal Use of Fertilizers and Pesticides in Agriculture*', established in 1995 at the Ministry of Agriculture (see footnote 60).

Also, the farmers' knowledge of and willingness to perform a selection of 18 sustainable practices was measured (Fig 6.3 and Fig 6.4), the outcomes of which were reliable (Cronbach Alpha= 0.93). Both farmers and informants considered the knowledge and skills of farmers with respect to these practices as medium (Mean=3.13, Mean=3.07 respectively) which testifies to their positive attitudes towards sustainability. While farmers believe their willingness to perform sustainable practices slightly higher than their skills (Mean=3.38), informants believe farmers willingness to perform is lower than their knowledge (Mean=2.79)

The knowledge and willingness of farmers with respect to concepts such as '*cultivation of legume*', '*ISFM*', '*IPM*' and '*biological control*' are less than medium. These concepts are new and have been introduced recently. Farmers also claimed that these concepts are not only new for them but also for the experts. Finally, what is important to stress here is that the knowledge and skills of farmers with respect to '*improved fallows*' (Mean=3.39) score higher than their willingness to perform (Mean= 2.95), which is confirmed by informants. This again illustrates the importance of the country's economic context and the trend to intensive cultivation as main driving forces of the farmers' action and behavior in spite of their knowledge and skills. As already indicated, because most farmers are smallholders who have to cultivate their lands every year, they cannot leave their land fallow. From this example one can learn that there is no linear correlation between knowledge and behavior; more knowledge will not automatically lead to better behavior.

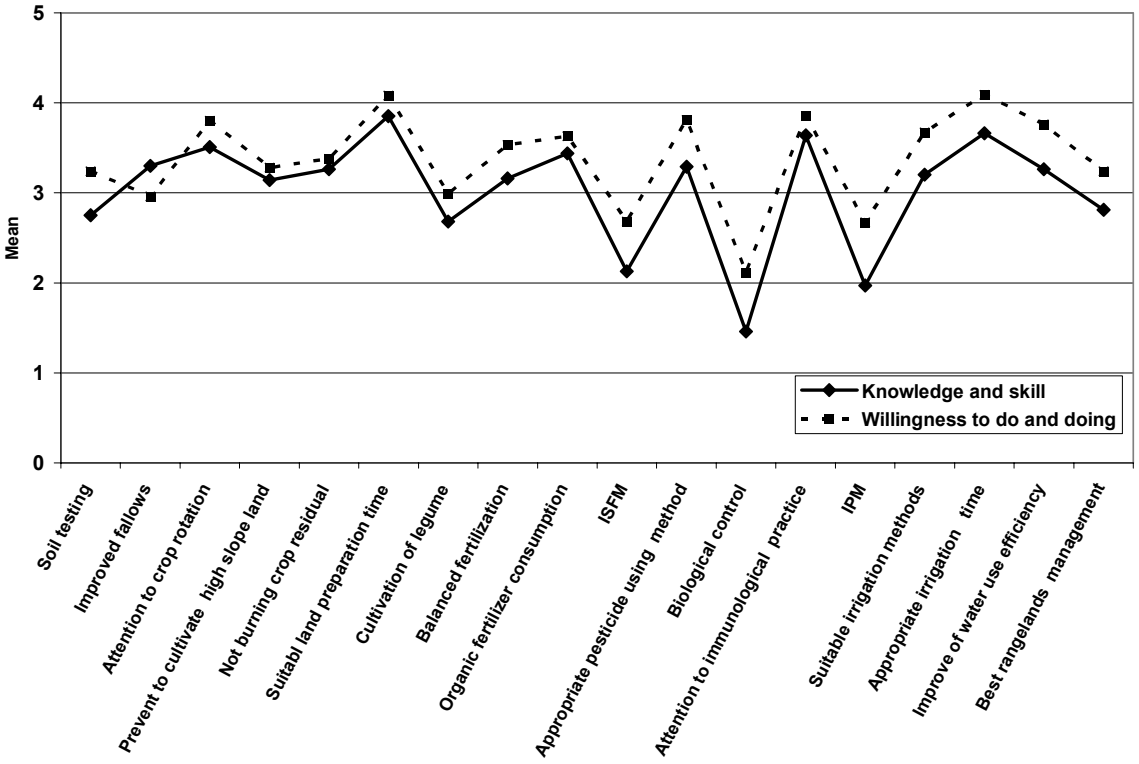

Fig 6.3. Farmers' opinions about their knowledge and skills with respect to sustainable agriculture and their willingness to perform (*Note: 0=nil, 1=very low, 2= low, 3= medium, 4=high, 5=very high)*

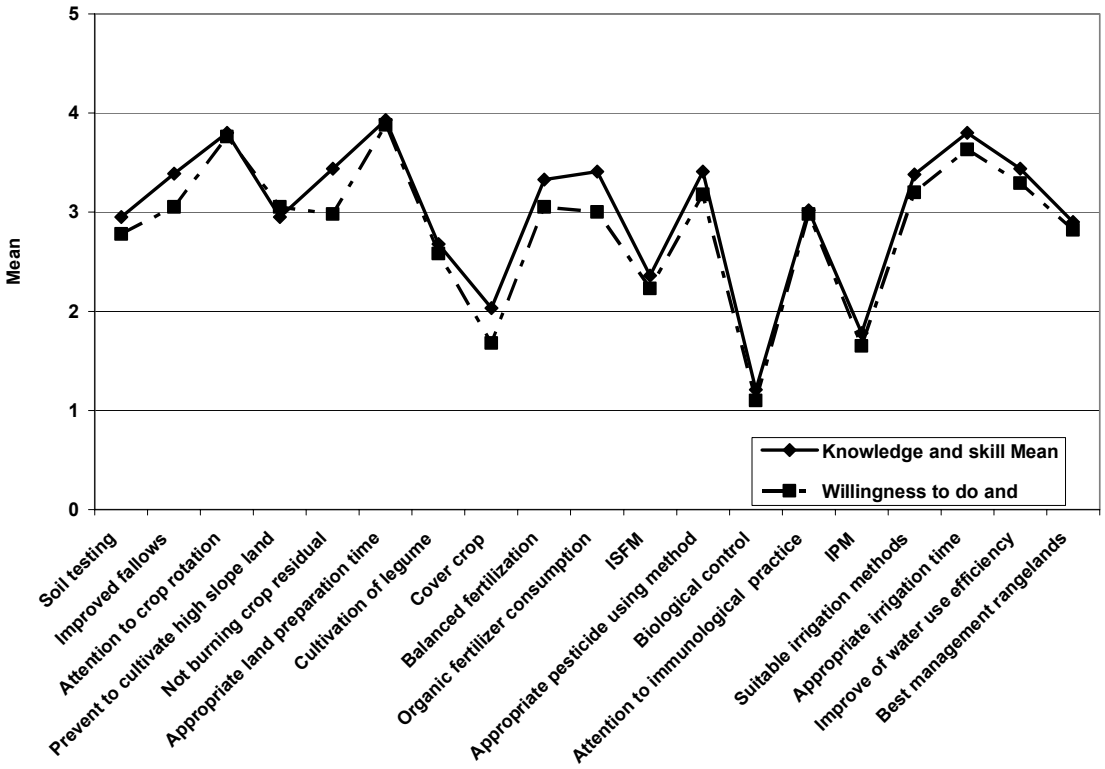

Fig 6.4. Informants' opinions about the knowledge and skills of farmers with respect to sustainable agriculture and their willingness to perform (*Note: 0= nil, 1=very low, 2= low, 3= medium, 4=high, 5=very high)*

In the previous section (6.2.2), farmers who were asked to compare the sustainability of traditional and modern methods of water use, measured sustainability against such criteria as availability of water and its quality (see Table 6.7). In this section they were asked about their understanding of general scientific concepts related to sustainability (see Table 6.11) that had been introduced in recent times. The farmers' familiarity with those concepts scored less than medium, with the exception of '*sustainable agriculture*' and especially of 'a*ppropriate use of pesticides and chemical fertilizer*'. But, farmers' familiarity with the 18 selected sustainable practices scored higher than their familiarity with general scientific concepts.

6.2.4. Attitudes towards technology

As can be read from table 6.12, farmers generally have a positive attitude towards technology; they believe that the advantages of technology outweigh its disadvantages (Mean=3.44). Moreover, they are more in favor of modern technology (Mean=3.47) than of traditional technology (Mean=3.35). In particular, they favor (semi-) deep wells (Mean=3.69) more than Qanats (Mean=3.35) as sources of water exploitation. Informants were also asked to score farmers' perception of technology, and they confirmed that farmers are very positive (Mean=4.71) towards modern technology, such as tractors, chemical fertilizers and (semi-) deep wells. Informants believe this is mainly because of modern technology's impacts on '*increasing production, increasing income* and *easiness of agricultural activities'*. Among modern technologies, farmers gave a low score to sprinkler and drip irrigation systems (Mean=3.09, Mean=3.12) which is also indicated in the table 6.4.

Table 6.12. Farmers' attitude towards traditional and modern technology

Attitude towards technology	**Technology**	**Mean 3.44**	**SD**
Modern technology Mean = 3.47	Semi/Deep well	3.69	.660
	Tractor	3.94	.231
	Chemical fertilizer	3.60	.583
	Chemical pesticide	3.49	.648
	Sprinkler irrigation	3.09	1.186
	Drip Irrigation	3.12	1.113
Traditional technology	Qanat	3.35	1.035

Note: 1= Doesn't have any advantages, 2= Disadvantages more than advantages, 3= Advantages more than disadvantages, 4= Completely useful, SD=Standard Deviation

6.2.5. Attitudes towards science and research

Both farmers and informants consider the attitude of farmers towards science and research generally to be positive (Mean=3.88; Mean=3.86). This is measured indirectly through items which are shown in table 6.13. For instance, both farmers and informants believe that the relationship of farmers with agricultural extension experts (Mean=4.14, 4.07) and the Rural Service Centers (RSC) (Mean=4.07, 4.17) has improved since 20 years ago. It is also confirmed by 86.2% of the farmers and 92.8% of the informants that the recommendations of agricultural experts are useful or very useful. Moreover, the majority of farmers (81.8%) apply experts' recommendations to a large extent (Mean=3.99) in their fields. Main reasons for farmers to use those recommendations are because of increasing production (57.9%), income (10.5%) and efficiency of resource use (13.2%).

Table 6.13. Farmers' attitude towards science and research

Attitude towards science and research (Cronbach Alpha=.78), (Number of loaded Items=4)		**Farmers**		**Informants**	
		Mean 3.88	**SD**	**Mean 3.86**	**SD**
Relation with agricultural extension experts and RSC compared to 20years ago	Relation of farmers with the agricultural extension experts	4.14*	.833	4.07*	.894
	Relation of farmers with Rural Service Center (RSC)	4.07*	.873	4.17*	.834
Efficiency of experts' recommendations	Usefulness of agricultural experts, extension and RSC advice	3.26**	.707	3.38**	.623
	Application of agricultural experts and extension experts recommendations	3.99***	.707		

Note:

** 1= reduced considerably, 2= reduced, 3= did not change, 4=increased, 5=increased considerably*

*** 1= not useful, 2= a little useful, 3= useful, 4= very useful*

**** 1= nil, 2= very low, 3= low, 4= high, 5=very high, SD=Standard Deviation*

In addition to the closed question items presented in the table 6.13, farmers were asked to illustrate expert recommendations which they have accepted or refused, and the reasons of their acceptance or refusal. The farmers indicated that they benefited from thirty of the expert recommendations. The main reasons why farmers follow those recommendations are increase of production (61.0%) and increase of income (15.3%). Farmers also indicated that they are not willing to adopt nineteen expert recommendations. '*Not burning of crop residual*' is one of the main recommendations that farmers refuse to accept despite its added value for sustainable agriculture. Following this recommendation would postpone cultivation. Because the majority of farmers are smallholders who live under the pressure to cultivate the land twice a year, and also every year, there is not enough time to protect crop residual before the second cultivation time. As a result, farmers have to burn crop residual in order to prepare the

land for the second cultivation. Other recommendations that many farmers were not ready to accept are '*sprinkler irrigation*' and '*land consolidation*'.

In this section we have shown that farmers are positive towards science and research and that their relationship with experts and the RSCs has improved in recent times. But on the other hand, it has also become clear that some expert recommendations are not being followed because of the economic circumstances of the majority of farmers. This especially concerns recommendations that require cooperation such as land consolidation and also recommendations that can only be more effective in the long run.

6.2.6. Attitudes towards rural institutions and farmers participation

In another cluster of questions farmers and informants were asked, firstly, whether there was any traditional cooperative system in their villages and whether it was still working. Secondly, they were asked how they perceive and evaluate current rural institutions. Thirdly, they were asked if there were any changes with respect to collective action of farmers compared to 20 years ago, and how they assess the government's role in promoting farmers participation during this period. Finally, the informants were asked how they assess farmers' cooperation in land and water management projects.

Existence of traditional cooperative system and traditional participation

Asked about the existence of traditional cooperative systems, 22.9% of the informants stated that these systems were still in operation in their villages. Among the reasons for the abandonment of traditional cooperative systems that informants mention are *'land reform', 'increase in the number of owners because of inheritance', 'degradation of Qanat'* and *'local issues'*. Moreover, informants stated that in the past there was traditional participation and collective action in the village such as '*land preparation and cultivation', 'irrigation and harvesting', 'cleaning of canal and Qanat',* and also *'distribution of water'*, practices that are still performed by some of the farmers. People also participated in the building of public baths and mosques, and in the management of the traditional cooperative system.

Farmers and informants' perception of rural institutions

In 45.2 % of villages there are several kinds of rural institutions. Among Agricultural Production Cooperatives (APCs), the 'rural production cooperative' (*tavoni tolid*) is the most widespread of these institutions (36.8%) (Table 6.14).

Table 6.14. Rural institutions and farmers' membership

Variable	%	Variable	%
Kind of institutions in the village		**Farmers' membership in:**	
RPC (*tavoni tolid*)	36.8	RPC (*tavoni tolid*)	36.2
Cooperative societies (*sahami zeraie*)	2.8	Cooperative societies (*sahami zeraie*)	1.4
Mosha cooperative	2.1	*Mosha* cooperative	2.1
Water association (*tavoni abbaran*)	0.7	Water association (*tavoni abbaran*)	1.4
Combination of above institution	2.8	No one	58.9
No one	54.8		

41.1 % of the farmers is a member of one of the rural institutions; 36.2% of them is a member of a 'rural production cooperative' (*tavoni tolid*). Informants and farmers who are not members of any rural institutions impute the absence of a rural production cooperative (*tavoni tolid*) in the village to '*lack of information about importance of rural production cooperative* (*tavoni tolid)', 'lack of enough guidance by government', 'lack of farmers' enthusiasm for collective actions', 'farmers' preference for independent working' and 'dissatisfaction with rural cooperatives*'. Informants also mention *'lack of need for cooperation because of having an individual/private (semi-) deep well'* as one of the main reasons for the lack of a water association (*tavoni ab baran*) in the village.

According to table 6.15, farmers and informants are not very optimistic about the efficiency of rural institutions; they believe the disadvantages of these institutions outweigh their advantages (Mean=3.80, Mean=3.92). They are, however, more positive about the 'rural production cooperative (*tavoni tolid*)' (Mean=4.38, Mean=4.41) as one of the modern Agricultural Production Cooperatives (APCs) and also about the 'village council' (Mean=4.37, Mean=4.67) that was introduced less than 10 years ago. They believe that both are efficient and that their advantages prevail over their disadvantages.

Table 6.15. Farmers and informants' attitude on the efficiency of rural institutions

Attitude towards rural institutions' efficiency (Cronbach Alpha= .87),(Number of loaded Items=6)	**Farmers**		**Informants**	
	Mean 3.80	**SD**	**Mean 3.92**	**SD**
Agricultural Production Cooperatives (APCs)				
Rural production Cooperative (*tavoni tolid*)	4.38	.963	4.41	.910
Cooperative societies (*sahami zeraie*)	3.59	1.345	3.50	1.333
Mosha cooperative	3.56	1.241	3.74	1.094
Industrial farm (*Keshto sanat*)	3.52	1.330	3.94	1.209
Water association (*tavoni abbaran*)	3.59	1.317	3.58	1.259
Village council	4.37	1.024	4.67	.662

Note: 1=I don't know, 2= Don't have any advantages, 3= Disadvantages more than advantages, 4= advantages more than disadvantages, 5= Completely useful, SD=Standard Deviation

As was indicated in Chapter 4 (section 4.3.2), the modern Agricultural Production Cooperatives (APCs) were established in Iran in the early 1970s in order to increase the production of the large number of small and fragmented production units that were the consequence of the 1962 land reform. After the Islamic Revolution of 1979, some rural production cooperatives were dissolved. After 1996, however, the establishment of APCs became a major strategy of the Ministry of Agriculture in its efforts to achieve agricultural development and increase production. Although the number of APCs grew rapidly, they were unsuccessful in achieving land consolidation and group work, which were the main reasons for their establishment (Karami and Rezaei-Moghaddam, 2005). Karami and Rezaei-Moghaddam (2005) argue that due to the rapid expansion, the government has not been able to provide as much support and leadership to them as it did to earlier APCs.

Farmers' and informants' assessment of change of collective action, attention to integrated management, and role of government in improving farmers' participation compared to 20 years ago

In general, farmers and informants are moderately optimistic about positive change of collective action and participation (Mean=3.54, Mean=3.65) compared to 20 years ago (table 6.16).

Table 6.16. Attitudes towards collective action and participation

Attitudes towards collective action and participation (Cronbach Alpha= .79),(Number of loaded Items=6)	**Farmers**		**Informants**	
	Mean 3.54	**SD**	**Mean 3.65**	**SD**
Attentiveness of farmers to collective actions	3.35	1.182	3.19	1.110
Necessity of farmers' participation in the villages' civil and infrastructure projects	3.64	.969	3.62	.882
Attentiveness to Integrated Land and Water Management (ILWM)	3.49	.859	3.53	.679
Attentiveness to Integrated Pest Management (IPM)	3.48	.907	3.58	.747
Request of government from the people to increase their participation	3.79	.890	4.17	.834
Establishment of opportunities for participation of people by government	3.51	1.015	3.98	.715

Note: 1= reduced considerably, 2= reduced, 3= did not change, 4=increased, 5=increased considerably, SD=Standard Deviation

66.8% of the farmers and 73.8% of the informants believe that the necessity for farmers' participation in the civil and infrastructure projects of the villages has increased. On the whole, they believe that the attentiveness of farmers to collective action has slightly increased

(Mean=3.35, Mean=3.19). However, 22.6 % of the farmers and 11.9% of the informants think the need for participation has not changed, while 27.1% of the farmers and 35.8% of the informants stated that the attentiveness of farmers to collective action has decreased compared to 20 years ago. As can be seen from table 6.16, farmers and informants believe that government's requests for participation (Mean=3.79, Mean=4.17) and providing opportunities for the people to participate in rural projects (Mean=3.51, Mean=3.98) have moderately increased. A possible explanation is the introduction of village councils that are evaluated positively by farmers and informants (see Table 6.15). Moreover, farmers and informants believe that there is a slight increase in the attentiveness to integration management such as ILWM (Mean=3.49, Mean=3.53) and IPM (Mean=3.48, Mean=3.58), which is one of the main governmental strategies for improving participation.

The informants are moderately positive (Mean=3.38) about the people's participation in land and water projects. The majority of informants (92.1%) believe that people cooperate in various ways in projects related to land and water management and to people's public welfare. The informants mentioned 35 kinds of projects, in which local people participate in the implementation of those projects according to their capabilities, partly by payment of project costs, partly by voluntary working in the project as a laborer, and partly by giving their land and some means and facilities which are needed for the project. The informants believe that the formulation of projects is top-down and the people's role in identifying processes is low. This sometimes prevents people from participating in the implementation of those projects. To enhance the efficiency of the project's performance, local residents and farmers should be included in the process right from the start.

In addition to the closed questions items, informants were asked to illustrate the main reasons which encourage farmers to participate and the one which prevent them to participate in the rural projects. Accordingly, the main reasons that encourage people to participate in rural projects are: *increase of income, increase of production, increase of public welfare, increase of water use efficiency, preparation facility of agricultural input such as chemical fertilizer and pesticides, awareness of people about the suitability of the project's results, less need for capital funds for farmers, satisfaction of farmers from the benefit of the project for themselves.* The informants also point to reasons why people refuse to participate in rural projects, such as *poverty (economic weakness) of farmers, disagreement and cultural differences of people, inefficiency of the Rural Service Center (government) and lack of benefit of the project for the people*.

This section has shown that there was a traditional cooperative system in the villages, which has been abandoned mainly because of '*land reform', 'increase in the number of owners because of inheritance', 'degradation of Qanat'* and *'local issues'*. This confirms what was

indicated in Chapter 4 about the land reform of 1962 and its role in the disappearance of the Buneh system. Moreover, in the villages there were traditional participatory and collective practices that some of the famers are still performing, and that can be incorporated in the reflexive phase of land and water management.

Today, there are different kinds of rural institutions in the villages which can be categorized at least into two groups: the first one which is directed towards agriculture production issues and is generally called the Agricultural Production Cooperative (APC) and the second one which is directed towards the public sphere of village issues (cultural and socio-economical issues) such as the Village Council. Among the APCs the 'rural production cooperative (*tavoni tolid*)' is the major one in the Iranian villages and the majority of farmers who are member of one of the APCs are member of this modern cooperative production which since their establishment in 1996 has become a major strategic object of the Ministry of Agriculture. However, the majority of farmers are not member of any of those APCs which partly is because of disagreement among the farmers themselves, partly because low efficiency of government leadership and partly because farmers' dissatisfaction with the earlier rural cooperative system that was established after the land reform.

Although there are different (more positive and more negative) attitudes to collective action, farmers are generally optimistic about the possibilities for positive change compared to 20 years ago. They generally have a positive attitude to the government's activity in improving farmers participation in rural issues compared to 20 years ago. This can again be seen as one of the signs for the emergence of a reflexive turn towards sustainability (see Chapter 5).

Yet, the main challenge still is the dominance of a top-down approach in the process of project identification and implementation, and the need to include rural people from the beginning in the whole process.

6.2.7. Attitudes towards nature and environmental and agricultural ethics

In the section 6.2.1 about the economic context of ethics in agriculture, it was shown that economic factors prevent farmers from performing sustainable practices. Another cluster of questions was set to measure the farmers' and informants' perceptions of nature, the farmers' basic philosophy of farming, and the most important ethical issues in the farming system from the farmers' and informants' point of view.

Farmers' and informants' perceptions of nature

To measure the perceptions of nature held by Iranian farmers and informants seventeen ethical statements were used, representing the five distinct normative groupings (Anti-

environment, Benign indifference, Utilitarian conservation, Stewardship and Radical environmentalism) distinguished by Minteer *et al.* (2004); they compass the complete range from a strongly anthropocentric to a strongly non-anthropocentric position within environmental ethics. It should be noted that Minteer *et al.* (2004) believe that, while Likert-types scales do not provide precise measurement of respondents' perceptions, they do allow us to gain a sense of which environmental ethics they are using to decide on a particular management scheme (Table 6.17). All the seventeen items are accepted in which its Cronbach alpha is 0.73, which means that these general environmental ethical principles are reliable in the Iranian farmers and informants community.

Table 6.17. Environmental ethics typology of Iranian farmers and informants

General environmental ethical principles (Cronbach Alpha= .73), (Number of loaded Items=17)	**Farmers**		**Informants**	
	Mean 4.15	**SD**	**Mean 4.20**	**SD**
Nature can be dangerous to human survival	3.58	1.625	3.20	1.721
Nature can be spiritually evil	2.54	1.736	2.67	1.854
Nature is a storehouse of raw materials that should be used by humans as needed	3.90	1.385	3.98	1.334
Humans were created as more important than the rest of nature	3.54	1.572	3.60	1.594
Because humans can think, they are more important than the rest of nature	3.82	1.388	3.74	1.515
Cruelty toward animals makes people less human	4.32	1.264	4.38	1.343
The supply of goods and services provided by nature is limited	3.25	1.582	3.12	1.714
Nature adds to the quality of our lives (for example, outdoor recreation, and natural beauty)	4.18	1.116	4.62	.539
Human survival depends on nature and natural processes	4.35	1.082	4.71	.508
Duty : It is our religious responsibility to take care of nature	4.77	.477	4.81	.397
Nature will be important to future generations	4.80	.462	4.90	.297
Nature is God's creation	4.95	.249	4.90	.370
All living things are sacred	4.58	.895	4.48	1.065
Animals should be free from needless pain and suffering	4.36	1.164	4.33	1.366
All living things are interconnected	4.64	.827	4.81	.455
All living things have a spirit	4.21	1.417	4.36	1.322
All living things have a moral right to exist	4.75	.649	4.90	.297

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree, SD=Standard Deviation

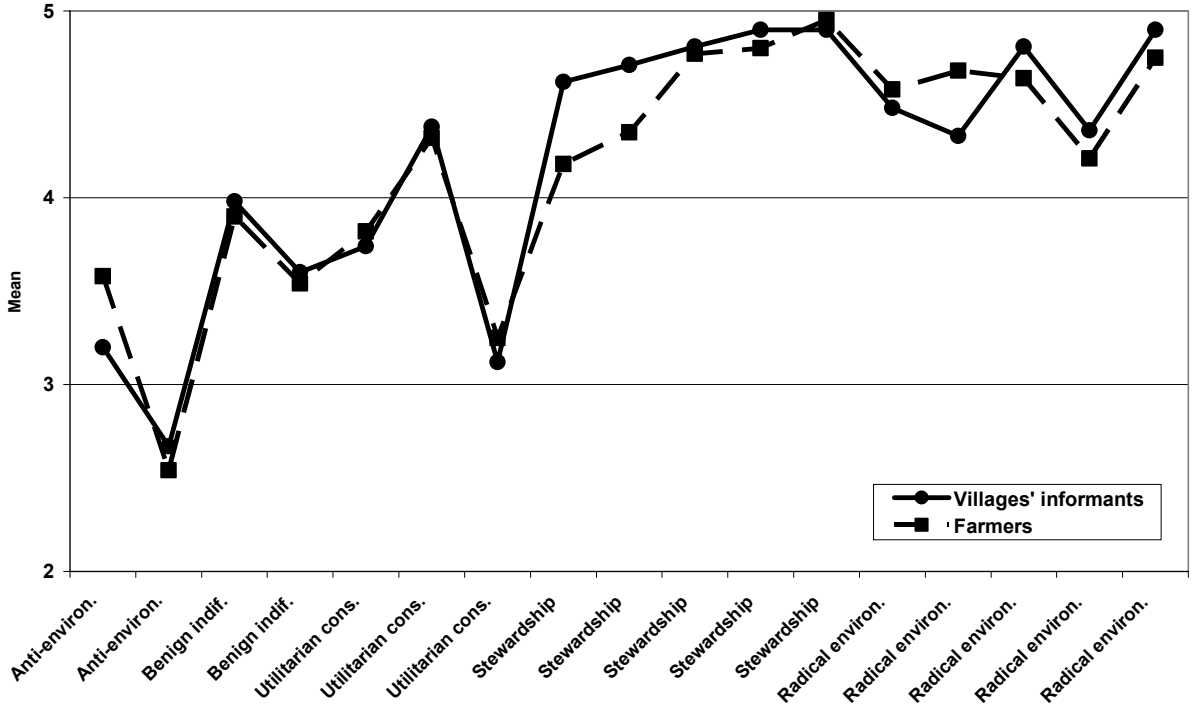

Fig 6.5. Environmental ethics typology of Iranian farmers and informants

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree

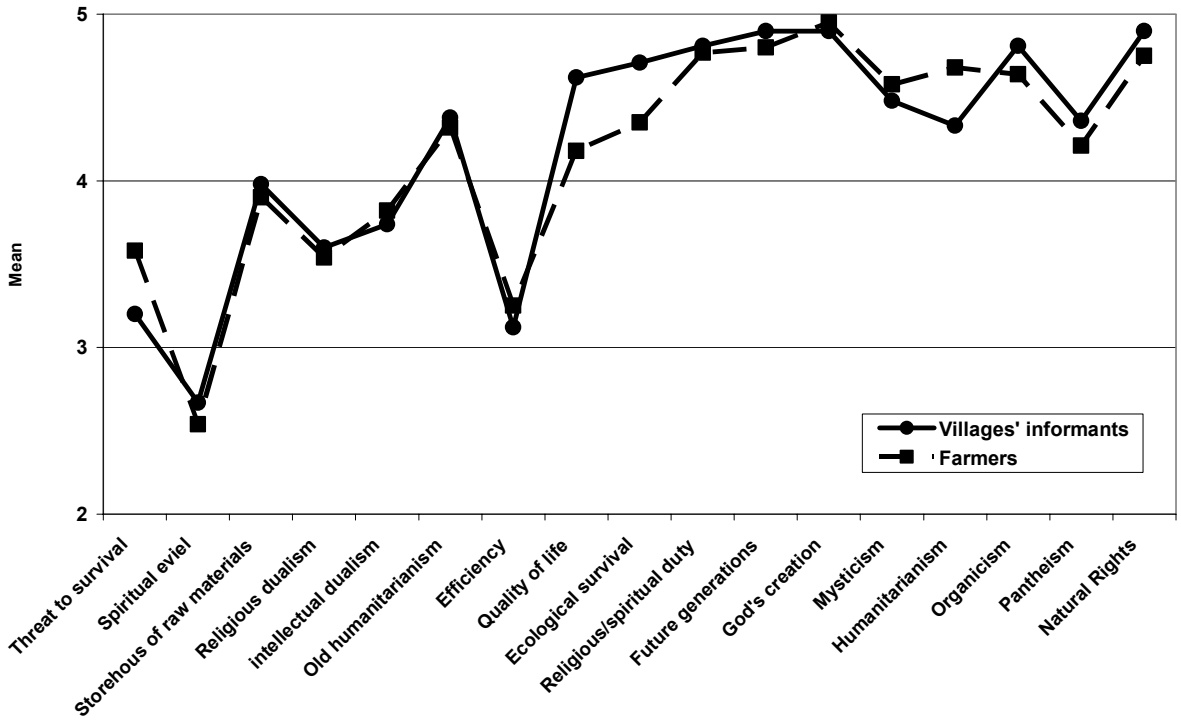

Fig 6.6. Environmental ethics typology of Iranian farmers and informants

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree

The three statements '*Nature is God's creation*', '*It is our religious responsibility to take care of nature*' and '*Nature will be important to future generations*', which are representative of the idea of *stewardship*, have the highest scores from the farmers' and informants' point of view (see Table 6.17). Aligning the respondents' answers with the five distinct normative groupings consisting of Anti-environment, Benign indifference, Utilitarian conservation, Stewardship and Radical environmentalism also confirms that the farmers' and informants' perception of nature and their support for the general environmental ethical principles fit into the *stewardship idea* (see fig 6.5 and fig 6.6). This can be related to the Islamic religious background of the respondents. Karami and Mansoorabadi (2007) have claimed that religious and spiritual beliefs belong to the most important variables to explain Iranian farmers' attitudes to sustainable agriculture.

To refine the picture of the farmers' ethical stance towards agriculture and the farming system, it was relevant to examine their basic philosophy of farming as well as their opinion with respect to some important specific ethical issues.

Farmers' basic philosophy of farming

Table 6.18. Farmers' basic philosophy of farming

Item	First	Seconde	Third	Not mentione	Weighted mean	Rank
Farming is a job for me	40.7	31.1	25.6	2.6	2.09	1
Farming is source of income for me	25.9	24.3	20.9	28.9	1.47	2
I do farming because it was work of the Prophet, it is honest work and improves my spirit	11.9	15.5	20.9	51.7	0.88	3
I like farming / farming is my interest	11.9	8.7	2.3	77.1	0.56	4
I do farming to protect the environment, land and water	13.3	2.9	9.3	74.5	0.55	5
Because through farming I can establish a job and also prepare food for the people	5.2	5.8	16.3	72.7	0.44	6
I do farming to protect my family heritage	3.0	11.7	4.7	80.6	0.36	7

Note: To calculate the weighted mean, a score was given to the priorities in which first =3, second =2, third =1

To capture their basic philosophy and value system, farmers were asked to illustrate why they do farming. Seven items were addressed by farmers which are presented in Table 6.18.The majority of farmers consider agriculture as a job or as source of income. Religious

considerations come next, followed by individual interests, land and water conservation, food security (altruism), and protection of the family heritage respectively.

Important ethical issues in the farming system from the farmers' and informants' point of view

Table 6.19. The most important ethical issues in the farming system

The most important ethical issues in farming is: (Cronbach Alpha= .81), (Number of loaded Items=12)	**Farmers**		**Informants**	
	Mean 3.71	**SD**	**Mean 4.02**	**SD**
Farming is becoming more cutthroat	3.41	1.741	3.67	1.648
Farming is becoming more like a business and less like a way of life	3.67	1.297	4.07	1.276
Pollution derived from chemical fertilizer and chemical pesticide	3.79	1.473	4.54	.745
Fertilizer and other nutrients are added to the soil because the increase in yields justifies the added input cost (if not, land is not maintained)	3.91	1.281	4.17	1.378
The industrialization of agriculture in terms of a tension between farmers' belief in working the land out of a sense of ***stewardship*** and the economic realities of farming as a business	3.13	1.756	3.98	1.508
You do what you need to do	3.69	1.296	3.48	1.742
Business agreements in farming today can no longer be done simply on a handshake	4.07	1.415	4.29	1.309
Reduced importance of personal ethics, being trustworthy in business dealings	3.86	1.246	4.02	1.129
Reduced importance of personal ethics in soil conservation	3.65	1.325	3.94	1.197
A general decline in neighborliness in rural area	3.64	1.372	3.88	1.173
Some government programs (i.e. annually prize award to whom produce the highest production) encourage farmers to adopt to behave unethically outright	3.79	1.422	3.67	1.282
Outbid local farmers on rented land (thus increasing land rental prices), bring in their own equipment and supplies, farm the land for a few years without fertilizing, and then stop renting after yields decline ("raping" the land)	3.39	1.591	3.73	1.432

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree, SD=Standard Deviation

12 issues which are reliable (Cronbach Alpha= .81**)** have been partially accepted (Mean=3.71, Mean=4.02) by the farmers and informants as the most important ethical issues in the agriculture and farming system (Table 6.19). The farmers' response to these ethical issues shows that the definition of farming has changed from a way of life to a business. Farming takes place in an environment that is increasingly industrial, market-oriented, and businesslike. This has caused tensions between the farmers' belief in working the land out of a sense of stewardship and the economic realities of farming as a business. The intensification of market processes in agriculture might compel farmers to believe that ethics should be thought about in terms of how they affect business. This could create the potential for farmers to justify unethical conduct because such behavior is seen as necessary in order to remain competitive. In addition, some governmental programs (i.e. annually prize award to farmers who produce the highest yields) encourage farmers to behave unethically outright.

This section showed that the stewardship idea can explain the farmers' and informants' perception of nature which has roots in their Islamic religious background. Taking this general perspective which can be a point of departure for the development of sustainability, we observed that the basic philosophy of farming and the atmosphere of the farming system have changed in such a way that farming has become more of a business and less of a way of life. Within an economic context in which a productionist view is dominant, new ethical issues are raised. This results in a tension between the farmers' belief in working the land out of a sense of stewardship, and the economic pressure which forces them to work their land in an unethical way. This tension should be taken into account in developing a reflexive ethical framework for land and water management.

6. 3. Concluding remarks

The purpose of the empirical studies in this chapter was to investigate the current perspective of land and water resources management in the village at large and the attitudes of Iranian farmers and village informants towards issues which should be considered in the reflexive framework of land and water management in Iran, such as sustainability, integration, participation, technology, perception of science, and ethics and nature.

The outcomes of this large survey show that the underground water exploitation regime and land use pattern which were outlined in Chapter 3 have changed. The Qanat irrigation system has been partly replaced by (semi-) deep wells. The general pattern of land ownership has also changed, from a combination of large-scale feudal landownership with small-scale absentee and peasant proprietorship prior to the land reform of 1962 to a system in which the majority of farmers are smallholders. The shift from tradition to industrial modernization in the land

and water system, which was the subject of Chapter 4, has brought some opportunities such as increased water exploitation that has allowed the farmers to bring more land under cultivation and increase their independency, but it has also brought some drawbacks such as the lowering of the ground water table because of overexploitation, a decrease of the volume of effluent water every year, and the salinization of water.

To assess the possibilities and constraints for a transition to reflexive land and water management in Iran (already discussed in Chapter 5), we have also probed the attitudes of Iranian farmers and village informants to a number of issues that are of crucial importance for such a transition.

Sustainability: opportunities and constraints

The status of soil fertility as one of the basic elements of global food security is perceived differently by different farmers. There is a group who believes that soil fertility has increased compared to the pre-modern era mainly because of using chemical fertilizers, and there is a group who believes that it has decreased mainly because of intensive cultivation and overuse of chemical fertilizers.

In spite of these different visions, the farmers generally have a positive attitude to sustainability. Of course, their familiarity with scientific concepts such as biodiversity is less than with that of sustainable practices such as soil testing, crop rotation and leaving land fallow. But, although the farmers have enough knowledge about those sustainable practices, they are not willing to perform those practices, especially 'improved fallows'. Their smallholding land use pattern and the economic pressure they are under are the main driving forces for the farmers' actions and behavior in spite of their knowledge and skills.

Possibility of integrating traditional and modern land and water management

The farmers and informants are aware of advantages and disadvantages of both traditional and modern ways of agriculture; they can be divided into two groups, a more optimistic and a more pessimistic group. The optimists believe that some of the disadvantages of traditional methods can be compensated by combining them with modern methods, while the pessimists either favor traditional or modern methods. One of the main suggestions of the optimists to make integration work is that farmers and experts should work together, sharing their knowledge in the whole process of farming, and using a bottom-up instead of a top-down approach.

Technology

In general, farmers are positive about technology; they believe that the advantages of technology outweigh its disadvantages. However, they are more in favor of modern technology than of traditional technology. This has been confirmed by the informants who feel that farmers have a very positive attitude towards modern technological devices such as tractors, chemical fertilizers, and (semi-) deep wells. The informants believe that this is mainly because of modern technology's impact on the production volume, the income level, and the easiness of agricultural activities.

Social institution: challenges and hopes of participation

Two strategies towards sustainable land and water use are mentioned, land consolidation as a way of coping with the issue of smallholding, and Agricultural Production Cooperatives (APCs) as an institution which has a mandate for arranging farmers' participation to facilitate implementation of land consolidation and relevant rural projects

The majority of farmers are member of the 'rural production cooperative (*tavoni tolid*)', the major type of APCs, which since their establishment in 1996 has become a main strategic device (see footnote 8 of Chapter 4) for the Ministry of Agriculture. Together with this positive sign we noted that farmers' collective action and their participation in the rural projects have slightly increased. Moreover, we also observed that the role of government to facilitate this participation also has changed compared to 20 years ago and the introduction of the Village Council, whose members are directly elected by the village inhabitants, is interpreted as the reason of this positive change.

A further asset is the old legacy of collective action that still lives on in many villages, at least to some extent. Such valuable traditions and experiences could be gathered and deliberately used in the transition to reflexive land and water management.

The main reasons which prevent farmers to participate in the implementation of land consolidation and also to be a member of APCs are disagreement among the farmers themselves, distrust of governmental agencies, deficient governmental leadership, and farmers' dissatisfaction with the earlier rural cooperative system. Another obstacle to participation is the dominance of the top-down approach in the process of project identification and implementation.

Ethico –religious aspects

The farmers' and informants' perception of nature and their support for general environmental ethical principles fit into the idea of stewardship which is related to their Islamic religious background and can be considered as the starting-point for a new ethical framework for reflexive land and water management.

There is however a tension between the stewardship idea and the current economic context of farming that is determined by the industrialization of agriculture and by social preferences for low-cost, high-quality food. The basic philosophy of farming has changed from a way of life to a business.

Science and research: part of the problem and part of the solution

The farmers have a positive attitude about science and research in general. Their relationship with experts and the Rural Service Center has improved in recent times. But on the other hand, it also became clear that some expert recommendations are not being followed because of the economic circumstances of the majority of farmers. This especially concerns recommendations that require cooperation such as land consolidation and also recommendations that can only be more effective in the long run.

In addition, the farmers put emphasis on the significance of communication and the sharing of knowledge with scientists in the whole process of farming - an issue that is of great importance for the reflexive framework of land and water management.

Chapter 7
Soil and water experts

Recent developments point to the fact that scientists in the postmodern era will have to strive for genuine partnerships with farmers and other stakeholders for successful research and development (Mowo, 2005). Also, many applied sciences are rapidly changing their approach to science, for instance broadening their field of study (from genome wide analyses to modelling, from chemicals to organic agriculture), merging disciplines and changing methodologies for their analyses (bioinformatics for genomics, ITC for epidemiological studies, computational screening for chemicals, etc) (Pasquali, 2007).

In this study it is therefore relevant to know what the role of soil and water scientists in the transient phase towards reflexive modernity in Iran is, how they see the current situation and institutions and how they see their role. The opinion of experts on the theoretical framework (paradigms of the technology-institution-belief nexus) of this study is also interesting to know. Accordingly, to explore and examine the attitudes of soil and water experts towards the current situation and the future possibilities of reflexive land and water management a questionnaire was produced, which was completed by 94 Iranian soil and water experts who took part in several international and national conferences, held in Iran on subjects related to sustainable use of land and water resources, and also by those who work at Iranian organizations. The results of this survey will be discussed in this chapter in which, first, the main land and water policy priorities in Iran from the experts' point of view (7.2.1) will be outlined. Second, experts' attitudes towards sustainability, the possibility of integrating traditional and modern land and water management, and technology (7.2.2.1) will be discussed. Third, experts' assessment of organizations in relation to sustainability issues and the possibility of sustainability under current conditions of the country (7.2.2.2) will be probed. Finally, soil and water experts' attitudes towards ethics in land and water science and the relation between science and society (7.2.2.3) will be sketched.

7.1. Methodology

7.1.1. Participants

The subjects of this study were 94 Iranian soil and water experts who took part in a number of international and national conferences at which they were interviewed by us. These venues were, respectively, the 4th Asian regional conference and 10th international seminar on participatory irrigation management (PIM), the international history seminar on irrigation drainage, held in Iran from 2-5 May 2007, and the 10th national soil sciences conference held

in Iran from 26-28 August 2007. Also interviewed were experts working at the Soil and Water Research Institute (SWRI), the Rural Development Institute and the Farming Systems Bureau of the Ministry of Agriculture. The experts' educational and social profile is shown in table 7.1.

According to table 7.1, the average length of work experience of participants in the field of land and water management was 12.3 years. Most of them (86 %) are highly educated, 67.8 % of them work in university and research institutes, 23.3 % of them work in governmental organizations and 8.9 percent of them work in the private sector.

Table 7.1. Participants' educational and social profile

Variables	**%**	**Variables**	%
University degree		**Organization**	
Bachelor	14.0	University	14.5
Master of Science	52.7	Research institute	53.3
Doctorate	33.3	Ministry (Energy)	8.9
Gender		Ministry (Agriculture)	13.3
Female	14.0	Management and planning	1.1
Male	86.0	Private sectors	3.3
Work experience (Years)		Consultant engineers	5.6
10 or less	50.0	**Educational field**	
11-20	37.5	Agricultural sciences	7.2
20 or more	12.5	Economics	3.6
Job		Irrigation sciences	9.6
Student	5.4	Rural developments	7.2
Academic	57.0	Env. & civil engineering sciences	9.6
Expert	26.9	Soil sciences	54.3
Manager	9.7	Geology and micromorphology	6.1
Journalist	1.0	Natural resource sciences	2.4

7.1.2. Instrument and Data analysis

In order to collect the data needed for answering the research questions, a questionnaire was produced and distributed among Iranian soil and water experts. Data analyses were conducted using exploratory factor analysis. The determinant factors were identified by application of Cronbach's alpha coefficient. The reliability of statistical analysis was assessed based on the results obtained from factor analysis, combined with the interpretations done by using expert knowledge (Minteer *et al.,* 2004; Pasquali, 2007; Karbasioun, 2007). The calculated

Cronbach's alpha coefficients were all higher than 0.62, indicating the positive role of the studied variables on the attitude of Iranian soil and water experts. The final questionnaire included 6 open questions and 74 closed questions in 6 different parts. In designing the closed questions, a 5-point Likert-type scale was applied. A quantitative method of data analysis was applied. Descriptive statistical analysis and non-parametric statistical methods were used. As mentioned, in order to extract different factors of the study, exploratory factor analysis with varimax rotation was used.

7.2. Results and discussion

The results of the survey are presented below.

7.2.1. The main land and water policy priorities in Iran from the experts' point of view

In order to understand the views of Iranian soil and water experts on different land and water management paradigms, the respondents were asked to rank the 5 most important land and water policy priorities which should be taken into account by policy makers in Iran. The results are shown in table 7.2. The respondents selected 9 items as the main priorities in the land and water management of the country. Among the 9 items, *"improving productivity of land and water resources through soil protection, land consolidation, and the improvement of the cooperation system and the farming system*" appeared among 27.0% of the respondents as the first, 22.9% as the second, 13.2 % as the third, 21.8% as the fourth and 13.5 % as the fifth priority. This means that this policy item was seen by the experts as the first and most important priority. To determine the rank of each of the 9 items among the entire group of respondents, their weighted mean has been calculated, which is shown in table 7.2.

Without going through the questionnaire, we can nonetheless conclude from the information of table 7.2 that although the experts are not familiar with the concept of sustainability, they are concerned about ethical issues in land and water management in terms of sustainability. In other words, experts are aware of the side effects and consequences of modernity. Also, finding policies to deal with those issues has a high priority in their suggestions for sustainable land and water management.

7.2.2. General perception of experts about research questions

We first wanted to get a general overview of the experts' ideas about the items of our research questions including shifting paradigms, sustainability, integration, participation, technology and their perception of the role of science and ethics with regard to sustainable land and water

management. On the data exploratory factor analysis was applied and different factors of the study were identified. Reliability of the factors was calculated by using Cronbach's test. Cronbach's alpha coefficients for all factors were higher than 0.62, which is reasonable and acceptable.

Table 7.3. Extracted factors from the closed questions of questionnaire and their reliability

Title	Num. of loaded Items	Cronbach Alpha	Mean	SD
Attitude towards sustainable development	7	0.67	3.93	.462
Attitude towards integration of traditional and modern land and water systems	6	0.70	4.13	.587
Attitude towards technology	5	0.62	4.15	.615
Assessment of organizations in relation to sustainable development	3	0.65	1.88	.712
Assessment of educational system in relation to sustainable development	3	0.64	2.39	.609
Possibility of policy making towards sustainable development under current conditions of Iran	4	0.64	3.27	.700
Attitude towards land and water ethics	5	0.62	4.01	.755
Attitude towards ethics in soil and water science and relation between science and society	4	0.69	4.44	.576

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree, SD=Standard Deviation

The factors which are shown in table 7.3 can be divided into 3 categories encompassing, firstly, experts' attitudes towards sustainability, the possibility of integrating traditional and modern land and water management, and technology; secondly, experts' assessment of organizations, the educational system and the possibility of reflexive policy making in the current situation of Iran; and finally, experts' attitude toward ethics in soil and water science and the relation between science and society, which will be discussed in detail below.

7.2.2.1. Experts' attitudes towards sustainability, possibility of integrating traditional and modern land and water management, and technology

The views of soil and water experts on sustainable development are positive (mean= 3.93, table 7.4); 84.0 percent of the respondents partially to fully agree that sustainable

development should be the first priority in land and water management policy-making. Moreover, respondents do not agree with the overuse of land and water resources in the short run for producing enough food to meet the high demand of the consumers in the country, currently and in the future. However, a nationwide survey conducted earlier by Karami and Hayati (1998) revealed that the mean endorsement scores of sustainable agriculture by agricultural researchers, extension agents and extension experts were low. We can therefore conclude that there has been a growing diffusion of the idea of sustainability in the Iranian experts community during the last decade, several years after the notion of sustainable development entered the international and Iranian agenda in 1992.

Table 7. 4. Soil and water experts' attitudes on sustainable development in Iran

Attitude towards sustainable development (Cronbach Alpha= .67), (Number of loaded Items= 7)	**Mean**	**SD**
	3.93	**.462**
We must produce enough food even though we will overuse our land and water resources in the short run(*)	4.39	1.058
The only way to satisfy the demand for food in the future is to apply technology and forget about sustainable development(*)	3.91	1.298
In the short run the only way to produce enough food is overuse of our land and water resources, but in the long time it will be possible to make a plan for sustainable land and water management	2.19	1.304
Sustainable development should be the first priority in policy-making with respect to land and water management, even though we will have to import our food in the future	4.27	.975
Land and water resources protection should always be the first priority, even though it could lower production, productivity and income	4.09	1.133
Sustainable development should have the highest priority in policy-making regarding land and water management,	4.44	.699
The research systems of the country should pay more attention to the value of sustainable development in approving research projects	4.23	.831

Note: 0=don't know, 1=fully disagree, 2=partially disagree, 3=neutral, 4=partially agree, 5= fully agree, SD=Standard Deviation,

** To keep consistency of statements, items have been reversed*

Table 7.2. The main land and water policy priorities in Iran from the experts' point of view

Items \ Priority	First	Second	Third	Fourth	Fifth	Not mentioned	Weighted mean	Rank
Improving productivity of land and water resources through soil protection, land consolidation, and the improvement of the cooperation system and the farming system	27.0	22.9	13.2	21.8	13.5	1.6	3.23	**1**
Attention to sustainability through organic agriculture and perceiving farm as living things	14.9	11.4	20.6	10.9	13.5	28.7	2.17	**2**
Recognition of land and water resources potential & land use planning	17.6	14.3	2.9	10.9	8.1	46.2	1.84	**3**
Expansion of research, education and extension on sustainable development issues	8.1	11.4	17.6	14.5	16.2	31.9	1.84	**3**
Applying holistic and systematic approach in the land and water resource management planning and attention to local issues	9.5	11.4	10.3	14.5	13.5	40.8	1.67	**4**
Attention to economic issues and investigation on infrastructure to improve land and water productivity, and support of farmers	8.1	10.0	11.8	10.9	21.6	37.6	1.59	**5**
Attention to private sector, NGOs and promotion of stakeholders participation	4.1	5.7	8.8	7.3	8.1	66.0	0.92	**6**
Promotion of management through meritocracy (professional criteria) and consistency/continuity in the planning in spite of changing managers	5.4	5.7	8.8	5.5	2.7	71.9	0.90	**7**
Review, reform and applying of land and water laws towards sustainable development	5.4	7.1	5.9	3.6	2.7	75.3	0.83	**8**

Note: to calculate the weighted mean, a score was given to the priorities in which first =5, second =4, third =3, forth = 2, fifth=1

The experts were also asked about their attitudes on the possibility of integrating traditional and modern land and water management. Table 7.5 shows a positive attitude of soil and water experts towards the integration of traditional and modern land and water systems (mean= 4.13); 81.2 percent of the respondents partially to fully agree with integration. Moreover, while 17.6 percent of the respondents have a high or very high appreciation of the usability of traditional land and water production systems and 22.0 percent of them believe that such systems are still usable today, 56.4 percent of respondents believe the usability of the traditional system alone is low to very low. This means that soil and water experts believe that through integration of traditional and modern technology and the application of indigenous knowledge the shift towards a new paradigm of sustainable land and water management is possible.

Table 7.5. Soil and water experts' attitude towards integration of land and water traditional and modern systems

Attitude towards integration of land and water traditional and modern systems (Cronbach Alpha= .70), (Number of loaded Items= 6)	**Mean** **4.13**	**SD** **.587**
We can integrate new technology with traditional technology to find a way towards sustainable management	4.36	.993
Technological innovation will still be possible if we change the direction of technological development in a way that is compatible with sustainable development	4.44	.837
By integrating the traditional system and new technologies it is possible to find a way towards sustainable management	4.45	.798
By combining the Qanat system with new technologies it is possible to find a way towards sustainable land and water management	3.88	1.413
It is possible to integrate the traditional system with new technologies on the way towards sustainable development	3.65	.935
It is possible to establish new efficient systems of land and water resource management by integrating indigenous knowledge, traditional technology and new technology	4.03	.781

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree, SD=Standard Deviation

We also asked the experts about their attitude towards technology. According to table 7.6, most experts have a positive view on technology (mean = 4.15); 82.3 percent of them believe that through changing the direction of technological innovation and through integration of traditional and modern technology it is possible to find a way towards sustainability. It is

important to note that 72.5 percent of the respondents completely reject the claim that it is impossible to reconcile technology with sustainable development.

In this section (7.2.2.1), experts' attitudes towards sustainability, integration of traditional and modern land and water systems, and technology have been reported. The survey data support the conclusion that soil and water experts have a positive attitude towards sustainable development. Moreover, they emphasize that it should be the first priority in land and water management policy-making. This implies that they are aware of the side effects and consequences of modernity on the one hand, and they do not believe that the traditional system of land and water management alone is sufficient to cope with the current requirements and demands on the other hand. We can conclude that the influence of the idea of sustainability in the experts' community is growing and that the shift towards a reflexive land and water management paradigm is considered possible. However, the next question is to what extent this positive attitude is being implemented in practice; with this question we will deal in the next section on how experts assess the current situation of the country in terms of sustainable land and water management.

Table 7.6. Soil and water experts' attitude towards technology

Attitude towards technology (Cronbach Alpha= 0.62), (Number of loaded Items= 5)	**Mean**	**SD**
	4.15	**.615**
We can integrate new technology with traditional technology to find a way towards sustainable management	4.36	.993
Technological innovation will still be possible if we change the direction of technological development in a way that is compatible with sustainable development	4.44	.837
By integrating the traditional system and new technologies it is possible to find a way towards sustainable management	4.45	.798
By combining the Qanat system with new technologies it is possible to find a way towards sustainable land and water management	3.88	1.413
It is possible to integrate the traditional system with new technologies on the way towards sustainable development	3.65	.935

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree, SD=Standard Deviation

7.2.2.2. Assessment of organizations in relation to sustainability issues and the possibility of sustainability under current conditions of the country

Now that we know the general attitude of soil and water experts toward sustainability, it is also important to know their assessment about the current situation of the country in terms of sustainable land and water management in practice. So, this section is about the answers of experts to the questions in this regard.
As can be seen from table 7.7, the soil and water experts' assessment of sustainable development in practice is not positive (mean= 1.88); 81.0 percent of the respondents believe that the practical attention paid to sustainable development by governmental programs and the educational system is low to very low.

Karbasioun (2007) indicates that no change was perceived in sustainability in agriculture and natural resources by experts in different disciplines in the Esfahan province. Also, he points to the lack of sustainability in the farming system promoted by the recent agricultural development of Iran. Moreover, 87.6 percent of respondents believe to a very high and high degree that the values of sustainable development have been ignored due to the effects of the large influence of political debates and of the sectoral approach (exclusive views or compartmentalization) in policy making and program design. In addition, 91.0 percent of respondents believe to a very high and high degree that this has happened also in practice**.** In this regard, Karbasioun (2007) also claims that uncontrolled influence of political visions on decision making in the agricultural sector is one of the crucial problems of agricultural development in Iran.

Table 7.7. Soil and water experts' assessment of sustainable development in practice in Iran

Assessment of organizations in relation to sustainable development (Cronbach Alpha= 0.65), (Number of loaded Items= 3)	**Mean**	**SD**
	1.88	**.712**
Governmental programs are according to sustainable development	1.84	.910
The educational system of the country has been successful in teaching the value of sustainable development	1.89	.850
The educational system of the country pays enough attention to teaching the value of sustainable development	1.92	.917

Note: 0= nil, 1=very low, 2= low, 3=acceptable, 4=high, 5=very high, SD=Standard Deviation

The assessment of the Iranian educational system by experts is shown in table 7.8. They hold that the educational system of country does not pay enough attention to teach the values of sustainability and has not been successful to teach these values as well (mean= 2.39). Nevertheless, 52.2 percent of the respondents believe that students are sufficiently familiar and 33.7 percent of them are highly familiar with the concept of sustainable development. How can they be familiar with the concept if the educational system does not pay enough

attention to teaching the values of sustainability? This can be explained when we know that 86 percent of the respondents are highly educated and 67.8 percent of them work in universities and research institutes. In other words, experts who work in universities and research institutes are more familiar with the concept than the other experts who work in administrative organizations and the private sector. Moreover, the first group is less involved in the planning process.

Table 7.8. Soil and water experts' assessment of the educational system of Iran in relation to sustainable development

Assessment of educational system in relation to sustainable development (Cronbach Alpha= 0.64), (Number of loaded Items= 3)	**Mean**	**SD**
	2.39	**.609**
I am familiar whit the concept of sustainable development	3.37	.794
The educational system of the country has been successful in teaching the value of sustainable development	1.89	.805
The educational system of the country pays enough attention to teaching the value of sustainable development	1.92	.917

Note: 0= nil, 1=very low, 2= low, 3=acceptable, 4=high, 5=very high, SD=Standard Deviation

As can be seen from table 7.9, experts believe that practical limitations or managerial and local forces push the policy makers to put land and water ethics at the second place of their decision-making process. However, 90.1 percent of the respondents believe to a very high, high or acceptable degree that it is possible to address both the practical problems of administrative organizations and the concerns of sustainable development at the same time. Rezaei-Moghaddam *et al.* (2005) point out that some experts have argued that there can be a reconciliation between production and environmental protection, and therefore sustainable development is achievable. But they conclude from their personal observations that some of the agricultural experts are very skeptical of the so-called de-modernizing aspects of sustainable agriculture and see it as "imperialist propaganda" to thwart the advancement of developing countries. Others who are "less politically minded" perceive sustainable agriculture as an idealist approach that developing countries such as Iran cannot afford.

It can be concluded from the above information, that soil and water experts do not have a positive assessment on the practical implementation of sustainable development. They attribute this perceived failure to the uncontrolled influence (undue influence) of political issues and sectoral approaches (exclusive views or compartmentalization) in policy making, program design and implementation. In other words, the pressure of socio-economic and

political issues in the planning and implementation processes is more powerful than experts' opinion and comments. This shows that despite the positive attitude of experts towards sustainable development, some factors prevent the practical implementation of sustainability.

Table 7.9. Soil and water experts' views on the possibility of policy making towards sustainable development under current conditions in Iran

Possibility of policy making towards sustainable development under current conditions in Iran (Cronbach Alpha= 0.64), (Number of loaded Items= 4)	**Mean** **3.27**	**SD** **.700**
It is possible to make a policy which would be compatible with the value of sustainable development in the current situation of the country	3.29	1.153
It is possible to integrate the traditional system with new technologies on the way towards sustainable development	3.65	.935
Practical limitations or managerial and local forces push the policy makers to put land and water ethics at the second place of their decision-making process(*)	2.52	1.188
It is possible to find a way to address both practical problem of administrative organizations and concerns of sustainable development simultaneously	3.62	.879

Note: 0= nil, 1=very low, 2= low, 3=acceptable, 4=high, 5=very high, SD=Standard Deviation ***** *To keep consistency of statements, the item has been reversed*

According to the experts' point of view there is a gap between the theoretical acceptance of sustainable land and water management and its implementation in practice; the question then arises to what extent this gap is related to the context of the stakeholders' knowledge, attitudes and behaviour. In other words, people may be well informed and concerned about environmental issues but the social and institutional context in which they are embedded may offset an adequate behavioral response (Folke, 2003). This is why Rier (2003) argues, quoting Vaughan (1996, 114) that "individual behavior cannot be understood without taking into account the organizational and environmental context of that behavior."

Anyhow, we now have some evidence that the diffusion of the sustainability idea within the experts community is growing and that a paradigm shift toward reflexive land and water management paradigm is possible. However, this reflexive phase needs an inclusive approach encompassing soil and water experts and other stakeholders who are involved in the land and water area. The combination of ethics and the sciences can help in this regard to reduce the gap and to increase a sensitivity to accept more cooperation towards sustainability with all stakeholders. Therefore, the experts' perception of science and ethics is very important. How do experts perceive land and water ethics in a land and water management system aiming at

sustainable development? How do experts perceive science and are they ready to cooperate with the non-scientists in the land and water systems? We will deal with these questions in the next section.

7.2.2.3. Attitudes towards ethics in land and water science and the relation between science and society from the experts' point of view

The experts believe that land and water ethics is a branch of philosophy which is compatible with science and must be the first priority of any policy making to achieve sustainable management (Table 7.10). This is in tune with Korthals and Bogers (2004) who argue in favor of this combination and refute the gap between ethics and science as well: "It is often said that science is impersonal, objective and without values, and ethics is often seen as the counterpart of science, as something personal and subjective". 85.8 percent of the respondents partially to fully agree that land and water ethics can play a role in promoting and facilitating dialogue among scientists. Also, 81.4 percent of the respondents partially to fully argue that some kind of land and water ethics is part of their decision making process.

Table 7.10. Soil and water expert's attitudes towards land and water ethics in Iran

Attitudes towards land and water ethics (Cronbach Alpha= 0.62), (Number of loaded Items= 5)	**Mean**	**SD**
	4.01	**.755**
Land and water ethics and protection of land and water resources through sustainable management:		
must be the first priority of any policy-making	4.62	.881
is the branch of philosophy that deals with issues of right and wrong in human affairs, and it doesn't need emphasizes too much scientific research and accordingly policy-making(*)	3.41	1.646
is incompatible with science practice(*)	4.01	1.488
plays a role in promoting and facilitating dialogue among scientists	4.10	1.389
is part of my decision-making process	3.93	1.389

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree, SD=Standard Deviation

** To keep consistency of statements, items have been reversed*

Table 7.11. Iranian soil and water experts' attitudes towards ethics in soil and water science and the relation between science and society

Attitudes towards ethics in soil and water science and relation between science and society (Cronbach Alpha= 0.69), (Number of loaded Items= 4)	**Mean** **4.44**	**SD** **.576**
The public should be informed about the social and ethical implications of scientific research	4.37	.915
Communication with the public at large belongs to the essential activities of scientists	4.68	.535
In addressing the public, scientists should first state their ethical view on the subject	4.25	.908
Ethical considerations should play a role in soil and water science	4.43	.810

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree

Experts positively believe that it is necessary to take ethics into account in the relation of science and society, and to steer soil and water sciences towards sustainability (mean=4.44), which is shown in table 7.11. In fact, not only 93.4 percent of the respondents partially and fully agree that the public should be informed about societal and ethical implications of scientific activity, but also 96.7 percent of them partially to fully agree that scientific activity should include science communication to the public. Moreover, 90.4 percent of respondents partially to fully agree that the general public should be closely involved in decisions concerning land and water technologies. In addition, 94.2 percent of experts partially to fully agree that ethical considerations should play a role in soil and water science.

It is interesting to note that respondents have different views about the conduct of science. While 27.5 percent of the respondents partially to fully agree that science should be ruled exclusively by scientists, 56.1 percent of them partially to fully disagree with this idea. Also, while 27.0 percent of respondents partially to fully agree that informing the public about science is the task of journalists and the media, 56.2 percent of them partially and fully disagree with this idea.

To know how soil and water experts perceive nature and to find out support for a range of general environmental ethical principles, ethical statements of Minteer *et al.* (2004) were discussed. We used twelve statements of Minteer et al which are representative of respectively four normative groups (anti-environmentalism, utilitarian conservationism, stewardship and radical environmentalism); Cronbach alpha is 0.71, which shows that the result is reliable for the Iranian experts community (Table 7.12).

Table 7.12. Environmental ethics typology of Iranian soil and water experts

Environmental ethics typology of Iranian soil and water experts (Cronbach Alpha= 0.71), (Number of loaded Items= 12)	**Mean**	**SD**
	3.92	**.430**
Nature can be dangerous to human survival	1.19	0.877
Nature can be spiritually evil	1.31	0.963
Cruelty toward animals makes people less human	4.27	1.018
Nature adds to the quality of our lives (for example, outdoor recreation, natural beauty)	4.57	0.689
Human survival depends on nature and natural processes	4.76	0.495
It is our religious responsibility to take care of nature	4.81	0.462
Nature will be important to future generations	4.97	0.164
All living things are sacred	4.41	1.189
Animals should be free from needless pain and suffering	4.46	0.989
All living things are interconnected	4.78	0.422
All living things have a spirit	3.29	1.979
All living things have a moral right to exist	4.30	1.431

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree

As can be seen in table 7.12, the two statements '*It is our religious responsibility to take care of nature*' and '*Nature will be important to future generations*', which are representative of the *stewardship idea,* have the highest scores (Mean=4.81 and Mean= 4.97 respectively) in the experts' point of view. By drawing up a trend analysis of respondents' answers to ethical statements which are shown in fig 7.1 and fig 7.2, it can be shown that the experts' perception of nature and their support for general environmental ethical principles fit into the *stewardship idea,* which agrees with the perception of nature by farmers and informants (see Chapter 6).

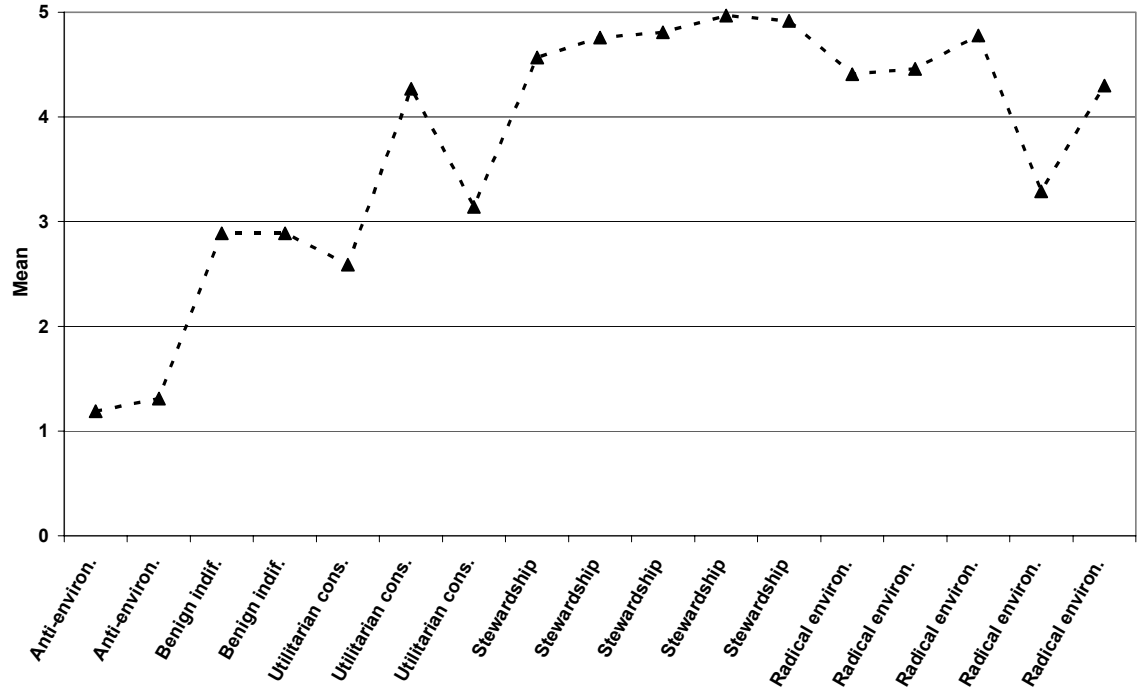

Fig 7.1. Environmental ethics typology of Iranian soil and water experts

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree

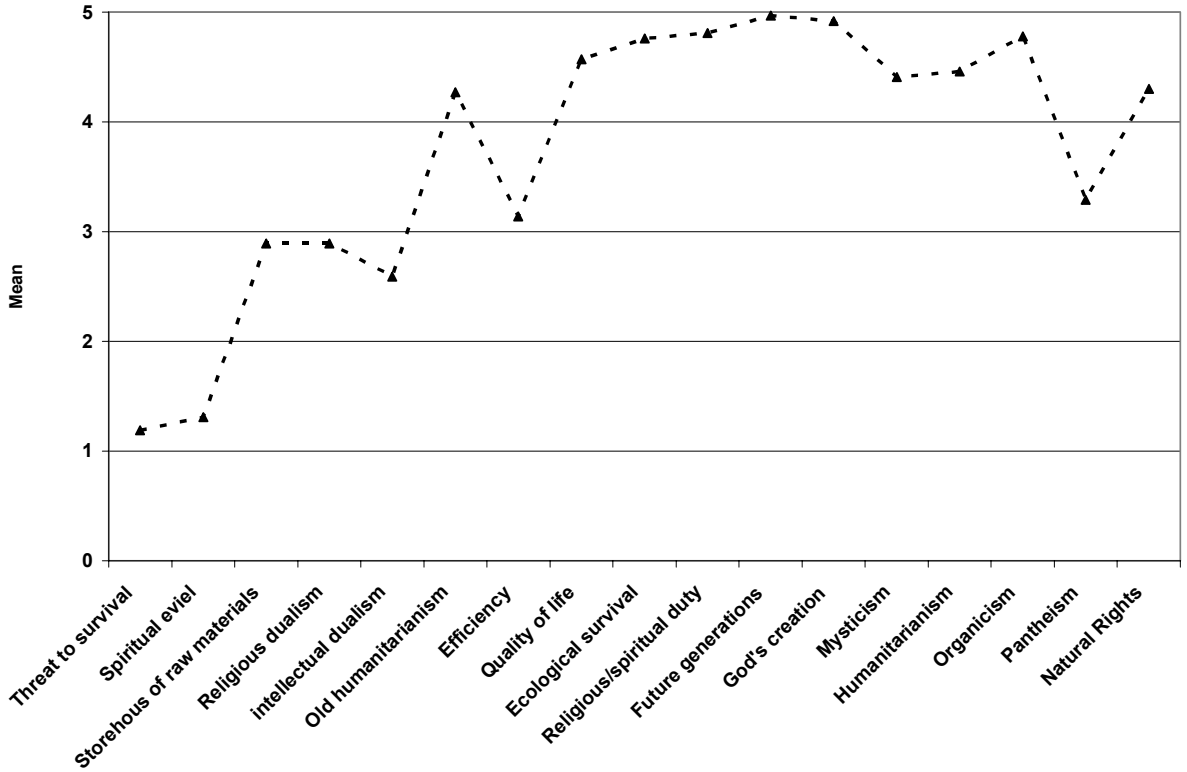

Fig 7.2. Environmental ethics typology of Iranian soil and water experts

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree

7.3. Concluding remarks

The purpose of this chapter was to investigate soil and water experts' attitudes towards sustainability, integration, participation, technology, and their perception of science and ethics which should be taken into account in the ethical framework of land and water in Iran. Although the experts are not explicitly familiar with the concept of sustainability, they are concerned about ethical issues in the land and water management in terms of sustainability. Experts are aware of the side effects and consequences of industrial modernity. Also, finding policies to deal with those issues has a high priority in their suggestions for sustainable land and water management.

It turns out that the soil and water experts have a positive attitude towards sustainable development and the integration of traditional and modern technology, which means that the reflexive land and water framework can be realized. However, the experts do not have a positive assessment of sustainable development in practice in the current situation of the country. They attribute the perceived shortcomings to the strong influence of political debates and sectoral approaches (exclusive views, compartmentalization) in policy making, program design and implementation which entail that the values of sustainable development are ignored. Also, experts believe that practical limitations or managerial and local forces push the policy makers to put land and water ethics at the second place of their decision-making process. However, they believe that it is possible to address both practical problems of administrative organizations and concerns of sustainable development at the same time.

Also, from the experts' point of view, land and water ethics is a branch of philosophy which is compatible with science and which can play a role in promoting and facilitating dialogue among scientists. Moreover, the relation between science and society needs to be taken into account when promoting the role of soil and water sciences towards sustainable land and water management. In addition, they believe that the public should be informed about societal and ethical implications of scientific activities, and scientific activity should include scientific communication. This means that they agree to play their role as communicators in the relation between science and society and to communicate with other stakeholders who should be considered in the land and water management. Finally, experts' perception of nature and their support for general environmental ethical principles fit into the *stewardship idea.*

It is interesting to compare the experts' attitude towards science and society with other opinions. Beek *et al. (*1997) argue that universities often emphasize mono-disciplinary study, and the prestige of scientists is more often derived from publications in a highly specialized scientific journal. Inter- and multi-disciplinary research has at the moment a lower standing than mono-disciplinary research. This complicates the search for solutions to environmental

problems and for sustainable development. Therefore, to improve the existing land use systems at farm level in terms of Sustainable Land Management (SLM), they advocate that soil scientists and agronomists should seek the cooperation with socio-economic specialists, land-use planners and land users. Bouma (2001) also indicates that relations between soil science, policy makers and stakeholders are changing rapidly in post-modern network societies where dynamic coalitions of informed citizens are acquiring new powers. This rapid change is speeding up innovation, technologies, and knowledge in general. But these changes, in order to be approved and sustained by stakeholders, have to be communicated and, most importantly, discussed. The role that our interviewees see for themselves and for applied scientists is congruent with these opinions.

Chapter 8
Key persons in politics and policy-making

In chapter 6, I clarified the ideas and thoughts concerning land and water management of farmers and village informants who are directly involved with land and water management. This was done by way of discussing a large scale survey. In chapter 7, I elaborated on the attitudes of soil and water experts as the land and water stakeholders who have contact, on the one hand, with farmers and village informants and, on the other hand, with policy makers. This was done the same way. Finally, in this chapter, I will clarify the policy makers' points of view on sustainability, integration of traditional and modern technology, science, social institutions and participation, and ethics and nature. It is important to explore and examine their approach towards the problems and possibilities of a transition towards reflexive and sustainable land and water management in Iran. Using the results of the two large scale surveys of chapter 6 and 7 and the theoretical considerations of this study (the three paradigms of the technology-governance-mentality-nexus) as my basis, I performed in-depth interviews with Iranian policy makers who play a prominent role in the land and water sector. According to the results of these interviews, causes of land degradation and water scarcity in Iran (8.2.1) and the role of the land reform of 1962 in the process of industrial modernization in Iran (8.2.2) will be investigated. Then, the domination of land and water management paradigms in Iran and the opportunities and constraints of a transition towards reflexive sustainable modernity (8.2.3), will be discussed, as well as the issue of importing western strategies and the lack of internal experiences in this transition phase (8.4.2). Next topics for discussion are: that the role of science, research and technology (8.2.5), the role of political parties, civil society and democracy (8.2.6), and the challenges and hopes for participation in the communication and reception of sustainability as a project and idea (8.2.7). Finally, ethical issues will be discussed, concerning the need of ethics regarding land and water, ethics in science and technology and ethics in the administration (8.2.8).

8.1. Methodology

8.1.1. Participants

To collect data needed for answering the research questions, open-ended interviews were done with 12 policy makers/high level informants in July and August 2008 in Iran. The policy makers/high level informants who participated in this study are involved in the area of environment, agriculture, and land and water management. They were chosen among the people who work at the ministry of Agriculture, with different Environmental Protection Organizations, and at universities and research institutes. The policy makers/high level

informants have experiences at different managerial levels; from deputy president, minister, deputy minister to general director, with different relevant organizations during the last 3 decades since the Islamic revolution of 1979 (Box1). It should be noted that they are playing different roles in the general arena of the Iranian political culture and they don't represent special groups.

Box1. Demographic profile of interviewee
1. Former deputy president and head of the Environmental Protection Organization, Professor at University and member of the Tehran city council, PhD in medical science
2. Former minister of Agriculture, Secretary of Iranian Farmers' House, PhD in Agriculture
3. Former deputy of Ministry of Agriculture, Agriculture consultant company, Msc in Agriculture
4. Former research deputy of Ministry of Agriculture, agriculture consultant company, Msc in Agriculture and Irrigation science
5. Former general director of Soil and Water Institute (SWRI), University Professor and Chair of Soil and Water department, PhD in Soil science
6. Former chair of GFAR, Deputy of Agriculture Research and Education Organization (AREO), President of Soil Science Society of Iran (SSSI), PhD in Soil science
7. Former representative of Parliament and member of Agriculture and Water Committee of parliament, Professor of University, PhD in Soil science
8. Member of Academy of Science, Scientific member of Soil and Water Research Institute (SWRI), PhD in Soil science
9. General director of environmental and sustainable agriculture bureau of Ministry of Agriculture, PhD in environmental and fishery science
10. Former general director of farming systems bureau of the Ministry of Agriculture, Professor and Chair of the department of Environment of the Azad University, PhD in Agriculture
11. General director of the bureau of 'Development of irrigation network, drainage and renovation of agricultural land' of Ministry of Agriculture, MSc in Irrigation science
12. Deputy general director bureau of 'Development of irrigation network, drainage and renovation of agricultural land' of Ministry of Agriculture, MSc in Irrigation science

8.1.2. Data analysis

All recorded interviews were transcribed into manuscripts. All 12 manuscripts were codified according to the objectives of the research and the items of the questionnaires. The codification finally resulted in eight items that cover the main topics of the interviews. These items as a matter of fact reflect the 'technology-institution-belief nexus' of this study. Here is the list of these items and they will be discussed in the next sections.

1. Causes of land degradation and water scarcity in Iran
2. Land reform of 1962 and industrial modernization in Iran: advantages and disadvantages

3. Land and water management paradigms in Iran and the transition to reflexive sustainable modernity: opportunities and constraints
4. Science, research and technology: part of problem and part of solution
5. Import of western strategies and lack of internal experiences
6. Political parties, civil society and democracy as the main way to implement sustainability
7. Stakeholders' participation, government, land consolidation and rural institutions: challenges and hopes for participation
8. Ethical issues and need of ethics regarding land and water, ethics in science and technology and ethics in the administration

8.2. Results and discussion

8.2.1. Causes of land degradation and water scarcity in Iran

The policy makers/high level informants mentioned ten reasons or causes of land degradation and water scarcity. The first reason is related to the geo-climatological condition of Iran, in particular its location in the arid and semi-arid region. This is however only true to some extent. One informant argues that "*high water use efficiency of desert areas in comparison with the north part of the country with enough water shows that degradation and scarcity is more complex than what only physical and volumetric indicators might suggest*". In connection with this, Safinejead (1989) compares the average yield of wheat and barley in the irrigated land of dry area in the eastern and central regions of the country with the western region. This yield is higher than the average yield of the western region with more water, 1629 and 1150 kg respectively during the years 1960 to 1981, and he argues that other aspects should be taken into accounts.

The second reason is the process of urbanization, the population growth and the demand for more food.

The third reason concerns the rapid change of consumption patterns and lifestyles in recent decades. For instance, people expect to consume different types of food during all seasons and in all locations although they are often very scarce in certain seasons and not always local available. This rapid change of consumption patterns and lifestyles should be considered as the first and important step that triggers a domino effect of degradation and scarcity. This is what Carson (1962) also claimed as the base of environmental crisis:

> "It took hundreds of millions of years to produce the life that now inhabits the earth - aeons of time in which that developing and evolving and diversifying life reached a state of adjustment and balance with its surroundings. The environment, rigorously shaping and

> directing the life it supported, contained elements that were hostile as well as supporting. (…). Given time – time not in years but in millennia- life adjusts, and a balance has been reached. For time is an essential ingredient; but in the modern world there is no time. The rapidity of change and speed with which new situations are created follow the impetuous and heedless pace of man rather than the deliberate pace of nature*."* (Carson, 1962: 6)

The fourth reason is the domination of an engineering or mechanical view on land and water issues by emphasizing on technological aspects and neglecting sociological aspects in the process of planning.

The fifth reason is people's view on the inexhaustibility of natural resources which implies that they think that natural resources can be used during a very long, unlimited period of time.

The sixth reason is the lack of laws and improper laws in relation to natural resource management.

The seventh reason is the improper top-down mechanism of planning processes and the inconsistency in the application of programs by changing policies.

The eight reason covers the complexity of ecosystems and lack of knowledge on the proper mechanisms of nature.

The ninth reason concerns the inefficiency of educational system to cope with environmental issues. For instance, in university educational programs, the scientific disciplines are dealt with separately, which is necessary. But it often implies over-specializing of scientific disciplines, which means that students don't get sufficient knowledge about neighboring disciplines; education within a mono-disciplined vision is part of the problem

The tenth reason concerns the inflexibility and sometimes ignorance of religious values in the transition to modernity.

In general, the informants stressed the difference between the change and the speed of change on the global level and in the developing world, in particular in a country like Iran. Due to the dominance of imported western strategies to change the country in a short period of time Iran is suffering more from the disadvantageous consequences of modernization than, by comparison, the developed countries. The informants believed that the existing system of management and exploitation of land and water resources, which has been shaped by the events of the 1960s, has become primarily technology oriented (or: construction oriented) (Ardekanian, 2005, Karbasiuon, 2007). The dominant strategy at that time was the use of the

experience of industrialized societies and to transfer their technology. However, gradually negative consequences of modernity appeared in the original western countries. The developing countries are suffering more from the consequences of improper use of technology than the developed countries despite the fact that developing countries are expected to have learned from the experiences in industrial countries (Alizadeh and Keshavarz, 2005). A description of the opinions of the informants on the land reform of 1962 and its consequences as an important event in the process of industrialization will be given in the following section.

8.2.2. Land reform of 1962 and industrial modernization in Iran: advantages and disadvantages

There is a consensus among the policy makers that before the land reform of 1962 Iran's traditional system of landlord-peasant (*Arbab-Rayati*), during a long history, had developed, responded and adapted to the specific geoclimatological condition of country. Its members were working according to the written and unwritten rules and regulations that were understandable for everybody. They indicate that there was injustice to some extent by landlords which should be considered as one of the main negative aspects of the traditional system. This confirms what in this regard had been mentioned in Chapter 3.

As indicated in Chapter 4, the participants also believe that the main goal of land reform as part of the White revolution (*Enghelāb-e Sefid*)[61] was the prevention of the diffusion of communism in Iran. The US Congress recommended this in order to settle political unrest. The participants also think that the reform represents a shift towards modernization. From a sociological point of view, it can be assessed that the land reform was successful to end landlord's injustices. However, it didn't succeed to change the 'peasant' into a 'farmer or producer' in the sense of the modern producer. This was mainly because the land reform plan seriously neglected the socio-economic aspects and the value systems of the rural areas. Only parts of the land reform plan could be implemented in such a short time. In addition, the new smallholders, while being dissociated from the traditional system, were not capable to participate in the modern associations. The government adhered to the top-down vision and was not able to create opportunities for the new smallholders and to attract them to participate in the new cooperation system. In other words, the administration that was responsible to apply the land reform law, ignored costumes and cultures of rural areas and embraced a top-down view. Of course, according to the land reform act, land should be distributed to the

[61] The White Revolution (*Enghelāb-e Sefid*) was a far-reaching series of reforms launched in 1963 by the last Shah of Iran, Mohammad Reza Pahlavi. The Shah had intended it to be a non-violent regeneration of Iranian society through economic and social reforms, with the ultimate long-term aim of transforming Iran into a global economic and industrial power. The White Revolution consisted of 19 elements that were introduced over a period of 15 years, with the first 6 introduced in 1963. http://en.wikipedia.org/wiki/White_revolution, (last visit on 3 June 2009)

peasants. But they still had to be share-cropper (*Mosha*) and dependent. Later on, however, they rejected this condition in practice. This issue was addressed by one of the informants who recently had direct responsibility at the farming system bureau

Centralization got accelerated as a result of the land reform and the replacement of landlords by the government as a big landlord. Gradually after 1962, the country which was a wheat exporter started to become an importer of wheat. Also, many smallholders had to sell their land because of economical problems and migrated to the urban centers in search of work. Moreover, the speed of land degradation increased; one of the participants expressed that the same event has happened, since the collapse of Soviet Union, in countries such as Azerbaijan, Uzbekistan, Armenia and Tajikistan. Because of these consequences of the land reform, this period is called "agricultural disintegration of Iran". The increasing gap between rural and urban area is its main feature.

With the Islamic revolution of 1979 the land reform, which was accepted by that time, was not complemented by a proper alternative farming systems. In addition, some modern associations which were established in small parts of the country were ignored, instead of keeping them and studying them for their contribution to the improvement of agriculture. Those associations were destroyed and their means distributed to the members, which was in tune with justice as one of the slogans of revolution. As a result, smallholding and reduction of the size of land continued in the first decades after the revolution. It is important to note that there is also agreement on the fact that Islamic heritage law also is one of the main reasons for smallholding along with land reform.

The Islamic revolution continued the process of modernization which had started since the land reform. To implement social justice and to reduce the gap between the urban and rural areas, a revolutionary institution which is called *Jihad-e-Sazandegi* (the Construction Crusade) was established in the early era of revolution. Through this organization a lot of scientific elite and intellectual people got involved with the rural areas and the rural issues. As a result of this experience, they gained more inside knowledge of rural issues and they made it clear that without improving the rural area it would be impossible to improve production to reduce dependency, which was the other slogan of the revolution. To this end, lots of investments had been done in the infrastructure, such as rural roads, public bath, health care house, postal services, telecommunications, and so on. Consequently, after two decades the general features of rural areas had been changed and the process of modernization was continued. After the end of the Iraq–Iran war in 1988, a period of reconstruction (*Doran-e-Sazandegi*) began. More attention was paid to land and water management, resulting in more dam building, more irrigation networks to increase the efficiency of water transfer to the farm, and more drip and sprinkler irrigations were build to stimulate water use efficiency on farm

level and on national scale. Simultaneously, a 'land equipment and renovation plan' was started. The value system of industrial modernity, as described by Foltz (2002), expresses itself here within the context of contemporary Iranian natural resource management. It is the policy that has dominated decision-making on natural resource policies, both prior to and since the Islamic revolution of 1979.

8.2.3. Land and water management paradigms in Iran and transition to reflexive sustainable modernity: opportunities and constraints

Among the informants there is consensus concerning the existence of three periods of land and water management: the period of tradition, the period of industrialization and the period of sustainability. In other words, before the land reform the traditional system was dominant, but since then modernization is an on going process although in some parts of the country still the traditional way of agriculture is dominant, while in other parts industrial agriculture is dominant. In other words, they believe that it cannot be said that industrial agriculture is dominant everywhere and always. However, there is also a slight turn towards sustainability since 1990s. The participants believe that Iran has started to make progress towards sustainable development, but also that it has much more to do. Of course, they emphasized that this turn is made because of the concerns growing inside the country on the one hand and coming from global processes and events on the other hand.

While emphasizing that Iran is making the first step of the transition towards sustainability, the current situation of the country was described by the participants in different ways. There seems to be an ambiguity in the interpretation of sustainable development, especially among the policy makers. Some of the participants explained that there is a group of policy makers that is skeptic about sustainable development. They think it is a western plan to prevent progress for developing countries. So, they resist using the concept of sustainable development in national plans. However, by the introduction of the principles of sustainable development through workshops and conferences such as "*Islam and sustainable development, 1999*", skepticism is reduced.

Informants, looking at the policies and programs on a constitutional level, believe they can be adjusted to the principles of sustainable development. This has been done already to some extent. Article 50 in the 1979 constitution of Iran is showing the importance of environmental protection from an Islamic point of view.

> "In the Islamic Republic protection of the natural environment, in which the present and future generations must lead an ever-improving community life, is a public obligation.

> Therefore all activities, economic or otherwise, which may cause irreversible damage to the environment, are forbidden"

The third and forth *Five year socio-economic development plan* of the country after the Islamic revolution agree with principles of sustainable development. For instance, the water sector in the *4th 5-year Development Plan (2004-9)* sets 6 qualitative and 19 quantitative goals in which it encourages an integrated approach to management, consideration of economic aspects of water supply, sustainable development, raising finance, and strengthening public contributions (Hashemi *et al.,* 2007). Also, the same plan states that all projects which will be implemented in the future should be evaluated on environmental aspects.

Moreover, policy makers believe that "90 percent of Iran's 20-year strategic plan (2005-2025) (*Barnameh chashmandaz 20 saleh)*[62] is according to the principles of sustainable development…". However, discontinuity in the application of those policies and programs and inconsistencies by changing policies are some of the main challenges to sustainability and the application of its principles, say the participants.

8.2.4. Import of western strategy and lack of internal experiences

According to the participants one of the other constraints on the implementation of sustainable development is the import and copy of the western strategies in policy making. "*In relation to the idea of sustainability we are still following the same strategy as when we were importing the idea of industrialization as an idea of progress from the west. This has its advantages and disadvantages*…" Generally speaking, people in the west, having gone through the transformation towards the phase of industrialization, were internally confronted with its consequences. Therefore, the idea of sustainability was intended to cope with those consequences that emerged from the inside. But in a country like Iran where industrialization is applied much later, compared to western countries, and in which it is still an on going process, people are already confronted with some of its consequences: "*it is hard to make policy without enough experiences for a paradigm shift at large*…" Nevertheless, policy makers believe that it is irrational to postpone action, because it is a good opportunity to use the experiences of the developed countries and to prevent more negative consequences of the industrialization. But the informants stress that the way of transfer should be changed by taking into account context of origin and destination. This is even more important when we

[62] This plan is a macro strategy for the country's economic, social and cultural development for the next 20 years, which envisages Iran as a developed country with a leading position in the economic, scientific and technological domains of the Middle East region

consider that in a developing country like Iran the technological aspects of modernization are applied earlier than other aspects.

In addition, other constraints for the extension of sustainable development and also sustainable land and water management are: "*economical development as the dominant strategy which is in tune with the productionist view, based on subsidize economy and ignoring the price of natural resources, the domination of a technical view on the project planning, and also the improper top-down mechanism of planning processes*" For instance, regarding the *Doroodzan dam* "*lots of investments have been done by governments before and after Islamic revolution. However, investments in irrigation networks and land use were made without including consumers and producers from the first step, and ignoring socio-cultural aspects*". This example highlights the failure of the governmental unilateral vision. The *"average wheat yield in the farm just under this dam was about 3 tons but half an hour away from this location you could find farms with less investments of the government which had an average wheat yield of 6 tons"*.

Therefore, to communicate the idea of sustainable development in the country, people are needed on the different levels from policy makers to local people; people that are familiar with environmental issues and concepts as sustainability. The educational system should be organized from nursery to university according to this objective. Moreover, in the planning process socio-economic and environmental aspects should be considered together with the technical aspects of modern technology such as water well, irrigation networks, drip and sprinkler irrigation.. Fortunately, some laws such as the 'comprehensive soil law' and the 'Fair Water Distribution Act (1982)' could provide a basis for an inter-link between sectoral policies. The 'Guideline of implementing balanced use of water in agriculture' which is approved by the ministers council in 2008 shows also this change of vision and takes into account non-structural aspects of hydraulic structure simultaneously.

> "Article 6: Before establishing any hydraulic structure such as irrigation and drainage networks the Ministry of Energy and Ministry of Jihad-e-Agriculture have to consider all requirements which are needed for the establishment and arrangement of farming systems in order to let participate producers/beneficiaries, to foster their effective cooperation in all steps of study and implementation, and to accept responsibilities of exploitation, maintenance and irrigation management of those hydraulic structures"

8.2.5. Science, research and technology: part of the problem and part of the solution

Using science and technology to exploit nature is unavoidable if humankind is to progress. However, "*science and technology should be used along with ethics…"*. Regarding

technology, "*technology itself is neutral and beneficial, but if we don't use it in a proper way, it could be harmful especially modern technology…"*. To clarify this a little bit more: technology can be divided into traditional technology, in which it hardly has any capability to destroy nature, and modern technology, which has a high capability to destroy nature if we use it in an improper manner. For instance, with the Qanat, as traditional technology, it was not possible to overexploit water. With the more modern pump water well overexploitation of water is possible more easily. So, "*with modern, high powered technology, the cultural directives for using it become more important and every country must use its own cultural resources in this respect…"*. This means technology transfer without taking into account the native context in the process can be harmful. This has happened in Iran. Therefore, "*we should distinguish between the technology itself and consequences of improper use of technology in the country…"*. Highlighting this can correct people's evaluation and prevent negative views in which modern technology is presented as the only source of degradation and scarcity.

Regarding science two things should be distinguished. On the one hand, nature is complex and our knowledge is not enough to cope with those complexities. However, by way of integrating scientific disciplines we can reduce the consequences of this complexity. On the other hand, the 'conqueror view' on science, aimed at conquering nature and still dominant in general, should be changed towards a view on nature that shows respect; in which it is accepted that the human being is part of nature and should adjust himself to nature. This vision should be expressed within the scientific atmosphere and research areas of the country, where till now the productionist view still dominates with its concomitant partitioning of scientific disciplines (issue of interdisciplinary science) and exclusion of stakeholders (issue of relation between science and society). Participants emphasized the last two issues and believed that "science *and research in the academic environment are far away from the real issues which the country and its administrative organizations are dealing with…*"

In the current situation, with a fast growing economy to cope with the demand of society, without having beneficiaries who are aware of how to use science and technology in a proper way, and also without having independent quality control mechanism, the application of science and technology could increase land degradation and water scarcity. This is like "giving matches to children matches who will surely play with this fire ('*dadan tigh be daste zangi mast' in Farsi*). So, "*technology development should take place in a multilateral way, in which the right of beneficiaries and consumers are respected. It will give them the opportunity to choose the proper technology. However, they should be aware of the negative consequences of the improper use of technology. Moreover, there should be an independent quality control system in the development chain as well …"*. A broader perspective is needed, in which to take into account all these aspects. Of course, a process of technology transfer is

complex ,and changing direction towards sustainability is difficult; it needs a strong political will along with lots of investments which will not show concrete results already in a the short time. This is also one of "*the reasons of putting long term policy in the second place by some policy makers who are looking for gain in the short time of their management period …*"

8.2.6. Political parties, civil society and democracy as the main way to communicate, promote and implement sustainability

Soil and water experts say they do not see any possibility for sustainable development under the current conditions of the country. They believed this is mainly because of the high influence of political issues and sectoral approaches (exclusive views, compartmentalization) in policy making on the one hand and practical limitations of managerial and local forces on the other hand. Together they have resulted in the fact that the values of sustainable development have been ignored. Policy makers put land and water ethics to the second place of their decision-making process.

With regard to this policy makers stated that the *"lack of political parties, strong civil society and democracy, which together explain why there is not enough transparency, responsibility and accountability in the bureaucratic system and* in *society at large, is one of the main reasons why expert vision and understanding gets undermined"*. In other words, along with the exclusion of the public in the top-down system, it also makes experts less powerful or effective even in the bureaucratic system and administrative organizations. So, *"democracy is a necessary condition for sustainable development"*. Cultural change in society at large is needed. "*Compared to the situation before Islamic revolution, and because of the broad social changes following the significant increase of public and higher education, people's mentality has changed. Therefore, it becomes easier to absorb modern concepts*". This is what also expressed by Soroush about the Iranian current context in general:

> "On the one hand Muslims, I'm speaking now from Iran and about Iran, who are the majority of the population, like their religion, it is like their homeland, they would like to live in it and to be happy with it and to have a prosperous life in their intellectual or spiritual homeland, i.e. Islam. On the other hand, of course, they understand the necessities and the requirements of the modern age, the modernity, the post-enlightenment world system as we know it today."(Soroush, 2007)

Therefore, there is needed a model in which to include those two value systems. It was part of all development plans since the Islamic revolution to include Islamic values in them and not only western values (Samimi, 2008). In other words, this highlights the challenge to a

duty-based paradigm, posed by a right-based culture of modern society. Soroush (2007) suggests a third paradigm:

> "In my own characterization, modern culture is a rights-based culture, whereas pre-modern or religious culture was duty- or obligation-based. It does not mean that these two are totally at loggerheads, but the emphasis is different. Modern man is seen as freed from the bondage of religion, and as having exiled God to the remote heavens; but he is very close to a morally deterring kind of egoism. In the religious atmosphere, you are supposed to be more humble and conscious of your obligations. Now can duty- and rights-based views be reconciled? Both have their shortcomings. What we need is neither to combine nor to eliminate the two, but perhaps a third paradigm. Perhaps we should revalue the concept of virtue, which may do justice to both obligations and rights"**.**

8.2.7. Stakeholders' participation, government role, land consolidation and rural institutions: challenges and hopes for participation

Since the demise of the traditional land and water management system, lots of activities have been done to establish new cooperatives although, in the end, none of these succeeded with a significant achievement.

In the traditional system, cooperation was organized through the hierarchical relationship between landlord, peasants and other people in the village. This system was based on experiences of generations. It was a long history in which the country finally reached a status quo where the traditional system could work according to (un)written rules and regulations that were understandable and applicable by all members. Since the replacement of the landlord by the government and the corresponding loss of those experiences, all new cooperatives have been established by way of a top-down approach by the government. This unilateral vision of organizing cooperatives which is still continuing is one of the main challenges of stakeholders' participation. Informants state that "*participation in the modern sense is a mutual relation between governmental organization and people which should be organized through top-down and bottom-up approaches that determine opportunities for stakeholders to participate voluntarily. This relation needs to be fed by new experiences which both sides currently don't have sufficiently. However, after the Islamic revolution, after having different elections for political institutions from the presidential level to the rural council, gradually experiences accumulate which call for a change of the socio-cultural behaviour towards participation…*". Accordingly, some believe that "*a significant achievement of rural institutions, such as rural production cooperatives (tavoni tolid) and water associations (tavoni abbaran), depends on the degree of institutionalization of political parties, of civil society and of democracy in the society at large…"* which can give people

opportunities to participate voluntarily on the one hand, and promote policies and regulations of the government on the other hand, that consider the role of all stakeholders from the beginning. Of course, paying "*attention to the mechanism which is still working around the Qanat irrigation system since the land reform, and also taking into account experiences of small bottom-up cooperatives which have been established around water wells, can be useful…"*

Regarding NGOs "*there are some policy makers who don't have positive views on NGOs because they do think it is a western approach…*". This is one of the reason why the number of request to the government and opportunities for participation have known fluctuations because of changing policy makers. For example, "*the "Farmers' House", as a big NGO which was established in order to protect the right of farmers by making them powerful (Article5) has been confronted with this fluctuation. However, it is following its own strategy to be stronger in this regards…"*

> The "Goal of Farmers' House" is to harmonize farmers' activities around the country in order to support and protect their political and socio-economic rights and their human rights in the Iranian context (Farmers House constitution, Article 5)."

As heritage right was addressed as one of the main reason of smallholding, besides the land reform, there is believe that *"if Islamic heritage right will be reinterpreted which fortunately is under study in the Expediency Discernment Council*[63] (*Majmae tashkhis maslehat) on the one hand, and if the dominant subsidized economy changes into one that agrees with sustainable development on the other hand, then the problem of smallholding will disappear and we will move towards sustainability…"*. Recently a law has been approved by parliament that prevents landowners to make their land smaller than a certain 'technical size'; if a piece of land is smaller it cannot be useful any more. Also, *"there are some signs that are hopeful for the future. By changing our views on agriculture economics, by the accumulation of finance in the private sectors, by changing our interpretation of independency into a less rigid one, compared to the first decades after revolution, it can be concluded that there is a shift towards decentralization that attracts more participation in general…"*

8.2.8. Ethical issues and the need of ethics regarding land and water, ethics in science and technology and ethics in the administration

[63] The Expediency Discernment Council of the System is an administrative assembly appointed by the Supreme Leader and was created upon the revision to the Constitution of Islamic Republic of Iran on 6 February1988. Its purpose is to resolve differences or conflicts between the Majlis (Parliament) and the Council of Guardian, and also to serve as a consultative council to the Supreme Leader.
http://en.wikipedia.org/wiki/Expediency_Discernment_Council , (last accessed 3 June 2009)

The process of modernization is seen to be accompanied by a change in socio-cultural behaviour of people; informants believe that the "*utilitarian vision is increasing*…". During this transition society in general and farmers/producers in particular can be divided into three groups. "*There are religious farmers which are sensitive to the use of resources and their general behaviour is sustainable-oriented. The second group is not strongly religious on the one hand, and they are not sensitive to ethics on the other hand: they are more sensitive to their benefit. The third group is non-religious. However, they are sensitive persons which do care about ethics and the benefits of others…".* Therefore, there is a difference between the value systems; the *"reinterpretation of religious values and their inclusion into an ethical framework that reflects the people's behaviour is essential and helpful…"*

The informants mention also the rising issue of distrust in different levels. This issue is increasing *"between farmers and experts and vice versa. It is caused by a lack of common language for communication. Also, distrust between research organization and administrative organization and vice-versa is increasing, because administrative organizations believe scientific and research organizations are dealing with issues far away from the real issues administrative organization are dealing with, and also scientists and researchers don't care about the experiences of those organisations. In addition, there is distrust between organizations on the national level such as Plan and Budgets Organization and other organizations on their programs and plans, due to improper top-down mechanisms in the process of planning …".* This shows the need for ethics in the administration.

8.3. Concluding remarks

The purpose of this chapter is to investigate policy makers' attitudes towards sustainability, integration, participation, technology, science and ethics, which should all be taken into account in the reflexive and sustainable land and water framework in Iran. Geoclimatological conditions of country, unilateral vision, change of people's mentality and mismanagement are seen to be the main groups of causes of land degradation and water scarcity. The '*technology–governance-mentality nexus*' framework shows itself to be useful here to understand the complexity and context of issues of land and water management. The rapid changes of consumption patterns and of lifestyles together with the import of western strategies to change the country in a short period of time are the causes that made a developing country like Iran suffer the consequences of industrialization more than the developed countries.

Land reform with its political goal in the first place, was a turning point towards modernization which increased the speed of land degradation and water scarcity. By replacing land lords with the government as a big landlord, centralization was increased. Gradually, the country which was a wheat exporter started after 1962 to become an importer of wheat. Also,

many smallholders had to sell their land because of economical problems and migrated to the urban centers in search of work. Consequently, the gap between rural and urban areas was increased in the period which is called "agricultural disintegration of Iran".

Our informants confirm the three paradigms of land and water management, roughly described 'tradition', 'industrialization' and 'sustainability'. However, they cannot always clearly separate them chronologically and do not believe that the industrialization phase has passed. Nevertheless, they confirm a slow move towards sustainability since 1990s. The transition towards sustainability is confronted with constraints and opportunities. As the concept of sustainable development is new, there is an ambiguity in the interpretation of sustainable development by the policy makers: a group of policy makers are skeptic and they think sustainable development is a western plan to prevent the progress of developing countries. However, by introducing the principles of sustainable development through workshops the skepticism is decreasing. Policies and programs of the country, coming from all the different levels can be brought in agreement with the principles of sustainable development, which has been also done to some extent. However, with regard to the application and extension of sustainability, one of the main challenges for the government and society at large is the inconsistency and discontinuity of the application of those policies and programs as a result of changing policies.

Iran is already confronted with some negative consequences of industrialization. The lack of internal experiences, the dominance of the western strategy of industrialization and the relatively recent 'take off' of industrialization, compared to western countries, make it difficult to introduce a policy shift towards a new paradigm. Nevertheless, one should accept the opportunity to learn from the experiences of developed countries to prevent more negative consequences of industrialization. But the method of technology transfer should be changed and the context of origin and of destination in the process of transfer should be taken into account.

The informants stress the need of transparency, responsibility and accountability in the bureaucratic system and society at large, and also the lack of communication and interaction between the rural institutions such as the rural production cooperative (*tavoni tolid*) and the water association (*tavoni abbaran*), and the people . Although since the Islamic revolution there is some accumulation of experiences in democracy by having various elections for political institutions from the presidential level to the rural council, there is still a need for a model that is context sensitive and that takes into account the Islamic value system along with modern values.

The informants believe that the use of science and technology is unavoidable. However, they emphasize the role of culture with respect to modern technology. So, technology should be developed in a way that takes these aspects into consideration. Science and research should consider the complexity of nature and change their dominant conqueror and productionist view towards nature. Moreover, they raise the issue of interdisciplinarity, that of the relation between science and society and the necessity of ethics of science and technology.

Finally, the informants have the opinion that the socio-cultural behaviour of people by moving towards modernization, are more prone to social distrust; hence the importance of equity and justice in the area of land and water management, and also the importance of Islamic ownership with which government cannot easily interfere. They argued for the need for the reinterpretation of religious values and their inclusion into an ethical framework.

Chapter 9
Comparative analysis of stakeholders' attitudes

The purpose of this part was to investigate the problems and perspectives of the transition to a reflexive land and water management paradigm. To this end, four large-scale surveys were carried out in which the attitudes, values and interests of farmers, village informants, soil and water experts, and policy makers have been investigated. In this chapter the outcomes of these investigations will be compared in order to highlight their agreements and disagreements with respect to the subjects that are of critical relevance for a reflexive turn in natural resources management.

9.1. Current perspective of land and water resources management regime and causes of land degradation and water scarcity in Iran

The surveys confirmed the drastic change in the underground water exploitation regime and the land use pattern which was portrayed in Chapter 4: the replacement of the Qanat irrigation technology by (semi-) deep well technology, and the substitution of a system of sharecropping by one of smallholding after the land reform of 1962.

The policy makers corroborated that the land reform, which was an important part of the White revolution (*Enghelāb-e Sefid*), was indeed the turning point towards the industrialization of agriculture and the modernization of the land and water system. Although the land reform was successful in ending the landlord's injustices, the replacement of the landlord by the central government marked the start of the hydraulic mission, which went hand in hand with the disintegration of agriculture and the dissociation of people from nature. Collective action was more and more replaced by individualism; there was a growing migration from rural to urban areas, while land degradation and water scarcity increasingly became a problem.

Policy makers mentioned ten causes of land degradation and water scarcity in Iran that could be divided into clusters, namely the geo-climatologic condition of the country, the unilateral vision of government, the changed mentality of farmers, and mismanagement. The rapid changes in consumption patterns and lifestyles, together with the introduction of western strategies to change the country in a short period of time, made a developing country like Iran suffer more than the developed countries during their process of industrialization.

In short, the surveys confirm the claims that were put forward in Chapter 1 of this thesis, that there is indeed a crisis in the sector of land and water management and, hence, that there is a need to find a way out of this crisis and towards a more sustainable land and water management.

9.2. Sustainability: Opportunities and constraints

Generally speaking, the empirical studies show that the stakeholders have a positive attitude towards sustainability. But this doesn't mean that they really act in a sustainable way. Moreover, the stakeholders recognized the three paradigms of land and water management, although they were not always able to clearly separate them chronologically. They do not believe that the industrialization phase has been passed, but they also acknowledge a slow turn towards sustainability since 1990s.

An important issue concerns the interpretation of the concept of sustainability itself. While experts tend to understand sustainability in scientific terms, and while farmers are more familiar with the practical aspects of sustainability, policy makers show some ambiguity in implementing this concept. These differences among stakeholders are understandable because the concept has been introduced only very recently. With the introduction and implementation of sustainable land and water management the mistake that occurred during the period of modernization should be avoided, to wit, copying the Western model without taking the local context into account. Fortunately, as the policy makers recognized, the policies and programs that are derived from the Iranian constitution are compatible with the principles of sustainable development.

In practice, the implementation of these principles is being confronted with several problems. Although farmers are familiar with practices that are important for the improvement of soil productivity and the sustainability of soil fertility such as 'leave land fallow' they are not willing to perform those practices, mainly because of the country's current economic situation. Experts are skeptical about the implementation of sustainable development under the country's current conditions, mainly because of the considerable influence of political issues and sectoral approaches (exclusive views, compartmentalization) in policy making on the one hand and the practical limitations or managerial and local forces on the other hand, which together have caused the values of sustainable development to be ignored. However, they believe that it is possible to address both practical problems of administrative organizations and concerns of sustainable development at the same time.

Another problem concerns the discontinuity of the application of the policies and programs related to sustainable development and the inconsistencies that emerge from shifting policies. There is a lack of transparency, responsibility and accountability within bureaucratic organizations and within society at large, due to a democratic deficit, and the absence of a strong civil society and independent political parties. Along with the issue of the exclusion of the general public in the top-down system, this deficit could hamper the effective use of expert knowledge even within the bureaucratic system and the administrative organizations. Therefore, as policy makers argue, successful implementation of sustainable development is dependent on the extension of democracy. They confirm Tony Allan's statement, discussed in Chapter 5, that reflexive land and water management is basically a political process.

9.3. Integration possibility of traditional and modern land and water resource management

One of the objectives of this PhD project concerns the possibilities of revitalizing traditional technological and managerial methods and integrating them with modern methods. The findings of the surveys show that the stakeholders are generally aware of the advantages and disadvantages of traditional and modern methods. Regarding the possibilities of integrating traditional and modern methods they can be divided into more optimistic and more pessimistic groups.

The more optimistic stakeholders are aware of the side effects and consequences of modernity, but they do not believe that the traditional system of land and water management alone is enough to cope with current land and water issues. The optimistic farmers and village informants presume that some of the disadvantages of traditional methods can be compensated by combining them with modern methods. Their main suggestions to make integration work is that farmers and experts should work together, sharing their knowledge in the whole process of farming, and using a bottom-up instead of a top-down approach. This underlines the importance of communication between scientists and farmers, which was also indicated in Chapter 4. To find a way towards sustainable land and water management, the experts suggested that the direction of technological innovation should be changed towards the integration approach.

The more pessimistic group of farmers can again be divided into two clusters. Some farmers favor tradition because they are more familiar with traditional methods and consider traditional methods to be better than modern methods. Other farmers are in favor of the modern system because they believe that traditional and modern methods are irreconcilable,

that using traditional methods in large-scale cultivation systems is impossible, and that modern methods are more scientific and efficient.

9.4. Science, research and technology: part of the problem and part of the solution

Technology

Generally speaking stakeholders have a positive attitude towards technology and believe its use is unavoidable to realize development.
Farmers favor modern technology mainly because of its impact on the level of production and income and because of its beneficial impact on working conditions.

Experts believe that technological innovation and sustainable development need not be incompatible. To find a way towards sustainability technological innovation should proceed through the integration of traditional and modern methods.

Policy makers distinguish between the technology itself and the consequences of the improper use of technology. This is very important with respect to modern technology, which has a greater capability to destroy nature than traditional technology. The policy makers stressed the importance of culture in shaping technological innovation. This again confirms the importance of taking into account the whole domestic context in which technology has to be adopted.

Science and research

In general the stakeholders have a positive attitude towards modern science, however, some issues were addressed which should be considered within the new reflexive framework. Farmers mentioned the lack of indigenous knowledge as a problem in the communication between farmers and agricultural experts. As indicated in Chapter 4, this is related to the reductionist character of modern science and the desire to control nature on the one hand and the elitism of the engineers and their distance from mainstream society on the other.

Policy makers mentioned two things with respect to science. On the one hand, they think that nature is complex and that our knowledge is not adequate enough to cope with those complexities. On the other hand, they see the conqueror view of science towards nature as problematic and believe that this view should be replaced by a view of respect for nature, in which humanity is considered as part of nature and should adapt to nature. The policy makers suggested that this vision should enter into the country's scientific atmosphere that is still

dominated by the productionist view, the separation of scientific disciplines and the exclusion of stakeholders.

Moreover, both experts and policy makers expressed the opinion that science and ethics are compatible and that ethics can play a role in promoting and facilitating the dialogue among scientists themselves, and also between science and society.
Compared to 20 yeas ago, the communication of farmers with experts has slightly improved. However, farmers are more in favor of those experts' recommendations which are in tune with the production paradigm and which lead to effects in the short run. Experts' recommendations which require cooperation such as land consolidation or which are only effective in the long run are less preferred by the farmers.

9.5. Challenges and hopes of stakeholders participation and the role of government

The large surveys confirmed the existence of traditional cooperative systems, of traditional participation and of collective action in the villages prior to land reform of 1962. They also confirmed the hierarchical character of the traditional cooperative system as it was portrayed in Chapter 3. The main reasons for the abandonment of traditional cooperative systems that stakeholders mention are: the land reform of 1962, the increase in the number of owners because of inheritance, the degradation of Qanat and local issues. Consequently, individualism is growing and smallholding has become dominant.

Since the replacement of the landlord by the government, all new cooperatives have been established in a top-down fashion by the government with all the concomitant problems. After the land reform of 1962, the rural area has experienced different kinds of cooperative systems with different rules and regulations, none of which were as successful as the Buneh system in organizing collective action. It is revealed that the majority of farmers are not member of these cooperative systems. However, among them farmers and informants have a positive attitude towards 'rural production cooperatives (*tavoni tolid*)'. Among the farmers who are member of one of the new cooperative systems the majority of them is member of 'rural production cooperatives (*tavoni tolid*)'.

Together with this positive sign, it was also shown that farmers' collective action and their participation in rural projects have slightly increased. Moreover, it became clear that the role of the government to facilitate this participation has also changed compared to 20 years ago. The introduction of the Village Council, whose members are directly elected by the village inhabitants, is interpreted as the reason for this positive change.

The main reasons which prevent farmers to participate in the implementation of land consolidation and also to be a member of Agricultural Production Cooperatives (APCs) are disagreement among the farmers themselves, distrust of governmental agencies, deficient governmental leadership, and farmers' dissatisfaction with the earlier rural cooperative system. Another obstacle to participation is the dominance of the top-down approach in the process of project identification and implementation. This unilateral vision is also mentioned by policy makers as one of the main challenges of stakeholders participation. Informants state that participation in the modern sense is a mutual relation between governmental organizations and the people. This reciprocal relation should be organized through top-down and bottom-up approaches that give stakeholders the opportunity to participate voluntarily in all kinds of projects that require cooperation. This relation needs to be fed by new experiences which both sides currently don't have sufficiently. However, after the Islamic revolution, by having different elections for political institutions from the presidential level to the rural council, gradually experiences accumulate which cause a change of the socio-cultural attitude towards participation.

Accordingly, some believe that a significant improvement of rural institutions, such as rural production cooperatives (*tavoni tolid*) and water associations (*tavoni abbaran*), depends on the degree of institutionalization of political parties, of civil society and of democracy in society at large which give people opportunities to participate voluntarily on the one hand, and promote policies and regulations that include all stakeholders from the beginning on the other. To solve the issue of smallholding, the stakeholders mentioned two suggestions that should be considered in the reflexive framework. The first one concerns a reinterpretation of Islamic heritage law in such a way as to prevent the heirs from dividing their lands. The second one involved terminating subsidies to agriculture, which will lead small farmers to sell their land to others and thus encourage land consolidation and the creation of cooperatives.

In addition to these hopes, it was discovered that there are still some valuable experiences with traditional forms of collective action which should not be ignored but should be collected and considered in the transition to reflexive of land and water management.

9.6. Nature, environmental and agricultural ethics

The surveys show that the stakeholders' perceptions of nature fit into the stewardship idea (Fig 9.1). The three statements which are representative of the stewardship idea, including 'Nature is God's creation', 'It is our religious responsibility to take care of nature' and 'Nature will be important to future generations', received the highest scores form the stakeholders (Fig 9.2). This highlights the religious context of Iranian society which is 99 percent Muslim and which is relevant for achieving sustainable development.

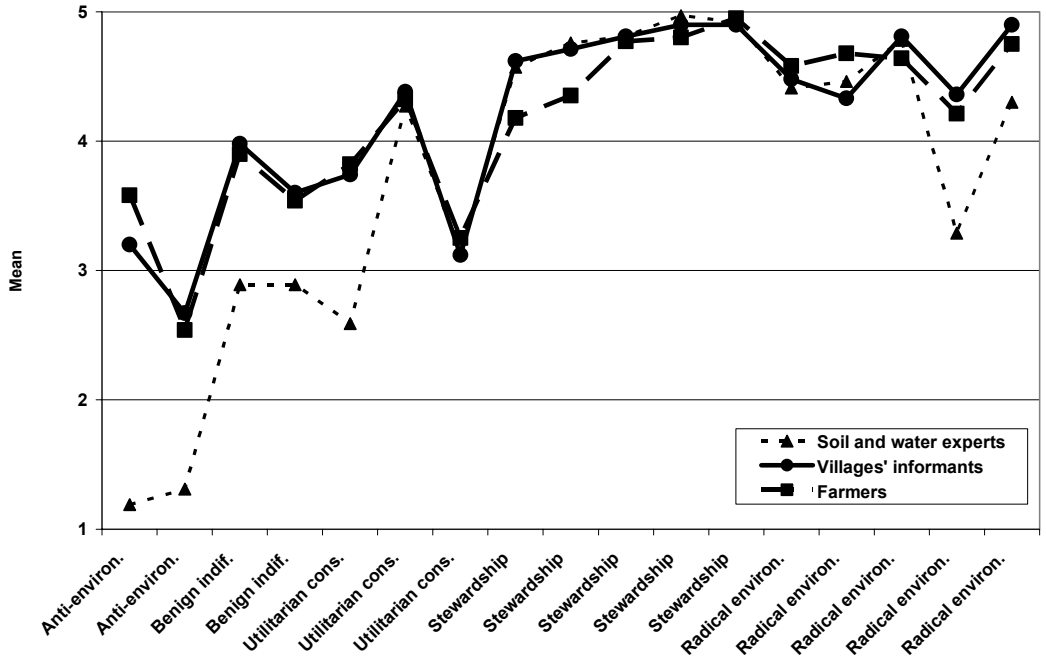

Fig9.1. Environmental ethics typology of Land and Water Stakeholders (LWS)

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree

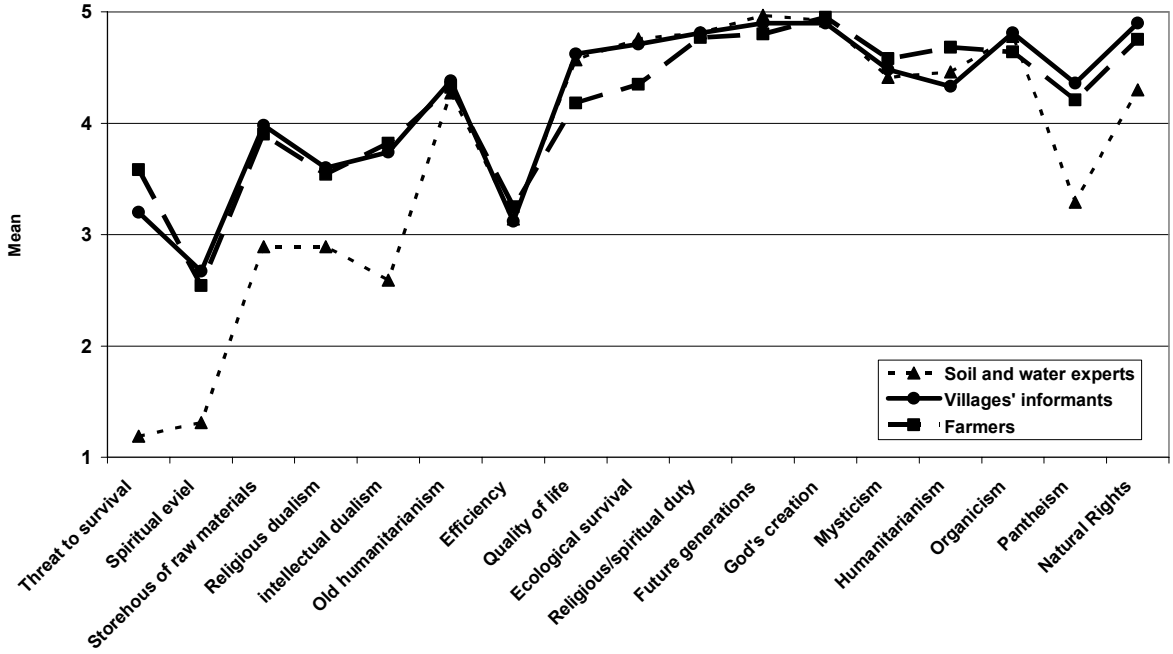

Fig9.2. Environmental ethics typology of Land and Water Stakeholders (LWS)

Note: 0= don't know, 1=fully disagree, 2= partially disagree, 3=neutral, 4=partially agree, 5= fully agree

The shift from tradition to industrial modernity went hand in hand with a shift in the basic philosophy of farming from a way of life to a business. Moreover, economic factors are preventing farmers from performing sustainable practices. This has brought about a tension between the stewardship idea and the current economic context of farming that is determined by the industrialization of agriculture and by social preferences for low-cost, high-quality food.

It should be taken into account in the ethical framework that some governmental programs (e.g. the annual prize award to farmers who produce extremely high volumes) encourage farmers either to adopt an orientation of deception or to behave unethically outright.

Finally, policy makers expressed the opinion that the process of modernization went hand in hand with the erosion of trust between farmers and experts, between research organizations and administrative organizations, etc. To rebuild trust it is important to promote equity and justice in the area of land and water management. The policy makers stress the need for the reinterpretation of religious values and their inclusion in an ethical framework and the need for ethics in the administration.

9.7. Concluding remarks

This chapter has highlighted the agreements and disagreements of stakeholders with respect to issues that are of importance for a successful transition to sustainable land and water management.

The large-scale surveys confirm that there is indeed a crisis in the sector of land and water management. Therefore, there is a need to find a way out of this crisis and towards a more sustainable land and water management system.
The stakeholders have a positive attitude towards sustainability. However, in practice, the implementation of principles of sustainability is being confronted with several problems such as the country's current economic situation, domination of exclusive visions and compartmentalization in the policy making process, the discontinuity of the implementation of the policies and programs related to sustainable development and the inconsistencies that emerge from shifting policies.

To find a way towards sustainability, technological innovation should proceed through the integration of traditional and modern methods. Moreover, the importance of culture in shaping technological innovation and taking into account the whole domestic context in which technology has to be adopted was emphasized by stakeholders.

With respect to governance, the lack of transparency, responsibility and accountability within bureaucratic organizations and within society at large was mentioned. Farmers' participation in various projects that require cooperation is frustrated by disagreements among the farmers themselves, by distrust of governmental agencies, by deficient governmental leadership, and by the farmers' dissatisfaction with the earlier rural cooperative system. All this confirms that the empowerment of experts in the process of policy making and the establishment of effective rural institutions depend on the degree of institutionalization of political parties, of civil society and of democracy in society at large.

The stakeholders' perceptions of nature correspond to the notion of stewardship. The stakeholders stressed the need for a reinterpretation of religious values and their inclusion in an ethical framework, and the need for ethics in the administration.

Stakeholders questioned the reductionist and elitist vision of modern soil and water science, and were in favor of a new relationship between science and society.

In the next chapter, these results will be used to further refine and develop the contours of the reflexive land and water management paradigm that was already outlined somewhat sketchily in Chapter 5.

Part IV
Towards reflexive land and water management

In the previous part the attitudes of farmers and village informants, soil and water experts, and policy makers towards a more sustainable and reflexive land and water management, and their evaluation of the chances for a turn towards reflexive land and water management within the current situation in Iran were explored. Building on the results of Chapter 6, 7 and 8, we conducted a comparative analysis in Chapter 9 to sketch the main outlines of a stakeholders' consensus, noting their agreements and differences on the various elements of the reflexive land and water framework which had been introduced in Chapter 5. This has provided quite a lot of food for thought regarding possibilities and constraints for a paradigm shift to reflexivity and led us back to the main questions of this thesis: What could reflexive land and water management in a non-European and more particularly Iranian constellation be like? How should reflexive land and water management take shape in the MENA-region, including Iran? What kind of technical system, institutional requirements, ethics, and soil and water science are needed in this transition? To this end, this final part will look back upon the previous parts to provide a synthesis of research findings and their conceptual and practical implications.

Chapter 10
Transition to reflexive land and water management in Iran

10.1. From traditional to modern to reflexive land and water management in Iran: answering research questions 1 and 2

In chapter one and two I outlined the research questions of this thesis:

1. *How can the causes and consequences of the environmental crisis Iran is confronted with, in particular degradation of land and the depletion of water resources, be conceptualized in terms of the technology-institution-culture nexus?*
2. *How can the technology-institution-culture nexus take into account the revitalization (rehabilitation) of the traditional paradigm and the integration of this paradigm with industrial modernity, in such a way that the benefits and advantages of both will be maintained as much as possible?*
3. *What technology is required according to the technology-institution-culture nexus that will fit the transition to such a reflexive paradigm?*
4. *What institutional requirements are needed according to the technology-institution-culture nexus to accommodate this transition?*
5. *What ethics is required according to the technology-institution-culture nexus that will fit the transition to such a reflexive paradigm?*
6. *What role should science and technology play in this transition according to the technology-institution-culture nexus?*

In this section I will first give an answer to the first two questions and in the next sections to the other four.

This dissertation started with highlighting the environmental crisis, in particular land degradation and water scarcity, as a global issue. Presenting the general perspective of Iran in Chapter 1 showed that the MENA region is also confronted with the issue. Regarding this, I explained that the subject matter of this PhD thesis encompasses the causes and consequences of environmental crisis and the trends and tendencies that suggest a way out of this crisis towards sustainable land and water management.

The description of the different aspects of land and water issues revealed the complexity of key drivers and their interwoven and that although the inclusion of all of them is necessary, it is a difficult task to find out which ones are the key challenges of sustainability.

The notion of the technology-governance-people nexus was introduced in Chapter 2 as a useful tool as it lays bare the foundation for a descriptive and normative framework to explore and examine the problems of land and water and the possibilities of a transition to sustainable land and water management.

Very often technology, governance and people are treated separately in relation to sustainable development. Behavior, for instance, is understood as something that must change but little thought is given to how it is shaped by technology (Murphy, 2007: 212). In refining these three concepts I showed that considering contextual accounts of technology, tensions between consensus and conflict views of governance and the multiple identities of the people is a realistic way of perceiving and linking technology-governance-people regarding sustainability.

After the introduction of the concept of land and water paradigm in Chapter 2, I presented in Part II in terms of the technology-governance-people nexus the paradigm of pre-modern (traditional) land and water management, the shift to industrial modernity in the Iranian context, and the emergence of reflexive modernization as a response to the challenges of industrialization.

In Chapter 3 I showed the strong connections between the key technical system (the *Qanat* system of underground irrigation channels), the main governance institution (the *Buneh* cooperative organization of agricultural production) and the belief system (first Zoroastrianism and later Islam) of the traditional, premodern system of land and water management. The traditional paradigm assumes that there is an intimate relationship among humans and nature. The dominant premodern way of land and water management is community based. The stewardship model incorporating a caretaker (steward), the object of care, and the owner of the object is the base of the ethico-religious system. This cultural and ethico-religious framework motivated people to use soil and water, and provided the legal and institutional structure to handle these scarce resources and their concomitant technologies. The social inequality and lack of individual freedom within the Buneh organization were drawbacks that would later contribute to the transition towards the modern paradigm.

In the period after the Second Word War, modernization represented the main developmental model for the less developed parts of the globe. In Iran, both the rulers and the new middle class that emerged in the 1950s considered the traditional system as backward and accepted large-scale modernization as the model for progress. As a result, there was a shift from tradition to modernity, which in the sector of land and water took place especially with the land reform of 1962 which was discussed in Chapter 4. Modernization brought some advantages such as increasing the area of cultivation and growing production. But on the other

hand, some elements of the traditional system that were important for natural resources management such as community-based organizations were ignored, due to the lack of understanding of the native context by both foreign and new domestic agents, and the speed of change compared to that of the modernization process in the West.

Due to this paradigm shift and the application of the western model the pre-modern (traditional) technology-institution-culture nexus changed. The underground water exploitation regime and land use pattern which was sketched in Chapter 3 was transformed. The Qanat irrigation system partly was replaced by (semi-)deep wells and large dams, the *Buneh* was substituted by a system of smallholding, and a mechanistic worldview with important ethical ramifications emerged.

As said, this shift brought opportunities such as increased water exploitation that allowed farmers to bring more land under cultivation and increased farmers' independency on the one hand, and brought some drawbacks such as the lowering of the ground water table level because of overexploitation of water, reducing the volume of effluent water every year and increasing salinization of water on the other hand.

Due to the abandonment of the *Buneh* system and the replacement of landlords by government agencies, the people were no longer able to collectively maintain the rural infrastructure and became dependent on the state for the necessary services and this led to the birth of the hydraulic mission of society with its core aim being the mobilization of water and the development of a reliable source of supply. The traditional sense of land and water resources management for the benefit of the community seems to have given way to an 'every man for himself' mentality. Instead of being a vital source of life that was provided by the local environment to which people had an intimate linkage, water now became a commodity that flowed from a tap with the origin of that water being remote and someone else's business to provide. The dehumanizing scale of modern water technology and the invisibility of its source provided people an "illusion of abundance". Moreover, due to this shift, the economic model of farming (productionist vision) emerged which considers the value of the land to be its resource or potential. The definition of farming changed from a way of life to a business. Consequently, the *economic context of ethics in agriculture* emerged: the industrialization of agriculture and the resulting technological treadmill on which farmers are increasingly being forced to run as a result of technological change as well as social preferences brought tensions between the farmers' belief in working the land out of a sense of stewardship and the economic realities of farming as a business. The farmer is to produce as much food as possible, and neither the producer nor the consumer should make value judgments about the non-economic worth of the land.

The commodification of land and water was a key part of the paradigm of industrial modernization that was based on Newtonian physics and underpinned by Baconian and Cartesian philosophy. This paradigm, which led to reductionism and the desire to control nature, was propagated by engineers who increasingly became instruments of state policies and at the same time became increasingly elitist and distant from mainstream society, ultimately losing touch with changing groundswells of grassroots opinion.

The disastrous effects of industrial modernization became apparent from the 1950s on when the environmental crisis surfaced. There are various responses to the environmental crisis, ranging from the radical anti-modernism of the first wave of environmentalism to the notion of reflexive modernity of the second wave in the North, which was outlined in Chapter 5. Reflexive modernity in the area of land and water management is shown to have three phases since the 1960s. Some scholars believe that, by and large, the semi-arid North have passed through all the three stages and that the South is still stuck with industrial modernity. Allan's view on reflexive modernity was criticized because it places too much faith in a unilinear model of institutional evolution and fails to recognize that the course that second modernity has taken within a European constellation will differ considerably from the course it is likely going to take within non-European constellations, where the dynamic of reflexive modernization displays its effects not on first-modern societies but rather on the distorted constellations of post-colonialism. I argued that different non-European routes to and through second modernity still have to be described, discovered, compared and analyzed as Beek, Bonss and Lau also say (Beek *et al*., 2003:7) (answering research question 2 of thesis).

By way of confirmation, there are also signs and indicators of a turn to reflexive modernity in Iran especially since the 1990s. Nevertheless, it is in its first stages and must be conceptualised and developed in terms of new technical systems of land and water management, of corresponding social institutions and of a new ethico-religious framework that is sensitive to the specific features of the region. In addition, the reflexive turn also calls for a new social contract between science and society and a shift to post-normal science, which were outlined towards the end of Chapter 5.

In part III I explored the attitudes of relevant stakeholders towards a more sustainable and reflexive land and water management system, and how they evaluate the chances for a turn towards such a reflexive system within the current situation in Iran.

Policymakers addressed ten reasons as purported causes for land degradation and water scarcity in Iran which were classified into four groups, to wit, the geoclimatological condition of country, the unilateral vision of government, change of people's mentality and mismanagement. This diagnosis confirms the validity of the 'technology-governance-

mentality nexus' framework to understand the complexity and context of issues of land and water management. The rapid changes of consumption patterns and of lifestyles together with the import of western strategies to change the country in a short period of time are the causes that made a developing country like Iran suffer more than the developed countries from the consequences of industrialization (answering research question 1 of the thesis).

On the basis of the results of the historical study (Part II) and of the empirical research (Part III) the contours of reflexive land and water management which were outlined in Chapter 5 can now be refined and developed (10.2) in terms of a new technology-governance-people nexus and the scientific approaches that are needed for the transition to the reflexive modernity paradigm. This paradigm includes an integrated technical system, new participatory arrangements and a new ethico-religious framework covering a post-mechanistic ethics, and reflexive soil and water sciences. The chapter will close with concluding remarks and some recommendations for future research (10.3).

10.2. Four key elements of the reflexive land and water management framework: answering research questions 3, 4, 5, and 6

> *"Putt's Law: Technology is dominated by two types of people: those who understand what they do not manage, and those who manage what they do not understand."* (Putt and Driscoll, 2006)[64]

> *"Water professionals will have to be able to translate cubic meters of water into governance implications*." (Röling, 2009:S229) *"Required skills in applying the ''third way'' approach are, among others, negotiation, cooperation, communication, process facilitation, leadership, etc*." (Van Vuren et al., 2009:S166)

> *"...cultural diversity is as necessary for humankind as biodiversity is for nature"* (The universal declaration on cultural diversity UNESCO, 2001, Article 1)[65]

> *"Christianity, together with other faiths that influence human conduct, needs again to become "a land ethic"."* (Rolston, 2006: 312)

[64] Putt's Law and the Successful Technocrat: How to Win in the Information Age http://www.quotationspage.com/quote/877.html , http://isbn.nu/authorx/putt_archibald (last accessed 12 May 2009)

[65] http://portal.unesco.org/education/en/ev.php-URL_ID=16964&URL_DO=DO_TOPIC&URL_SECTION=201.html (last accessed 12 May 2009)

> *"Science without religion is lame, religion without science is blind"*. Albert Einstein (1879-1955)[66]

10.2.1. Towards an integrated technical system of traditional and modern technology

As was outlined in Chapter 5, reflexive land and water management can be characterized firstly by the notion of sustainable development: development should be ecologically sound, economically feasible and socially acceptable. Secondly, it can also be characterized by the integration of traditional (indigenous, small scale) and modern (scientific, large-scale) technology and infrastructure. In reflexive modernity technology should be perceived as a system that 'includes the artifact itself and the things that surround it that make it useful, such as knowledge and social practices' or 'technology includes the artifact and its context and history, and (…) this has implications for the transfer of more sustainable technologies between settings' (see Chapter 2). Technological innovation should consider the whole socio-technical system instead of using a unilateral technology transfer approach. Adoption of technology should focus on the domestic setting and particularly on the way how social norms and technologies shape each other. For instance, technological water design should make the source of water visible in trying to reconnect people with nature and "making the invisible visible".

This strategy of looking at the whole system and changing the direction of technological innovation is also emphasized by the stakeholders. They suggest that farmers and experts should work together, sharing their knowledge in the whole process of farming, and using a bottom-up instead of a top-down approach. In addition, by distinguishing between the technology itself and the consequences of improper use of technology they consider the cultural context of technological innovation and its adoption. This was highlighted especially with respect to modern technology which has more potential to destroy nature compared to traditional technology.

With respect to water technology it was indicated that at the 4th World Water Forum of 2006 in Mexico there was a general agreement that nations should consider both small-scale decentralized solutions and large-scale approaches involving dams and reservoirs to meet their needs at the lowest possible social and environmental costs. Furthermore, the Forum remarked that, regrettably, local knowledge and adaptive technology development have been neglected historically, and recognized that knowledge coming from several sources could be complementary and might reinforce each other in solving water issues locally. In the context

[66] http://www.quotationspage.com/quotes/Albert_Einstein/ , (last accessed 12 May 2009)

of Iran's transition to reflexive water management the Forum's recommendation to try for 'a proper mix of science, technology and local knowledge' would, for instance, imply a rehabilitation of the traditional Qanat underground irrigation system and its integration with modern water supply systems.

The rehabilitation of the Qanat system is important because this system represents one of the most ecologically balanced water recovery methods available for arid and semi-arid regions and could help to reconnect people with nature again and to encourage greater ecological awareness and activism. The revitalization of this system should go hand in hand with the restoration and rehabilitation of the ancient systems which were developed in addition to the qanats to reduce water wastage to a minimum, such as pot irrigation, stamp irrigation, irrigation with salty water, and cultivation of seeds in the roots of camel's thorn. However, the rehabilitation of the Qanat irrigation system can only succeed with the help of modern technology. Modern mining technologies can be used to enhance the water efficiency of the Qanat system, whereas water productivity can be improved by combining Qanats and modern irrigation systems. Such a revitalization of the Qanat system by modern technological means can result in a substantial reduction of the dependency on deep wells.

What is required in addition to the restoration of the Qanat system is its integration into a modern environment. The rapidly increasing demand for water due to population growth and agricultural expansion in Iran cannot be accommodated by Qanats only. Therefore, what is called for is a complementary system of all three methods of water provision. Among other things, this implies that existing Qanat systems should no longer be ignored in the exclusive preoccupation with the building of large dams and the excavation of deep wells.

This is the general approach of reflexive technological innovation as the first element of 'technology-governance-people' with the example of the Qanat irrigation system. To achieve and implement this strategy we need to have proper governance. In the next section a general approach will be proposed of reflexive land and water governance and the issues which should be taken into account.

10.2.2. Towards new participatory arrangements: shift from government to governance

As was said in Chapter 5, reflexive land and water management can also be characterized by participatory natural resources management in the form of multi-stakeholder platforms or land- and water-user associations. In other words, reflexive technological systems can only operate within a suitable social context and need some form of land and water resources management that encourages collective action with a participatory rather than a hierarchical

character. The idea of Multi-Stakeholder Platforms as an institutional framework for resolving complex resource management problems holds that multiple stakeholders, who have different interests and needs with respect to land and water, should organize and arrange land and water use and conservation issues amongst them through some form of cooperation, including the building of capacity for collective learning and decision-making.

Since the replacement of landlords by the government and the loss of experience of traditional participation due to the abandonment of the Buneh, there have been lots of efforts to make new cooperatives which were confronted with different challenges. Making new cooperatives and improving participation have suffered from the lack of shared experience in rural institutions and the dominance of the top-down approach and unilateral vision in the process of project identification and implementation.

However, collective action and stakeholders participation has been slightly improved compared to 20 years ago and among the different kinds of cooperative system it turns out that stakeholders have a positive attitude towards 'rural production cooperatives (*tavoni tolid*)'. According to the laws and regulations, this cooperative system is established with the aim of consolidating the land of voluntary farmers who become members; increasing the productivity of soil and water resources by providing modern irrigation infrastructure; leveling of agricultural land; familiarizing farmers with modern methods of production and harvesting; efficient use of agricultural machinery; facilitating establishment of agricultural industry; and finally improving the income and living conditions of rural households (Karami and Rezaei-Moghaddam, 2005). The number of these cooperative systems has recently increased. However, if their institutionalization is to become a success much more needs to be done and participation issues in different levels need to be taken into account.

The main obstacles to participation and cooperation are disagreements among the farmers themselves, distrust with respect to governmental agencies, deficient governmental leadership and its unilateral vision, and farmers' dissatisfaction with the earlier rural cooperative system. To this we should add the view of experts that the influence of political issues and sectoral approaches (exclusive views, compartmentalization) in policy making is strong. Together with practical limitations of managerial and local forces on the other hand they determine that values of sustainable development are ignored in practice. In addition, discontinuity regarding the application of the policies and programs related to sustainable development and inconsistencies by changing policies hinder the extension of sustainability in practice.

The lack of political parties, a strong civil society and democracy causes a low level of transparency, responsibility and accountability in the bureaucratic system and society at large and that is one of the main reasons why political visions are undermining expert visions. In

other words, along with the public exclusion in the top-down system, this system makes also experts less powerful or effective even in the bureaucratic system and administrative organizations. This relation of civil society and government needs to be fed by new experiences which both sides currently don't have sufficiently. However, gradually democratic experiences accumulate after the Islamic revolution by the organization of different elections for political institutions from the presidential level to the rural council, which causes a change of the socio-cultural behaviour towards participation.

A significant improvement of rural institutions such as rural production cooperatives (*tavoni tolid*) and water associations (*tavoni abbaran*), and the extension of sustainable development depends on the degree of institutionalization of political parties, of civil society and of democracy in the society at large which can give people opportunities to participate voluntarily. Moreover policies and regulations of the government should promote the role of all stakeholders from the beginning.

All these considerations confirm that reflexive land and water management (as argued by Tony Allan) is a political process instead of a process of merely technical integration and should include participation, consultation and inclusive political institutions to enable the mediation of the conflicting interests of land and water users and the agencies which manage land and water. The framework to be put forward later is only useful for land and water users if they can assimilate integrated land and water resource management and if the innovation of 'integration' is appreciated as a political process and not just as a technical and investment or information sharing process. Therefore, reflexive land and water governance requires a new holistic approach and an unprecedented level of political cooperation. In other words, today's land and water solutions and reforms prescribe democracy and negotiation as important ingredients of public action (e.g. integrated water resource management, water user associations and multi-stakeholder platforms). For this a change in government towards governance is necessary. As Termeer (2009) argues, it is no longer appropriate to see the government as an all-powerful intrinsic body that sets policy, plans and implements this policy according to a plan. Rather the government is a player in increasingly neo-corporatist arrangements (including research institutes, water boards, water commissions, etc.) that need to negotiate solutions just as any other water user. Yet, in doing so the government operates within a paradoxical situation that consists of citizens (e.g. other water users) that urge the government to take action, while the government is simultaneously compelled to negotiate its policy and implementations. Hence, this means that policies are never implemented according to plan, which makes citizens clamor for government action. Therefore she proposes a third way that sees the processes of water management as a complex governance of many actors with many realities; thus struggle, dialogue and power plays come in (Van Vuren *et al*., 2009).

This is the reason why some necessary changes need to be taken into account for land and water management under the reflexive modernity paradigm such as a) a change of attitude and philosophy among decision makers, scientists and others to acknowledge and promote alternatives; b) a change of strategies of institutions encouraging equitable partnerships with local NGOs and farmers; a change from top-down transfer of technology to participatory technology development and to demand-driven, farmer-centred research, based on a bottom-up approach (Altieri, 2002).

This general perspective of reflexive technological innovation and reflexive governance that facilitates inclusion of stakeholders in the process of transition needs to be supplemented by two more elements: a reflexive ethico-religious framework and a reflexive soil and water science which are the subject of the next two sections.

10.2.3. Towards a new ethico-religious framework: post-mechanistic ethics

Towards an Islamic land and water ethics: Islamic stewardship and environmental virtue ethics

In Chapter 5 it was argued that such an inclusive and participatory approach to land and water resources management requires a post-mechanistic (rather than a mechanistic) ethical framework that encourages sustainable development through cooperation, consensus building and collective conflict management. With respect to a post-mechanistic ethics, it is contended that the methods used to mechanistically dissect agriculture and its components need to be revised and that the non-mechanistic aspects of agricultural systems (i.e. ecological and qualitative values) need to be considered when constructing sustainable systems. Moreover, it is argued that current Integrate Water Resource Management (IWRM) for its successful implementation needs to include more discussion, analysis, study, and commitment in deciding whether water is a common or an economic good and to take into account water's spiritual and cultural dimensions (Rahman and Varis, 2005).

In addition, it was indicated that reflexive modernity calls for a change in the perception of nature. In other words, as we need to revitalize traditional technology and integrate it with modern technology, we need also to revitalize and reinterpret the vision of nature which is the focus of second modernity. To this end, the pathway to a more reflexive land and water management in Iran and other countries of the MENA region needs to focus on the belief systems that could facilitate such a transition. This belief system can be inspired by the paper of Holmes Rolston III entitled 'Caring for nature: what science and economics can't teach us but religion can'. Holmes Rolston remarks, 'Christianity, together with other faiths that influence human conduct, needs again to become "a land ethic".' (Rolston, 2006: 312) and I

add: and integrate with modern ecological and environmental ethics. Here, because of its inclusiveness and community-based character, the 'land ethics' of Aldo Leopold could be an important source of moral inspiration. Its goal is to strengthen the ties between humans and the human community and the larger ecological community. According to Leopold's land ethics, land is not merely soil: it is a fountain of energy flowing through a circuit of soils, plants and animals. Food chains are the living channels, which conduct energy upward; death and decay return it to the soil. Leopold defines fertility as the ability of the soil to receive, store and release energy. He therefore concludes that the land ethic simply enlarges the boundaries of the community to include soils, waters, plants and animals, or collectively: the land.

> In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such. Perhaps the most serious obstacle impeding the evolution of a land ethic is the fact that our educational and economic system is headed away from, rather than toward, an intense consciousness of land. (Leopold, 1949, p. 240)

This is in tune with what we said in Chapter 3 about the Transcendent Theosophy (*al-hikmaht al-muta'liyah)* of Mulla Sadras' theory of 'unity of being' (*wahdat- al-wujūd),* which is according to Qur'anic verse "Whithersoever you turn, there is the Face of God", that world nature is part of the gradation of existence (*tashkīk alwujūd*) and the natural order "is not an independent domain of reality, which is Divine". Also, from the Qur'anic perspective the universe and everything in it has been created by Allah and is considered a sign (*āyāt)* of Allah. Moreover, nature has been created in order and balance *(mīzān)*, and with extraordinary aesthetic beauty, and all these aspects of nature, while enhancing humankind's life should be honoured, developed and protected accordingly. Humankind is God's Khalif on earth and his whole being is surrendered to God; he has no separate individual existence of his own. He is like the birds and the flowers in his yielding to the Creator; like them, like all the other elements of the cosmos, he reflects the Divine Intellect to his own degree. From this point of view he is "one with Nature"; he understands it "from the inside," he has become in fact the channel of grace for the universe. His Islam and the Islam of Nature are now counterparts.

In addition, human beings have responsibilities towards the whole environment, just as they have responsibilities towards their families. All patterns of human production and consumption should be based on an overall order and balance of nature. Finally, the rights of humankind are not absolute and unlimited: we cannot simply consume and pollute nature as we wish, carelessly. These considerations make up the doctrine of unity (*tawhid*), stewardship

(*khalif*) and trust (*amana*), which situates us in the area of a moral relationship with the rest of the creation demanding both self-restraint as a control over greed and an awareness of the needs of others, which in its best manifestation is generosity. Moreover, the unity of all reality (*tawhīd)* and the balance of nature *(mīzān)* constitute an important basis for religious ecology and ethics.

This doctrine of the Qur'anic and Sunna's perspective on nature including land and water forms the basis of the *Shari'ah* and Islamic law (*Figh*) for the achievement of mankind's happiness and justice as one of the essential benefits and interests of people on earth. According to this system, a systematic set of legal rules and principles is deduced which influences land rights, tenure systems and water rights to manage natural resources. Accordingly, the Islamic state consists of several institutions that have the mandate to protect land and water such as *hima* (special reserves, setting aside land for common good), *al-harim* (inviolable zones) and *awqaf* (charitable endowments). The head of these institutions, the *hisba*, mostly a jurist, acts as an environmental inspector.

Our large scale surveys showed that stakeholders' perceptions of nature fit into the stewardship idea (see Part III). Stakeholders attributed the highest ranking to the three statements 'Nature is God's creation', 'It is our religious responsibility to take care of nature' and 'Nature will be important to future generations', which are most representative of stewardship idea. This confirms that Islamic stewardship should be considered as the platform for the construction and development of the definition of sustainability.

Stewardship management shares some basic common ground with several related ethical concepts such as Leopold's Land Ethic, Deep Ecology, and Animal Rights and other rights-based approaches that are growing in the context of the use and management of natural resources like environmental stewardship, countryside stewardship, land stewardship, wild land stewardship and forest stewardship (Wunderlich, 2004). Woller and Appleby (2000) categorize the elements of stewardship as follows:

1. Stewardship is responsible management that takes into account the interests of others.
2. Stewards accept responsibilities to society and future generations of people (as with sustainability);
3. Stewards have responsibilities towards other species/the natural world, based on their intrinsic value or value to God;
4. Stewards accept a degree of answerability to a higher authority or authorities such as society or God.
5. Stewardship places a steward in a wider community and accepts that trade-offs will need to be made among community members.

In the context of natural resources management, Woller and Appleby suggest this definition.

> "Stewardship is the responsible use (including conservation) of natural resources in a way that takes full and balanced account of the interests of society, future generations, and other species, as well as of private needs, and accepts significant answerability to society. A religious interpretation would require the phrase "and ultimately to God" to be added."(ibid, 263)

Towards an Islamic environmental virtue ethics

This Islamic doctrine (unity (*tawhid*), stewardship (*khalif*) and trust (*amana*)) and the elaboration of Islamic stewardship are theocentric instead of anthropocentric and accordingly Islamic ethics is rooted in this context as well. Islamic philosophical ethics has been influenced by Greek virtue ethics including Stoicism, Platonism and Aristotelianism and has been elaborated by philosophers such as Ibn Sina, Alfarabi and Al-Gazali and Fakhr Al-Razi, representing a blend of philosophical and religious ethics in which the road to moral and spiritual perfection has mystical overtones (Fakhry, 2000). This type of virtue ethics can help us to understand how to live a good life in relation with nature and the environment. However, due to the need for a reflexive turn that integrates traditional and modern aspects, the third paradigm needs to revalue the concept of virtue (see Chapter 8) by considering the shortcomings of the two main ethical systems of the deontological or duty-based paradigm and the utilitarian-based culture of modern societies. MacIntyre's interpretation of virtue ethics and the cardinal virtues can be helpful in reorienting virtue ethics in an environmental context.

Virtues and practices

Virtue ethics differs from deontology and utilitarianism in that it puts primary emphasis not on moral acts, but on moral agents. Virtue ethics is about characters, not about utility or rights. The focus is not so much on the 'What should I do?' or 'What ought I to do' (what is the right course of action in the given situation?) but on such questions like 'How to live?', 'What is the good life?' or 'Who should I be?'

Virtues ethics was the dominant form of ethics from classical antiquity to modernity. It is about the development and cultivation of those virtues that will enable people to live a good life. According to Aristotle (384-322 BCE), a life can be considered a good life to the extent that people reach their 'telos' (final end). The proper telos of human life is 'eudaimonia' or 'human flourishing'. In order to achieve eudaimonia, one must practice the virtues, and without them one cannot reach that telos.

To act virtuously, according to Aristotle, one must look for the 'Golden Mean' – the felicitous middle – between the extremes of excess and deficiency. For instance, the virtue of courage lies between the two opposite vices of cowardice (too much fear and too little confidence) and recklessness (too much confidence and too little fear). Other moral virtues include temperance, justice, and prudence, each of them likewise 'means' between extremes. Thomas Aquinas (1224-1274), who was deeply influenced by Aristotle, added the 'theological' virtues of faith, hope, and love (charity) to these older Greek 'cardinal' or 'natural' virtues.

Around 1980, a revival of ancient virtue ethics set in that can be seen as a response to the growing disillusionment in the West with the moral and political legacy of the Enlightenment. Enlightenment thinkers like Kant and Bentham were charged with having replaced the old and rich tradition of the virtues with a new and severely impoverished moral vocabulary.

A case in point is Alasdair MacIntyre. In his 1981 book *After Virtue*, MacIntyre argued that an authentic moral life cannot be based on the seemingly exact calculation of costs and benefits (against utilitarianism), nor on the proper application of principles and rules to dilemmatic situations (against deontology). Moral life is not a matter of calculation or rule-following, he insists, but of the exercise of the virtues.

MacIntyre attempts to clarify the core concept of virtues by linking them to 'practices' or well-marked domains of cooperative activity. When classical authors like Homer and Aristotle talk about virtues, they often refer to the qualities that are required to participate and excel in such 'practices' as warfare, gymnastic games, flute-playing, poetry or geometry. MacIntyre presents a somewhat convoluted definition:

'By a "practice" I am going to mean any coherent and complex form of socially established cooperative human activity through which goods internal to that form of activity are realized in the course of trying to achieve those standards of excellence which are appropriate to, and partially definitive of, that form of activity, with the result that human powers to achieve excellence, and human conceptions of the ends and goods involved, are systematically extended' (MacIntyre, 1981: 187)

As other examples of practices MacIntyre mentions football, chess, architecture, farming, scientific research, historiography, politics, the management of households, and portrait painting. He also gives a first, tentative definition of a virtue:

'A virtue is an acquired human quality the possession and exercise of which tends to enable us to achieve those goods which are internal to practices and the lack of which effectively prevents us from achieving any such goods' (ibid., 191)

MacIntyre distinguishes the 'internal goods' of a practice from its 'external goods' (prestige, wealth and power), which are only contingently connected to it. In others words: football is ideally about achieving excellence in the game of football (which has to be shown in the competition between football clubs), not about realizing high salaries for the players or boosting the quotation of the club's stock at the stock exchange. While most virtues are defined for specific practices, MacIntyre also holds that there are a few virtues that are vital for achieving the 'internal goods' of almost any practice. He mentions in particular courage, honesty and justice.

Four cardinal virtues in an environmental context

The four cardinal virtues comprising justice, prudence, temperance and fortitude can help people to understand how to live a good life in relation with nature and the environment, and help environmental leaders and land and water professionals to acquire strength of character, grounded in virtue, to sustain them over a lifetime of service in urging others to care for the Earth, as Douglass Warner and DeCosse (2009) state.

The virtue of justice can help to move away from mere charity, from merely feeling sad for those who are suffering. The virtue of justice requires a response from us, requires us to act justly, to take action to foster just relationships between people and the Earth. How do we reform social institutions so that they do not force people into situations where their dignity is compromised? How can we foster the kind of character that cares about fairness and equity in the world?

Prudence is the intellectual habit that wisely assesses the means necessary to accomplish the end at which you are aiming. Prudence and environmental ethics invites us to consider these means, to have the capacity to make wise judgments in complex trade-offs. In case of sustainability this would suggest that we take precautionary action now, and assume the responsibility for environmental protection over time, rather than shift problems onto future generations. Temperance can best be understood as restraint or self control. As old fashioned as "temperance" sounds, this virtue is a highly relevant ethic that can be used to moderate consumption. One relatively simple way to express solidarity with those suffering environmental injustice can be to reduce one's consumption. Finally, fortitude, or bravery, is more commonly described as courage. Douglass Warner and DeCosse (2009) state that the vocation of working for any positive environmental change challenges us to cultivate an attitude of hope. Virtue ethics challenges us to move beyond our negative feelings and focus on what kind of person we want to be, what kind of character will help us live out our commitments. This kind of hope, rooted in our habit of mind and heart, is precisely what we

need to bring to situations where environmental injustices are being perpetrated. Courage can give us the perseverance to struggle for justice in the face of discouragement.

Land and water professionals of tomorrow also need these cardinal virtues. In searching for the implications of post-positivism for water knowledge and by looking at the heroic nature of water professionals who have to solve complex water problems, Zwarteveen (2009) redefines those four virtues as key virtues for the water world of tomorrow. She supports engagement of water professionals with, and critical reflection on, the meaning of development and progress. For instance, she argues that a belief in change – in progress – together with a belief in science or technology as an engine of such change – is what continues to inspire many of today's water experts. Yet, progress, as is widely known by now, should not be equated with technological advancement. She emphasizes that "the new knowledge the water professionals need within themselves includes, yet is much more than, natural science-based technical knowledge. By stating that water issues are inherently political, and knowledge always a social construct, she sees it as inevitable for the professional to ask him/herself the question whom to identify with, to reach the higher objective of making a better and sustainable world" (Van Vuren *et al*.,2009: S164) .

10.2.4. Reflexive soil and water sciences

In Chapter 4 I described the assumption of modern science towards nature which led to reductionism and the desire to control nature on the one hand and the elitism of engineers and a distance from mainstream society, ultimately losing touch with changing groundswells of grassroots opinion on the other hand. As a consequence, since the land reform in Iran alienation and lack of dialog between farmers and new agricultural experts increased. This is mainly because of experts' knowledge which according to the modern science of industrial agriculture does not need to engage with indigenous knowledge (Foltz, 2000). These issues of communication were echoed by farmers in reply to the question on the possible integration of traditional and modern methods. To make integration work farmers and experts said they should work together, share their knowledge in the whole process of farming, and use a bottom-up instead of a top-down approach. Experts and policy makers as well highlighted the domination of the conqueror and the productionist view towards nature and the over-partitioning of scientific disciplines (issue of interdisciplinary science) and the exclusion of stakeholders (issue of relation between science and society) in the scientific atmosphere and research area of the country.

That is why I argued in Chapter 5 that the reflexive turn not only asks for a reintegration of traditional and modern technologies, new participatory arrangements and a post-mechanistic ethics, but also calls for a new social contract between science and society and a new mode of

science to cope with those issues. This justifies the need for the new land and water experts as well to be prepared to deal with the challenges of the reflexive turn.

> "Today's water problems seem both more urgent and complex than those of the past, …., and calls for new modes of operation. Centralistic and technocratic approaches to solving water problems are giving way to approaches that acknowledge the inherently political character of water management, the plurality of its actors, institutions, discourses and knowledge systems, triggering a debate about what the knowledge and skill requirements are for the water professional of tomorrow, and who these professionals will be…. there is no blueprint for facing the new challenges in the water sector (Van Vuren *et al.,* 2009: S162) and "the question is whether the knowledge and skills developed in the past can be applied to solve today's and even tomorrow's water problems. " (ibid, S163)

In the line with the post-mechanistic ethics which I elaborated according to the Islamic doctrine, I will firstly discuss the need for the revitalization of the Islamic mode of studying in the academic arena, and secondly, the need for post-normal science and the need for reflexive land and water scientists.

Revitalization of an Islamic-inspired mode of inquiry towards stewardship management

In Chapter 3 I showed that for a believer of Islam, the Qur'an establishes a mode of scientific inquiry and quest for knowledge that is enveloped in a reverence for and humility toward the Divine. The Qur'an reveals that without such humility and reverence, "Nay, but man does transgress all bounds, in that he looks upon himself as self-sufficient (Qur'an 96:6-7)." This transgression is a source of the environmental decline brought about by humankind (Chishti, 2003). Thus "knowledge" and "science" are defined as basically different from mere curiosity and even from analytical speculation. Accordingly,

> "Islamic science defines as the systematic study of natural phenomena within the context of the Islamic Weltanschauung, at the heart of which lies the doctrine of tawhid, Divine unity. The underlying unity of the natural and human phenomena is taken to be an a priori metaphysical premise as everything issues forth from a single source, namely, the creative act of God. The Islamic sciences of nature, look upon the order of nature as vestigia Dei or signs of God (*ayat Allah*), pointing to the Divine origin of things. This suggests that the order of nature has an essential telos, which makes it both sacred and essentially meaningful. Within this framework, the natural order is construed as having an intrinsic intelligibility that can be discovered and grasped by the intellect (*al-'aql*). The analytical function of logical reasoning is

> complemented by the synthesizing power of the intellect. The natural phenomena, dissected and analyzed into their constitutive elements by reason, are integrated into a coherent whole by the intellect that occupies a higher epistemological position because of its intuitive and synthetic ability. This presents a holistic view of the universe and a holistic epistemology for scientific study." (Kalin, 2001)

For an Islamic scientist, the search for the absolute Truth is the main task and the many ways to accomplish this search are all ways of worship. For example, the study of nature for the sake of revealing God's signs in nature is a kind of worship. The study of natural phenomena teaches the origin and the evolution of the world, the presence of order and harmony in the universe, the presence of a telos for the universe, the significance of humanity, the possibility of resurrection and the interrelatedness of different parts of nature at a deep level, which point to the uniqueness of creation (Harder, 2001).

This broad scientific attitude calls for the humbleness and willingness towards stewardship management as was mentioned above.

A new relation between science and society, trans-disciplinary science and the need for the land and water professional of tomorrow

As a consequence of the growing complexity within many scientific disciplines, uncertainties are also increasing, not only with respect to technical and methodological issues, but also with regard to epistemological and ethical questions. At the same time the decision stakes are becoming higher and higher, reflecting conflicting purposes between stakeholders. Under these conditions the puzzle-solving strategies of normal science (in the Kuhnian sense) are no longer appropriate.

According to Molle (2009) past engineering approaches do not work out well, even if popular contemporary concepts like the environment and integrated water resources management are brought in. This is because these still work from the perspective that water management is a rational undertaking based on capital investment, good science and managerial rationality. It does not take into account the political nature of water decision making, and the interplay of ideas, interests and institutions that shape outcomes in ways that distribute costs and benefits unevenly across social groups.

As was indicated in Chapter 5, post-normal science instead of normal science and Mode 2 instead of Mode 1 are suggested by some scholars to consider these issues. Postnormal science, of which the most prominent characteristic is the extension of the peer community, recognizes the plurality of legitimate perspectives and ways of knowing and the inclusion of

an ever-growing set of stakeholders. With the emergence of post-normal science, the practice of science 'is becoming more akin to the workings of a democratic society, characterized by extensive participation and toleration of diversity'. 'Post-normal science can provide a path to the democratisation of science. Similarly, while Mode 1 science is related to the classical view of 'pure', curiosity-driven, fundamental, or autonomous science, detached from society, and often disciplinarily organized in e.g. biology, chemistry and physics, Mode 2 science is strongly application-oriented, trans-disciplinary and intimately interwoven with society. It not only transgresses the boundaries between scientific disciplines but also blurs the distinction between science and society – it is hard to say where science ends and society begins. In Mode 2 science and society are engaged in co-evolutionary processes. A fruitful communication between science and society is a precondition for the production of knowledge that is not only reliable but also 'socially robust.'

Mollinga (2009) calls the water professional of tomorrow a ''transdisciplinary'' engineer. He justifies the transdisciplinary research on natural resource management as a model for defining the attitudes and skills of water professionals able to address the present-day challenges in the agricultural water sector such as internalizing ecological concerns in design and water management; shaping the co-evolution of water technological and social systems; and involvement of the water interest groups in design, management and governance of these systems. Accordingly, he argues that the transdisciplinary engineer need "conceptual skills to conceive and make multidimensionality of water control operational; instrumental skills to shape water systems as boundary objects for different uses and users; and behavioural and institutional design skills to shape processes of negotiated design, management and governance." (ibid, S195)

On the basis of the perspective of water governance, Termeer (2009) portrays water professionals of tomorrow as ''public leaders'' who have to stick their necks out and organize responsible and respectful interactions, see opportunities, arrange connections, and simultaneously reinterpret their own routines.

This request for the new land and water scientist is also echoed among Iranian scholars. In the Third Iranian Soil Symposium Bybordy (2006)[67] emphasized that a soil scientist should consider him/herself as part of an ecosystem-oriented soil science that should change its focus from agriculture to the environment.

Moreover, in line with this new request the International Union of Soil Science (IUSS) recently established two commissions entitled "Soil Education and Public Awareness" and

[67] http://www.soiliran.org/Farsi/General/Soilhamayesh3.htm, (last accessed 12 May 2009)

"history, philosophy and sociology of soil science" under the division of Soils in Sustaining Society and the Environment.

However, Van Vuren *et al*. (2009) emphasize that old-fashioned land and water professionals and domain experts in the technical fields are still needed to develop solutions for the technical issues that are inherent to water works. Yet these experts should be incorporated in the process at specific points in time and need to have a greater social awareness.
The new land and water professional is the person who leads the larger process, knowing when and what specialized expertise is required. The technical as well as other specialized domains (law, agriculture, nature, and environment) are part of the process but no longer leading. Van Vuren *et al*. conclude that a certain percentage (perhaps 20–40%) of the total group of water experts will become such new public leaders according to the skills mentioned above (ibid, S167).

All this evidence implies that the knowledge and methods of land and water resources engineering and hydrology that constitute present-day professional identity needs to be creatively rethought and their curriculum[68] should be adjusted taking into account the needs of current and future issues.

10.3. Concluding remarks

In this chapter I developed the *transition to reflexive land and water management* according to the objectives of this PhD project: the revitalization (rehabilitation) of the traditional paradigm and the integration of this paradigm with industrial modernity in which the benefits and advantages of both will be maintained as much as possible considering the Iranian context. This reflexive framework is characterized, firstly, by the notion of sustainable development: development should be ecologically sound, economically feasible and socially acceptable. Secondly, it can also be characterized by the integration of traditional (indigenous, small-scale) and modern (scientific, large-scale) technology and infrastructure. Thirdly, it is participatory natural resources management in the form of multi-stakeholder platforms or land- and water-user associations. Fourthly, such an inclusive and participatory approach to land and water resources management requires a post-mechanistic (rather than a mechanistic) ethical framework that encourages sustainable development through cooperation, consensus building and collective conflict management. Finally, this reflexive turn requires a new social contract between science and society and a new mode of science to cope with the issues of transition to sustainable land and water management.

[68] In this regard the example of WaterNet in Southern Africa to organize a MSc on water resource management through cooperation of 50 university and research institutes is valuable (Van der Zaag, 2009).

Accordingly, this reflexive framework includes four key elements. First, reflexive land and water technological innovation with its strategy of contextualization strives for restoration and integration of traditional and modern technology that focuses on the whole socio-technical system. To achieve this technological strategy, and as a second element, reflexive land and water governance should facilitate the inclusion of stakeholders in the process of transition The third element is the Islamic land and water ethics with the core concepts of Islamic stewardship and environmental virtue ethics including the four cardinal virtues justice, prudence, temperance and fortitude directed towards the environment. This ethics can help people to understand how to live a good life in relationship to nature and the environment; also the land and water professional of tomorrow was defined. The fourth element covers the reflexive soil and water sciences revitalized by an Islam-inspired mode of inquiry that encourages to achieve stewardship management; this post-normal science and Mode 2 science facilitates the democratization of science to cope with the issue of interdisciplinarity and the exclusion of stakeholders (improving the relation between science and society) in the scientific atmosphere and research area. Finally, the land and water professional of tomorrow was portrayed as a “transdisciplinary engineer” and a “public leader”.

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Summary in English

Humankind lives in an era of crisis. At the beginning of the 21st century the world is currently facing an unprecedented environmental crisis. Concerns about land degradation and water scarcity are growing rapidly around the world. Food security is threatened by the degradation of land and water resources due to the intimate link between global water cycles, land management, and food production.

This PhD thesis is concerned with the causes and consequences of the environmental crisis and explores the trends and tendencies that suggest a way out of this crisis towards sustainable land and water management in Iran and the other countries of the Middle East and North Africa (MENA), which not only have a similar (arid and semi-arid) environment, but also, to a large extent, share the same religion and history.

In the first chapter the general perspective of Iran and the fact that current land and water issues are complex are outlined. Although there is a broad consensus that we are facing a growing global environmental crisis – land degradation and water crisis – , there is not surprisingly less consensus with respect to the causes and consequences of this crisis. Opinions and responses with respect to this land degradation and water crisis can be categorized into three groups that focus more or less on single aspects. While the first group of people stresses the - partially technologically induced - scarcity and shortages of our limited land and water resources, and the second group focuses on unsound governance and mismanagement, the third group draws our attention to public perceptions and preferences. There is, however, growing awareness among environmental social scientists that every single one of these perspectives is important and relevant for sustainable solutions to global land degradation and water scarcity. But these different perspectives should not be treated separately, these scientists claim, because technological developments, governance regimes and personal belief systems and lifestyles are strongly interconnected.

Deficient conceptualizations of sustainable development in the region justify the need to construct a framework that helps to understand the full range of human-environment interactions and how they affect societal developments and vice versa. This framework needs also to be sensitive to the specific features of the region and to be helpful in accomplishing a successful transition to sustainable land and water management. Therefore, six research questions were raised:

1. What are the causes and consequences of the environmental crisis Iran is confronted with, in particular of the degradation of land and the depletion of water resources?

2. What kind of (reflective) framework and paradigms are needed to comprehend these causes and consequences?
3. What kind of technical system is needed according to the paradigm of reflexive modernity of Iran?
4. What are the institutional requirements according to the paradigm of reflexive modernity in Iran?
5. What kind of ethics is needed that fits in the reflexive modernity paradigm for Iran?
6. What kind of soil and water science is needed according to the paradigm of reflexive modernity for Iran?

To answer these research questions it is necessary to collect data that combine ethical, environmental, economic and socio-political aspects and that are selected according to theoretical and empirical methodologies and their combinations. The first one comprises literature review and the second one comprises qualitative research including interviews with stakeholders (farmers, village informants, soil and water experts, and policy makers)**.**

Part I. Theoretical and conceptual

Chapter 2 describes the notion of the 'technology-governance-people' nexus as an appropriate framework which formulates the three most important aspects of land and water management regimes, to wit, the technical, social and belief systems which are strongly interconnected. Accordingly, this 'technology-governance-people' nexus over three periods of Iran's development is explored. To capture those elements I use the term water paradigm of Tony Allan (2006) and distinguish the pre-modern, the industrial modern, and the reflexive modern paradigm. Next I sketch the shift to the latter paradigm with respect to land and water resource management. Finally, a provisional *reflexive framework of land and water management* is constructed and developed taking into account the Iranian context covering two issues: the revitalization (rehabilitation) of the traditional paradigm and the integration of this paradigm with that of industrial modernity which maintains the benefits and advantages of both as much as possible.

Part II. Historical background: past, present and future of land and water resource management

In this historical part we do literature research to find items that can be helpful in analysing the pre-modern and industrial modernity paradigm and that can be used as input in the next part on empirical matters and in the *new reflexive framework.*

Chapter 3 shows that the technical, social and ethical aspects of the traditional, premodern system of land and water management are highly interconnected. The *Qanat* underground irrigation system was dependent on the social institution of the *Buneh* to operate properly, while Zoroastrianism and Islam can be considered as a cultural and ethico-religious framework for this socio-technological arrangement. The traditional land and water paradigm and its strong interconnection of 'technology, governance, and people' assumed that there was an intimate relationship between humans and nature. The dominant premodern way of land and water management was community based. The stewardship model incorporating a caretaker (steward), the object of care, and the owner of the object, was the foundation of the ethico-religious system.

The contribution of Islam, as the dominant religion in Iran and the MENA region, to this model can be summarized as follows: Starting with the general principle that Allah is the Creator, Sustainer, and Owner of all creation, humankind is considered to be the trustee of the Earth. Every created thing has inherent values, an ecological value, and a utilization value for humankind both as spiritual sustenance and material resource. Humankind's rights over nature are rights of sustainable use - of usufruct - based on moderation, balance, and conservation; future generations have a similar and equal right. Islamic land and water law includes Nature's rights (*haq*) over humankind, to wit, the rights to be protected from misuse, degradation and destruction.

This cultural and ethico-religious framework motivated people to use soil and water, and provided the legal and institution structure to handle these scarce resources and their concomitant technologies. The social inequality and lack of individual freedom within the Buneh organization explain the appeal of the western model and the push towards the modern paradigm.

In Chapter 4 is discussed the shift from tradition to modernity and the demise of the age of the Qanat system with the land reform of 1962. The idea of modernity in general and the emergence of modern land and water management in the specific context of Iran are outlined. Since the 17th Century, the idea of modernity gradually took hold of Western societies. At the end of the 19th Century and the beginning of the 20th Century this idea was introduced as a model of development to traditional societies such as Iran. As a result, there was a shift from tradition to modernity; in the sector of land and water this shift took place especially with the land reform of 1962. Modernization brought some advantages such as the increase of cultivation areas and the growth of production. But on the other hand, some elements of the traditional system that were important for natural resources management such as community-based organizations were ignored, due to the lack of understanding of the native context by

both foreign and new domestic agents, and the speed of change compared to that of the modernization process in the West.

Because of this paradigm shift and the application of the western model the pre-modern (traditional) technology-institution-culture nexus changed. The underground water exploitation regime and land use pattern (Qanat irrigation) was transformed and partly replaced by (semi-)deep wells and large dams, the *Buneh* was supplanted by a system of smallholding, and a mechanistic worldview with important ethical ramifications emerged.

Due to the abandonment of the *Buneh* system and the replacement of landlords by government agencies, the people were no longer able to collectively maintain the rural infrastructure and became dependent on the state for the necessary services and this led to the birth of the hydraulic mission of society with its core aim being the mobilization of water and the development of a reliable source of supply. The traditional sense of land and water resources management for the benefit of the community seems to have given way to an 'every man for himself' mentality. Instead of being a vital source of life that was provided by the local environment to which people had an intimate linkage, water now became a commodity that flowed from a tap whereby the origin of that water was remote and someone else's business to provide. The dehumanizing scale of modern water technology that makes its source invisible provided people an "illusion of abundance". Moreover, due to this shift, an economic model of farming which considers the value of the land to be its resource or potential (the productionist vision) emerged. The definition of farming changed from a way of life to a business. Consequently, a new *economic context of ethics in agriculture* arose: the industrialization of agriculture and the resulting technological treadmill on which farmers are increasingly being forced to run as a result of technological change as well as social preferences brought tensions between the farmers' belief in working the land out of a sense of stewardship and the economic realities of farming as a business. The farmer is to produce as much food as possible, and neither the producer nor the consumer should make value judgements about the non-economic worth of the land.

The commodification of land and water was a key part of the paradigm of industrial modernization that was based on Newtonian physics and underpinned by Baconian and Cartesian philosophy. This paradigm, which led to reductionism and the desire to control nature, was propagated by engineers who increasingly became instruments of state policies and at the same time became increasingly elitist and distant from mainstream society, ultimately losing touch with changing groundswells of grassroots opinion.

Chapter 5 shows that the disastrous effects of industrial modernization became apparent since the 1950s when the environmental crisis surfaced. Various responses to the

environmental crisis are discussed, ranging from the radical anti-modernism of the first wave of environmentalism to the notion of reflexive modernity of second wave in the North which was outlined in Chapter 5. Reflexive modernity in the area of land and water management is shown to have three phases since the 1960s. Some scholars believe that, by and large, the semi-arid North have passed through all the three stages and that the South is still stuck in industrial modernity. I criticize Allan's views on reflexive modernity on the grounds that he places too much faith in a unilinear model of institutional evolution and fails to recognize that the course that second modernity has taken within a European constellation will differ considerably from the direction it will take within non-European constellations, where the dynamic of reflexive modernization displays its effects not on first modern societies but rather on the distorted constellations of post-colonialism. It was finally argued that different non-European routes to and through second modernity still have to be described, discovered, compared and analyzed.

By way of confirmation, it is revealed that there are also signs and indicators of a turn to reflexive modernity in Iran, especially since 1990s. Nevertheless, it is in its first stages and must be conceptualised and developed in terms of new technical systems of land and water management, of corresponding social institutions and of a new ethico-religious framework that is sensitive to the specific features of the region. In addition, the reflexive turn also calls for a new social contract between science and society and a shift to post-normal science which were outlined towards the end of Chapter 5

Part III. Empirical questions: Stakeholders' opinions on the possibilities and constraints of a transition to reflexive land and water management

In order to assess the viability of the contours of reflexive land and water management and to probe the attitudes of relevant stakeholders (farmers and village informants, soil and water experts and present policy makers) on the opportunities and constraints of this transition phase, four large empirical researches were carried out, of which the results were presented in Chapter 6, 7, 8 and 9.

In Chapter 6 the attitudes of farmers and villagers towards the current situation and the future possibilities of reflexive land and water management are explored. 156 Iranian farmers and 42 Iranian village informants from villages chosen from 14 provinces around the country, took part in the interview. The results of this large survey are discussed in this chapter in which, first, the current perspectives on land and water resources management are described. Second, the possibility of integrating traditional and modern land and water resource management are discussed. Third, the farmers' and village informants' attitudes towards sustainability and, fourth, their attitudes towards technology are explored. Fifth, the farmers'

and village informants' attitudes towards science and research and, sixth, their attitudes towards rural institutions and farmers participation are outlined. Finally, farmers and village informants' attitudes towards nature and environmental and agricultural ethics are discussed.

Chapter 7 presents the attitudes of soil and water experts on constraints and opportunities of this transition phase. This is the result of a questionnaire which was completed by 94 Iranian soil and water experts who took part in several international and national conferences[69], and also by those who work at Iranian organizations. Their views on the main land and water policy priorities in Iran are also sketched. The experts' attitude towards sustainable development, their assessment of the current situation of the country in terms of sustainable land and water management, and their attitude towards the possible integration of traditional and modern land and water management paradigms are discussed. Finally, experts' perception of land and water ethics, within the broader horizon of land and water management aimed at sustainable development, and their perception of nature, are being portrayed.

Chapter 8 finally presents the attitudes of policy makers towards the constraints and opportunities of the transition phase towards reflexive modernity. In line with the theoretical parts of the PhD project (Part II) and the results of large-scale research that was done, open-ended interviews were done with 12 policy makers/high level informants. The results of these interviews are the subject of this chapter. The causes of land degradation and water scarcity in Iran, advantages and disadvantages of the land reform of 1962 and the industrial modernization in Iran are outlined. Also the opportunities and constraints of land and water management paradigms in Iran and the transition towards reflexive sustainable modernity are discussed. In addition, the chapter explores the view of policy makers on science, research and technology as part of the problem and part of the solution. The challenges of and hopes for participation and the government's role in this regard, will be elaborated on. Finally, ethical issues and the need of ethics regarding land and water, ethics in science and technology and ethics on an organizational level, are discussed.

Chapter 9 present a comparison of the attitudes, interests and values of the various stakeholders discussed in the preceding chapters. The possible agreements and differences with regard to the transition phase, between farmers and village informants, soil and water experts, and policy makers, are also discussed. Finally, the elements which should be taken into account within a *reflexive framework of land and water management* are introduced.

Part IV. Towards reflexive land and water management

[69] Held in Iran on subjects related to sustainable use of land and water resources.

After sketching the historical background in part II and the empirical questions in part III, in part IV we return to the main question that was raised in Chapter 1 and Chapter 2, concerning the possible meaning of a reflexive land and water management in the non-European constellation of Iran.

In Chapter 10 the reflexive framework is characterized, firstly, by the notion of sustainable development: development should be ecologically sound, economically feasible and socially acceptable. Secondly, it can also be characterized by the integration of traditional (indigenous, small-scale) and modern (scientific, large-scale) technology and infrastructure. Thirdly, it involves participatory natural resources management in the form of multi-stakeholder platforms or land- and water-user associations. Fourthly, such an inclusive and participatory approach to land and water resources management requires a post-mechanistic (rather than a mechanistic) ethical framework that encourages sustainable development through cooperation, consensus building and collective conflict management. Finally, this reflexive turn requires a new social contract between science and society and a new mode of science to cope with the issues of transition to sustainable land and water management.

Accordingly, this reflexive framework includes four key elements. First, a context-sensitive strategy of restoration and integration of traditional and modern technology that focuses on the whole socio-technical system. To achieve this technological strategy, a form of reflexive land and water governance that facilitates inclusion of stakeholders in the process of transition as the second element was outlined. An Islamic land and water ethics with the core concepts of Islamic stewardship and environmental virtue ethics as the third element was sketched and the four cardinal virtues of justice, prudence, temperance and fortitude in relation to the environment were defined. These virtues can help people to understand how to live a good life in their relationship with nature and the environment. Finally, a new definition of the land and water professional of tomorrow was attempted. A revitalization of the Islamic mode of inquiry that encourages to achieve stewardship management, and post-normal science and mode 2 science that facilitate democratization of science to cope with the issue of interdisciplinary science and exclusion of stakeholders (issue of relation between science and society) in the scientific atmosphere and research area were set forth as key components of the reflexive land and water framework. The land and water professional of tomorrow was accordingly portrayed as a “transdisciplinary engineer” and a “public leader”.

Summary in Dutch (Samenvatting)

De mensheid leeft in een tijdperk van crisis. Aan het begin van de 21ste eeuw ziet de wereld zich geconfronteerd met een milieucrisis zonder weerga. De bezorgdheid over landdegradatie en waterschaarste neemt alom snel toe. Wegens de nauwe relatie tussen mondiale waterkringlopen, landbeheer en voedselproductie wordt de voedselzekerheid bedreigd door de achteruitgang van terriene en aquatische hulpbronnen.

Deze dissertatie houdt zich bezig met de oorzaken en gevolgen van de milieucrisis en exploreert de trends en tendensen die een uitweg uit deze crisis suggereren in de richting van duurzaam land- en watermanagement in Iran en de andere landen van het Midden-Oosten en Noord Afrika (MENA), die niet alleen een overeenkomstig (aride en semi-aride) fysiek milieu kennen maar tot op grote hoogte ook een zelfde religie en geschiedenis delen.

In het eerste hoofdstuk worden het algemene perspectief op Iran en de complexiteit van de huidige land- en watervraagstukken geschetst. Hoewel er een brede consensus bestaat dat we geconfronteerd worden met een toenemende mondiale milieucrisis – een crisis van landdegradatie en water – , heerst er niet zo verrassend minder consensus aangaande de oorzaken en gevolgen van deze crisis. De meningen en reacties tegenover deze landdegradatie- en watercrisis kunnen in drie groepen worden verdeeld die zich elk min of meer op één aspect richten. Terwijl de eerste groep personen de nadruk legt op de – gedeeltelijk technologisch geïnduceerde – schaarste en tekorten van onze beperkte land en water hulpbronnen, en de tweede groep op slecht beheer (governance) en mismanagement, vestigt de derde groep de aandacht op de percepties en preferenties van het publiek. Er bestaat echter een toenemend besef onder sociale wetenschappers dat al deze invalshoeken belangrijk en relevant zijn om te komen tot duurzame oplossingen voor de mondiale landdegradatie en waterschaarste. Maar deze perspectieven moeten niet afzonderlijk worden beschouwd, zo stellen deze wetenschappers, omdat technologische ontwikkelingen, beheersstructuren (governance structures) en persoonlijke geloofssystemen en levensstijlen zeer sterk met elkaar verbonden zijn.

Gebrekkige conceptualiseringen van duurzame ontwikkeling in de regio rechtvaardigen de noodzaak om een kader te construeren dat in staat stelt om het hele scala van interacties tussen mens en milieu en de wijze waarop deze maatschappelijke ontwikkelingen beïnvloeden (en omgekeerd) te begrijpen. Dit theoretisch kader moet ook open staan voor de specifieke kenmerken van de regio en behulpzaam zijn bij het voltrekken van een succesvolle transitie naar duurzaam land- en watermanagement. Om die reden hebben we zes onderzoeksvragen geformuleerd:

1. *Wat zijn de oorzaken en gevolgen van de milieucrisis waarmee Iran zich geconfronteerd ziet, in het bijzonder de degradatie van land en de uitputting van waterhulpbronnen?*
2. *Welk (reflectief) kader en welke paradigma's zijn nodig om deze oorzaken en gevolgen te begrijpen?*
3. *Welk soort technisch systeem is vereist volgens het paradigma van reflexieve moderniteit in Iran?*
4. *Wat zijn de institutionele vereisten volgens het paradigma van reflexieve moderniteit in Iran?*
5. *Welk soort ethiek is nodig dat in het reflexieve moderniteitsparadigma voor Iran past?*
6. *Welk soort bodem- en waterwetenschap is nodig volgens het paradigma van reflexieve moderniteit voor Iran?*

Om deze onderzoeksvragen te beantwoorden is het nodig data te verzamelen die ethische, economische, sociaal-politieke en milieu-aspecten combineren en die geselecteerd worden door middel van theoretische en empirische methodologieën en combinaties daarvan. De eerste omvat een literatuuronderzoek en de tweede omvat kwalitatief onderzoek waaronder interviews met stakeholders (boeren, dorpsinformanten, experts op het gebied van bodem en water en beleidsmakers).

Deel I. Theoretisch en conceptueel

Hoofdstuk 2 beschrijft de notie van de 'technologie-governance-mensen' nexus als een passend kader dat de drie belangrijkste aspecten van land- en watermanagement formuleert, namelijk het technische, het sociale en het geloofssysteem, die onderling nauw verweven zijn. Deze nexus wordt daarom gedurende de drie onderscheiden perioden in de ontwikkeling van Iran geëxploreerd. Om de genoemde elementen te vatten maak ik gebruik van de term 'waterparadigma' van Tony Allan (2006) en onderscheid ik een pre-modern, een industrieel-modern en een reflexief-modern paradigma. Vervolgens schets ik de overgang naar het laatste paradigma met het oog op land- en watermanagement. Tenslotte wordt een voorlopig *reflexief kader voor land- en watermanagement* geconstrueerd en ontwikkeld waarbij rekening wordt gehouden met de Iraanse context en vooral twee zaken worden verdisconteerd: de revitalisering (rehabilitatie) van het traditionele paradigma en de integratie van dit paradigma met dat van de industriële moderniteit waarbij de voordelen van beide zoveel mogelijk behouden blijven.

Deel II. Historische achtergrond: verleden, heden en toekomst van land- en watermanagement

In dit historische deel verrichten we literatuuronderzoek om die onderdelen op te sporen die behulpzaam kunnen zijn bij het analyseren van het pre-moderne en het industrieel-moderne paradigma en die als input gebruikt kunnen worden in het hierop volgende empirische deel en in het *nieuwe reflexieve kader*.

Hoofdstuk 3 laat zien dat de technische, sociale en ethische aspecten van het traditionele, premoderne systeem van land- en waterbeheer onderling nauw verweven waren. Om adequaat te werken was het ondergrondse *Qanat* irrigatiessysteem aangewezen op de sociale institutie van de *Buneh*, terwijl zoroastrianisme en islam beschouwd kunnen worden als het culturele en ethisch-religieuze kader van dit sociaal-technologische arrangement. Het traditionele land- en waterparadigma en het daarbij passende verband tussen 'technologie, beheer en mensen' ging uit van een directe relatie tussen mens en natuur. De dominante wijze van premodern land- en waterbeheer was gebaseerd op de gemeenschap. De grondslag van het ethisch-religieuze systeem was een model van rentmeesterschap dat bestond uit een verzorgende (rentmeester), het object van zorg en de eigenaar van het object.

De bijdrage van de islam, de dominante religie in Iran en de hele MENA-regio, aan dit model kan als volgt worden samengevat: Uitgaande van het algemene principe dat Allah de Schepper, Onderhouder en Eigenaar van de hele schepping is, wordt de mensheid gezien als de beheerder (trustee) van de Aarde. Elk geschapen wezen heeft inherente waarden, een ecologische waarde en een gebruikswaarde voor de mensheid, als geestelijk voedsel en als materiële hulpbron. De rechten van de mensheid over de natuur zijn rechten van duurzaam gebruik – van vruchtgebruik – gebaseerd op matigheid, evenwicht, en behoud: toekomstige generaties hebben eenzelfde en gelijk recht. Het islamitisch land- en waterrecht omvat ook rechten van de natuur jegens de mensheid (*haq*), namelijk, het recht om beschermd te worden tegen verkeerd gebruik, degradatie en vernietiging.

Dit culturele en ethisch-religieuze kader motiveerde mensen bij het gebruik van bodem en water en voorzag in de juridische en institutionele structuur om met deze schaarse hulpbronnen en de bijbehorende technologieën om te gaan. De sociale ongelijkheid en het ontbreken van individuele vrijheid binnen de Buneh-organisatie verklaren de aantrekkingskracht van het westerse model en de impuls om naar het moderne paradigma over te gaan.

In hoofdstuk 4 wordt de overgang van traditie naar moderniteit en het eind van het tijdperk van het Qanat-systeem als gevolg van de landhervorming van 1962 besproken. Het idee van moderniteit in het algemeen en de opkomst van modern land- en waterbeheer in de specifieke context van Iran worden uiteengezet. Vanaf de 17^{e} eeuw heeft het idee van de moderniteit westerse maatschappijen geleidelijk in zijn greep gekregen. Aan het eind van de 19^{e} en het

begin van de 20e eeuw werd het idee geïntroduceerd als een ontwikkelingsmodel voor traditionele maatschappijen zoals Iran. Het gevolg was dat er een overgang van traditie naar moderniteit plaatsvond; in de sector van het land- en waterbeheer vond deze overgang in het bijzonder plaats tijdens de landhervorming van 1962. De modernisering bracht voordelen zoals de uitbreiding van het cultuurareaal en de groei van de productie. Anderzijds echter werden elementen uit het traditionele systeem die belangrijk waren voor het beheer van natuurlijke hulpbronnen, zoals gemeenschapsorganisaties, veronachtzaamd, zowel ten gevolge van gebrek aan inzicht in de inheemse context die de buitenlandse en de nieuwe binnenlandse ontwikkelaars aan de dag legden als het snelle tempo van de verandering vergeleken met het moderniseringsproces in het Westen.

Als gevolg van de paradigmaverschuiving en de toepassing van het westerse model veranderde de pre-moderne (traditionele) technologie-institutie-cultuur nexus. Het regime van ondergronds watergebruik en het patroon van landgebruik (Qanat irrigatie) werd veranderd en gedeeltelijk vervangen door (semi-)diepe bronnen en grote dammen, de *Buneh* werd vervangen door een systeem van klein grondbezit, en een mechanisch wereldbeeld met belangrijke ethische repercussies deed zijn intrede.

Door het verdwijnen van het *Buneh*-systeem en de vervanging van grootgrondbezitters door overheidsinstanties waren de mensen niet langer in staat om collectief de landelijke infrastructuur te onderhouden en werden ze afhankelijk van de verlening van noodzakelijke diensten door de staat. Hiermee werd de hydraulische missie van de maatschappij geboren met als kerndoel de mobilisering van water en de ontwikkeling van een betrouwbare voorziening. Het traditionele besef van land- en waterbeheer ten dienste van de hele gemeenschap lijkt te hebben plaatsgemaakt voor een mentaliteit van ‘ieder voor zich’. In plaats van een vitale bron van leven die werd verschaft door de lokale omgeving waartoe mensen een directe relatie hadden, werd water nu een product (*commodity*) dat uit een kraan stroomde, waarbij de oorsprong van dat water ver weg en de zorg en verantwoordelijkheid van iemand anders was. De dehumaniserende schaal van de moderne watertechnologie dat de bron van het water aan het gezicht onttrekt gaf mensen een “illusie van overvloed”. Bovendien kwam door deze verschuiving ook een nieuw model van het bedrijven van landbouw op, welke de waarde van het land in zijn productiepotentieel ziet (de productivistische visie). Het bedrijven van landbouw werd van een levenswijze veranderd in een business. Bijgevolg trad een nieuwe *economische context voor ethiek in de landbouw* op de voorgrond: de industrialisering van de landbouw en de daaruit resulterende technologische tredmolen waarop boeren in toenemende mate gedwongen worden te bewegen als gevolg van technologische veranderingen en sociale preferenties brachten een spanning teweeg tussen het geloof van boeren in het bewerken van de grond vanuit het rentmeesteridee en de economische realiteit van het boerenbedrijf als business. De boer moet zoveel mogelijk

voedsel voortbrengen en noch de producent noch de consument wordt geacht waardeoordelen te vellen over de niet-economische waarde van het land.

De commodificatie van land en water was een essentieel onderdeel van het paradigma van industriële modernisering dat gebaseerd is op de newtoniaanse fysica en gesteund wordt door de baconiaanse en cartesiaanse filosofie. Dit paradigma, dat reductionisme en de wens tot beheersing van de natuur inhield, werd gepropageerd door ingenieurs die in toenemende mate de werktuigen van het overheidsbeleid werden en zich tegelijk steeds meer elitair opstelden tegenover de rest van de maatschappij, waarbij zij uiteindelijk elk contact met de veranderende stemmingen van de publieke opinie verloren.

Hoofdstuk 5 laat zien dat de rampzalige gevolgen van de industriële modernisering vanaf de jaren vijftig, toen de milieucrisis de kop opstak, duidelijk werden. Uiteenlopende reacties worden besproken, variërend van het radicale anti-modernisme van de eerste golf van de milieubeweging tot de notie van reflexieve moderniteit van de tweede golf in het Noorden. We laten zien dat de reflexieve moderniteit op het gebied van het land- en waterbeheer vanaf de jaren zestig drie fasen doormaakte. Sommige auteurs menen dat het semi-aride Noorden zo ongeveer al deze drie fasen heeft doorlopen, maar dat het Zuiden nog steeds in de industriële moderniteit is blijven steken. Ik geef kritiek op Allan's visie op de reflexieve moderniteit in die zin dat hij te veel geloof hecht aan een unilineair model van institutionele evolutie en eraan voorbijgaat dat het verloop dat de tweede moderniteit in een Europese constellatie heeft genomen aanzienlijk zal verschillen van de koers die deze zal vertonen in niet-Europese constellaties, waar de dynamiek van de reflexieve modernisering zich niet aftekent tegen oorspronkelijk moderne samenlevingen, maar tegen de verwrongen constellaties van het post-kolonialisme. Tenslotte werd betoogd dat de verschillende niet-Europese routes naar en door de tweede moderniteit nog moeten worden beschreven, ontdekt, vergeleken en geanalyseerd.

Het hoofdstuk bevestigt niettemin dat er ook in Iran tekenen en indicatoren te bespeuren zijn van een wending naar de reflexieve moderniteit, in het bijzonder sinds de jaren negentig. Toch verkeert dit proces nog in zijn eerste stadia en moet het nader worden geconceptualiseerd en ontwikkeld in termen van nieuwe technische systemen van land- en waterbeheer, bijbehorende sociale instituties en een nieuw ethisch-religieus kader dat rekening houdt met de specifieke kenmerken van de regio. Bovendien vraagt de reflexieve wending ook om een nieuw contract tussen wetenschap en maatschappij en een overgang naar postnormale wetenschap. Deze werden aan het eind van hoofdstuk 5 geschetst.

Deel III. Empirische vragen: De opvattingen van stakeholders over de mogelijkheden en beperkingen van een overgang naar reflexief land- en watermanagement

Om de levensvatbaarheid van de hoofdlijnen van een reflexief systeem van land- en waterbeheer in te schatten en de houdingen van relevante stakeholders (boeren en dorpsinformanten, experts op het gebied van bodem en water, en huidige beleidsmakers) over de mogelijkheden en beperkingen van deze overgang te peilen, hebben we vier grote empirische onderzoekingen uitgevoerd, waarvan de resultaten in de hoofdstukken 6, 7, 8 en 9 werden gepresenteerd.

In hoofdstuk 6 worden de houdingen van boeren en dorpsbewoners onderzocht omtrent de huidige situatie en de toekomstige mogelijkheden van reflexief land- en waterbeheer. In totaal namen 156 Iraanse boeren en 42 Iraanse dorpsinformanten uit dorpen gekozen uit 14 provincies verdeeld over het land deel aan de interviews. De resultaten van deze enquête worden in dit hoofdstuk besproken. Eerst worden de huidige visies op land- en watermanagement besproken en ten tweede de mogelijkheid om traditioneel en modern beheer te integreren. Ten derde worden de houdingen van boeren en dorpsinformanten tegenover duurzaamheid gepeild alsook, ten vierde, hun houdingen tegenover technologie. Ten vijfde worden de houdingen van boeren en dorpsinformanten tegenover onderzoek en wetenschap en ten zesde hun houdingen tegenover landelijke instituties en boerenparticipatie uiteengezet. Ten slotte worden de houdingen van boeren en dorpsinformanten tegenover de natuur en milieu- en landbouwethiek besproken.

Hoofdstuk 7 presenteert de houdingen van experts op het gebied van bodem en water tegenover de mogelijkheden en beperkingen van deze transitiefase. Deze komen voort uit een vragenlijst die is ingevuld door 94 Iraanse experts op het gebied van bodem en water die aan internationale en nationale conferenties deelnamen[70] en ook door experts die werken bij Iraanse organisaties. Hun visies op de belangrijkste prioriteiten in het land- en waterbeleid in Iran worden ook geschetst. De houding van de experts tegenover duurzame ontwikkeling, hun inschatting van de huidige situatie van het land in termen van duurzaam land- en waterbeheer en hun houding tegenover een mogelijke integratie van traditionele en moderne land-en watermanagement paradigma's worden verder besproken. Ten slotte worden de opvatting van de experts over land- en waterethiek, binnen de bredere horizon van land- en waterbeheer gericht op duurzame ontwikkeling, en hun houding tegenover de natuur uiteengezet.

Hoofdstuk 8, ten slotte, geeft de houdingen weer van beleidsmakers tegenover de randvoorwaarden en mogelijkheden voor een transitiefase naar reflexieve moderniteit. Overeenkomstig de theoretische onderdelen van deze dissertatie (deel II) en de uitkomsten van het eerder verrichte grootschalige enquêteonderzoek, werden er open interviews gehouden met 12 beleidsmakers en/of topinformanten. De resultaten van deze interviews

[70] Gehouden in Iran over onderwerpen die te maken hebben met het duurzame gebruik van land en water.

vormen het onderwerp van dit hoofdstuk. De oorzaken van landdegradatie en waterschaarste in Iran, de voor- en nadelen van de landhervorming van 1962 en de industriële modernisering van Iran worden geschetst. Ook worden de mogelijkheden en beperkingen van land- en watermanagement paradigma's in Iran en de overgang naar een reflexieve, duurzame moderniteit besproken. Bovendien verkent dit hoofdstuk de visie van beleidsmakers op wetenschap, onderzoek en technologie, als deel van het probleem en als deel van de oplossing. De uitdaging van en de hoop op participatie en de rol van de overheid in dit verband, zal nader worden uitgewerkt. Ten slotte worden ethische kwesties en de noodzaak van een ethiek met het oog op land en water, ethiek in wetenschap en technologie en ethiek op het niveau van de organisatie aangestipt.

Hoofdstuk 9 geeft een vergelijking van de houdingen, interesses en waarden van de diverse stakeholders die in de vorige hoofdstukken zijn besproken. De mogelijke overeenkomsten en verschillen met het oog op de transitiefase tussen boeren en dorpsinformanten, experts op het gebied van bodem en water en beleidsmakers worden ook besproken. Ten slotte worden de elementen geïntroduceerd die verdisconteerd zullen moeten worden in een *reflexief kader van land- en watermanagement*.

Deel IV. Naar reflexief land- en watermanagement

Na het schetsen van de historische achtergrond in deel II en de empirische vragen in deel III, keren we in deel IV terug naar de hoofdvraag die in hoofdstuk 1 en hoofdstuk 2 was opgeworpen, aangaande de mogelijke betekenis van reflexief land- en waterbeheer in de niet-Europese constellatie van Iran.

In hoofdstuk 10 wordt het reflexieve kader allereerst gekarakteriseerd door de notie van duurzame ontwikkeling: ontwikkeling moet ecologisch verstandig, economisch levensvatbaar en sociaal acceptabel zijn. Ten tweede kan het ook gekarakteriseerd worden door de integratie van traditionele (inheemse, kleinschalige) en moderne (wetenschappelijke, grootschalige) technologie en infrastructuur. In de derde plaats gaat het om participatief beheer van natuurlijke hulpbronnen in de vorm van multi-stakeholder platforms of associaties van land- en watergebruikers. Ten vierde vergt een dergelijke inclusieve en participatieve benadering van land- en waterbeheer een post-mechanistisch (i.p.v. een mechanistisch) ethisch kader dat conflictmanagement. Ten slotte vraagt deze reflexieve wending om een nieuw sociaal contract tussen wetenschap en samenleving en een nieuwe vorm van wetenschap die in staat is om de vragen rond de overgang naar duurzaam land- en waterbeheer aan te pakken.

Dit reflexieve kader omvat vier sleutelelementen. Allereerst een contextgevoelige strategie van restoratie en integratie van traditionele en moderne technologie die zich richt op het totale

sociaal-technologische systeem. Om deze technologische strategie te verwezenlijken werd een vorm van reflexief land en water governance bepleit die als tweede element de deelname van stakeholders in het proces van transitie mogelijk maakt. Een islamitische land- en waterethiek met als kernbegrippen islamitisch rentmeesterschap en een milieuethiek op deugdethische basis werd als derde element geschetst, waarbij de vier kardinale deugden van rechtvaardigheid, prudentie, matigheid en standvastigheid in relatie tot het milieu werden gedefinieerd. Deze deugden kunnen mensen helpen begrijpen hoe een goed leven in relatie tot de natuur en het milieu te leiden. Ten slotte werd een nieuwe definitie van de professional op het gebied van bodem en water van morgen beproefd. Een revitalisering van de islamitische wijze van onderzoek dat rentmeesterschap bevordert en post-normale en mode-2 wetenschap die de democratisering van de wetenschap faciliteren met het oog op interdisciplinair onderzoek en de mogelijke uitsluiting van stakeholders (het vraagstuk van de relatie tussen wetenschap en samenleving) in de wetenschappelijke sfeer werden ook als sleutelcomponenten van een reflexief kader voor land- en waterbeheer gedefinieerd. Dienovereenkomstig werd de land-en-water professional van morgen geportretteerd als een “

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Courses:			
Information literacy course	Mansholt Graduate School of Social Sciences(MG3S)	2005	0.6
Mansholt introduction course	MG3S	2005	1
Developing PhD research proposal	Applied Philosophy Group	2005	3
Ethical dilemmas for life scientists	Wageningen Graduate Schools (WGS)	2005	3
Intensive Ethics course	Applied Philosophy Group	2005	6
Qualitative research methods	MG3S	2006	3
Rationality in science and technology	Dutch-Flemish network for philosophy of science and technology	2006	2
Socio-cultural field research methods	MG3S	2006	4
Philosophy of culture	Applied Philosophy Group (APP92803)	2006	3
Ethics of science and technology	Applied Philosophy Group (APP93303)	2007	3
PhD scientific writing	WGS	2007	1.5
Series of talks on ethics	Wageningen Ethic Centre	2006-2008	1.4
Presentations at conferences and workshops:			**5**
The STT Conference, *Technology and Religion,* Deurne, the Netherlands		2007	
The 4th Asian Regional Conference & The 10th International Seminar on Participatory Irrigation Management & The International History Seminar on Irrigation and drainage ,Tehran, Iran		2007	
The 5Th International Water History Association (IWHA) Conference of Past and Futures of Water **,** Tampere, Finland		2007	
Mansholt Multidisciplinary seminar(PhD day) The 8th International Conference on Management in Agrifood Chains and Networks, Eide-Wageningen, the Netherlands		2008	
The 1st World Congress for Environmental History on "Local Livelihoods And Global Challenges: Understanding Human Interaction With The Environment" Copenhagen, Denmark		2009	
Total (minimum 30 ECTS)			**36.5**

*One ECTS on average is equivalent to 28 hours of course work

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Mohammad Reza Balali was born on August 23, 1968 in Shahrood, Iran. He achieved his bachelors degree in the field of agricultural engineering- soil sciences from Tabriz University in 1994. In 1995 he started his MSc in the same field and graduated from Tarbiat Modarres University of Tehran in 1997. Since then he started his career as a researcher at Soil and Water Research Institute (SWRI) in the department of soil fertility and plant nutrition. Due to his interest to look at land and water issues from a philosophical point of view, he decided to do his second master in philosophy in 2003 and received his M.A. in the filed of Islamic Philosophy and Theology from PayameNoor-Tehran University in 2005. After passing national examination he was awarded a full scholarship from the Ministry of Agriculture and the Ministry of Science, Research and Technology of Iran, to do his PhD at the Wageningen University in 2005. Since then he started his PhD on environmental ethics as a member of the Applied Philosophy Group at the department of Social Sciences, focusing on land and water ethics towards sustainable management and food security. After graduation, he will continue his research at Soil and Water Research Institute in Tehran, Iran. His main interest is environmental philosophy and applied ethics, with a special interest in environment, agriculture, land and water.

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