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Restoration of Water Supply Systems Infrastructure in Earthquake Affected Small-holder Date Palm Plantations in Bam



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Project Summary

Following the devastating EQ of Dec 2003 in Bam District, agricultural sector suffered the most severe damages: 12percent of the farmers and 25percent of the agricultural staffs lost their lives in the quake. Another dire consequence was the closure of about 75 qanats tunnels due to the falling of earth walls. Collapse of 54 pump shelters (pump houses) and damages to pumps/engines and well casings led to lower, or complete cessation of, water withdrawal from these wells and this aggravated the situation of water supply systems that were badly needed in those times.

As an emergency relief program and in response to the government request, a NEX project entitled “*Restoration of Water Supply Infrastructure Systems for Earthquake-affected Smallholder Date Palm Plantations in Bam*” under was prepared by UNDP/CO under the Gov-UN Joint Flash Appeal in coordination and cooperation with the national experts of the Ministry of Jihad-e-Agriculture (MoJA). After approval by the donor i.e. DFID, it was presented to the Government of I.R. Iran and was signed on 3March, 2004 with MoJA. Activities and achievements of the project are briefly mentioned below:

- **Restoration of wells**

A total of 33 wells were selected for the project, starting with the most important and severely damaged ones and progressively including others. These wells and their pumping equipment were damaged to different degrees. Two of the wells had to be bored in a new location since the main borehole and casing were damaged. It is pointed out that this component of the project served about 2000 beneficiaries and helped in saving date palm trees and their yield in about 1500ha. It should also be mentioned that the discharge of some of the wells increased after the renovation/repair operations of the project.

- **Construction of new pump houses**

A total of 40 metallic pump-houses were constructed and installed in different parts of Bam and Baravat, including the wells restored by the project. These shelters are preferred over the destructed traditional brick walls in areas such as Bam that are prone to earth quake.

- **Conservation of Qanats waters**

More than four kilometers of the course of water from the mouth of the twin qanats (Eisavieh and Najmieh Qanats) to Poshtrood Village were lined and the necessary structures were built along the canals. This component of the project has tremendous impacts on water saving due to prevention of seepage losses. Another very important consequence of this component of the project is that for the new lined canals operation and maintenance is fast and easy. For the old earth channel, O&M was very labor-intensive and difficult,

- **Training**

Operation and maintenance of well pumps and engines was identified as the most important topic of training for the emergency phase. Therefore, a training was provided for the operators of all wells in the affected area (53 wells).

- **Distribution of tool kits**

In order to ensure the availability of the necessary tools for the trained pump operators 16 sets of tool kits were distributed among some of them.

- **Empowerment of Water-user Groups for Participatory Integrated, Production and Protection Management (IPPM)**

While one of the objectives of the abovementioned project was to increase water productivity in the Bam region, repeated reports by the governmental authorities warned that there was an immediate threat to date production posed by the escalation of Dubus Bug and increase in the “date dry up”. Accordingly, an addendum to the project was prepared and signed with MJoAg that aimed at ensuring the survival of plantations and stimulate development by facilitating wider participation of Water User Group Community and government officials in water and Participatory Integrated, Production and Protection Management (IPPM) through GEF-SGP. The addendum was designed for an 18-month period.

Those activities started in late Dec, 2004. After training of the trainers and 23 facilitators, the IPPM project established ten demonstration pilots, in ten earthquake-affected villages of Bam and Baravat for scientifically empowering date growers using participatory approaches and Farmer’s Field School (FFS) techniques. While the project initial action plan aimed establishing five sites, it could manage ultimately ten. In later stages, the project helped in establishment of 5 production cooperatives headed by the trained facilitators.

- **Project Review**

In the last phase of the whole project, a review workshop was held in April 2008 in Bam that was attended by different stakeholders including local farmers and authorities. The achievements, lessons learned, and experiences gained during the project implementation were disseminated through different presentations and were discussed among participants of this meeting.

Part One: Irrigation Water System Restoration

Introduction

Bam devastation by the earth quake was the first natural catastrophe on the global scale in the third millennium in terms of the number of victims and the extent of economical and social damages. In the early morning hours of 26 Dec, 2003, a quake measuring 6.7 on the Richter scale destroyed this 2000-year old city in a matter of 12 seconds. Tens of thousands of people were killed and many more were injured. The official figures of the casualties changed a number of times, reflecting, among other things, the extent of the devastation. The latest figures indicate that more than 30,000 people lost their lives.

The epicenter of the quake was in the middle of Bam City and it destroyed almost every building, residential or otherwise, in the two towns of Bam and Baravat and in many neighboring villages within a 10-15km distance from the center of Bam. This was an unprecedented earthquake in the area. Indeed, prior to the quake, a Citadel, namely, Arg-e-Bam, made of clay mud bricks, had been standing in the northeast of Bam City for more than 2000 years and was evidence of no serious earth quake in the history of the area. The Citadel was a tourist attraction and famous as an international cultural heritage. In the recent EQ, however, it was heavily damaged and the estimates are that it would take years before rehabilitation/reconstruction could be partially accomplished.

Bam is, indeed, a “garden city” with thousands of hectares of date palms inside the city and the nearby villages, right in between different houses and residential areas. As such, heavy damages were also inflicted upon the surrounding walls, water sources, and irrigation networks of these plantations. No direct damage has been reported to the trees, though some people have expressed fear of root damage¹.

Immediately following the quake, different national and international agencies started rescue and emergency operations in different forms. The UN agencies were among the first to send field missions for need assessment (NA) and project design. A preliminary NA by FAO was prepared as a report that was later used by UNDP/CO as a basis for discussion with the Government of I.R. Iran in order to help the country with the national project conducted by the Ministry of Jihad-e-Agriculture (MoJA) on restoration of irrigation water supply systems in Bam. These discussions and other information gathered by the UNDP/CO staff led to the preparation of a NEX project entitled “*Restoration of Water Supply Infrastructure Systems for Earthquake-affected Smallholder Date Palm Plantations in Bam*”.

***The sons of man are limbs of one another,
Created of the same stuff, and none other.
One limb by turn of time and fate distressed,
The others feel its pain and cannot rest.
Saadi, Great Persian Poet 1300's***

¹ The author has visited many plantations in different areas of the district for signs of direct damage such as tilting or uprooting of the trees and has asked local people about this, but, he has not been able to establish any such damage.

The project documents were repeatedly reviewed and discussed so as to make it acceptable to the donor i.e. DFID, UK. These documents were then presented to the Government of I.R.Iran and were signed on 3March, 2004. UNDP consultant was then selected through the usual recruitment procedures and a 4-months SSA was signed with him on 7March.

The original activities and budget lines were modified soon after the UNDP consultant went to Bam for updating the NA, as of March 2004 i.e. two and a half months after the quake. The modifications were proposed to DFID and following their agreement, the project started.

By early July, it was evident that the project would not be finished in the anticipated 4-month period. The delay was due to a number of reasons including the delay in budget accessibility in the early parts of the project, the limitations in the number of local technical personnel and labor, inadequate supply of different materials and equipment in the Bam market, and the continuation of the quake aftershocks. In the meantime, the first UNDP-recruited consultant had to leave since his contract was finished and he had previously accepted another job starting Aug 2004. A new consultant was recruited and the work continued. Fortunately, due to the increase in the budget funding, activities of the project were extended beyond the original commitments, with some time extension. The present report is prepared by the first consultant, who was asked to sum up the activities of the project and give an assessment of the impacts.

I-Water resources and irrigation issues

I-1-General status of water resources

Bam District as a whole is a typical desert oasis in dry environments of the southern parts of Iran. It has an arid climate with little annual rainfall: long term average annual rainfall is about 60mm, while in the recent years the actual amount has dropped to lower values. This means that crops and trees can not produce economical yields without irrigation, particularly considering the heat and high temperatures prevailing there in the spring and summer months.

Due to the aridity of the region, surface water resources are non-existent i.e. there are no permanent surface streams or rivers in or near the two towns of Bam and Baravat. There are, however, dry riverbeds that are few meters deep in certain reaches and indicate incidental flood water passage.

The groundwater situation is quite different. The district is surrounded by high mountains that do receive precipitation, both as rain and snow, which infiltrates into the alluvial fan and recharges the aquifers overlying the impermeable finely grained alluvial deposits. This situation was ideal for construction of shallow wells and, more important, the qanat systems (horizontal tunnels dug in the upstream aquifers to convey water by gravity from distant locations to the desired place downstream) The area has the oldest qanats of Iran and is claimed to have one of the greatest densities of qanats per land area in the whole country. There are some 375 lines of old traditional Qanats and 950 wells of different

depths in various parts of the district, about 118 of which are in the Bam-Baravat region. The discharge rates of the qanats vary widely, mostly in the range of 50-200 l.s⁻¹, while those of wells are in the range of 15-50 l.s⁻¹. These two means of exploiting groundwater provide hundreds of millions of m³ of the agricultural water required for irrigation of different crops in Bam district. Water quality is generally good for irrigation purposes and water salinity is not a problem.

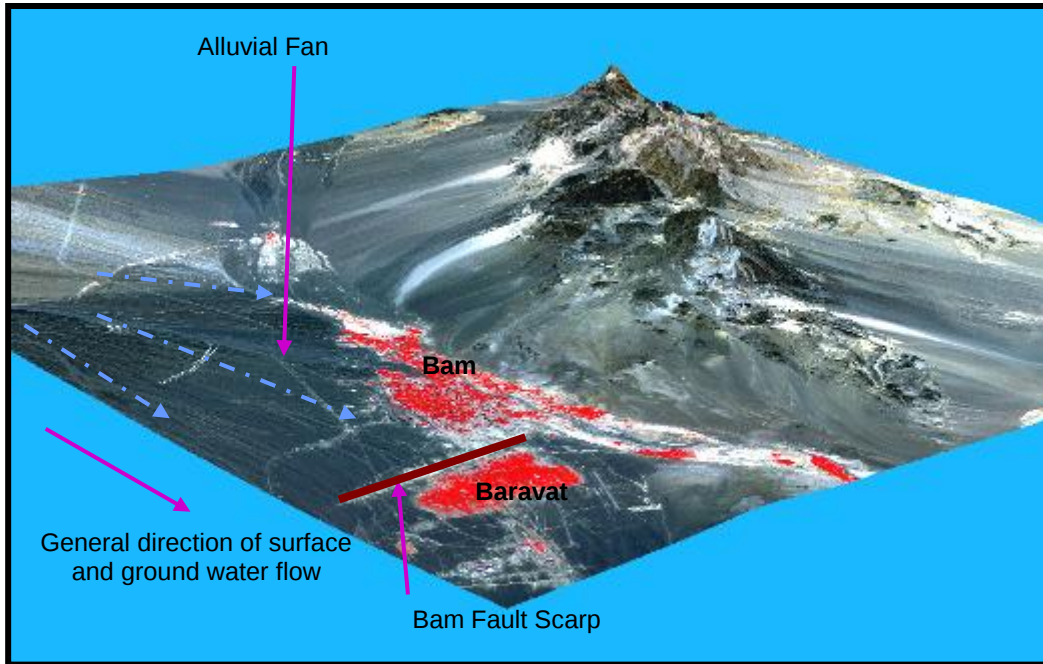


Fig. 2- A general view of the situation of Bam and Baravat showing the Barez Mountains and the general direction of water flow (modified from Ansari et el, Iranian Geological Organization, 2005).

It should be noted that the presence of Bam fault Scarp has greatly contributed to trapping of groundwater in the upper terrace and has formed a sort of underground dam that keeps recharge water in the aquifer there and contributes to the sustenance of qanat systems. Fortunately, recent geological studies have shown that the earth quake did not result in significant displacement of the fault scarp; therefore, it is not expected to have changed groundwater status in the area.

I-2-Irrigation and water right issues

As mentioned previously, irrigation is a must for any agricultural production in Bam. All crops and trees in the district are irrigated throughout their growing season. In other words, date palms and citrus trees that are biologically active during the whole year are irrigated in all seasons, while field crops and vegetables are watered during part of the year coinciding with their growth periods.

The role of water resources in the district goes beyond the economical arena of agricultural production. Indeed, it has contributed a lot to the social structure and

institutions of the local communities in different ways. For example, a very interesting aspect of water resources in Bam is the fact that each well or Qanat is shared between several farmers and landowners. These resources are owned, operated, and maintained by a water users group (WUG) whose members have different time shares of the whole flow rate of the source. In some cases, the number of shareholders is more than 100. The shareholders select one to several (perhaps 3) representatives who take care of general management issues and contact with Agricultural Department or Water Department in Bam. These representatives supervise the operation and maintenance and time of water allocation i.e. act as ditch riders, control water rights, or get involved in solving conflicts between members of the WUG.

The time share is widely different between farmers, ranging between as little as 10 minutes to several hours. There are various reasons for such differences. One reason is the inheritance laws: when somebody who owns a certain time share dies, that time share is divided between different heirs/heirss and, consequently, time shares get smaller and smaller. However, some farmers may buy time shares and add it to their own. An average time share of one hour is sold for several thousands of \$ US depending on the situation.

The interval between two subsequent irrigations is not the same in different parts of the district. However, these intervals are usually 7-9 days. During an interval, each water user has certain duration of time to divert water to his/her field. The next person comes at the right time and closes the previous intake and directs the flow to another intake (gate).

Irrigation water distribution networks are usually complex. For both the qanats and wells, the network consists of an open canal downstream from the mouth of the qanat, or from the well outlet pipe. The canal course of flow is usually crooked with frequent bends and meanders. At different locations where there are farm intakes, there are either simple metallic gates or temporary earth check dams built by the farmers to divert water to their farms inlets. In certain locations where these canals cross the roads, simple concrete pipes are installed underground to convey water. In some villages, such buried pipes are absent and water crosses the road openly, causing different problems. Inside Bam City, for the

Socio-economical roles of qanats in Bam

- **Birth and sustenance of the oasis and the city.**
- **Sense of social pride: legacy of indigenous knowledge, national historic civilization and scientific advances in hydraulics.**
- **Contribution to development of social structure through formation of WUG, whose members collectively manage the water, may pay in cash, help manually, and share the water.**
- **Agricultural development of the community**
- **Industrial development (agri.-related and tourism).**
- **Saving energy for water withdrawal and producing energy (old times water mills)**
- **Compatible with natural inflow-outflow equilibrium i.e. balanced and sustainable withdrawal of groundwater.**

crossings of large qanat streams, special concrete tunnels with a rectangular cross-section is built underground to convey the water. Besides, many of the aboveground concrete channels located on both sides of different streets are actually part of the irrigation water conveyance and distribution system. Before the earth quake, the drinking water supply system was separate from the irrigation network. However, after the quake, the two systems were somewhat mixed for quite some time.

On-the-farm ditches and channels are similarly poorly constructed. They are mostly unlined with a lot of weed growth. Therefore, lots of water is actually lost during conveyance. One important future action to help the area should be the lining of the irrigation water conveyance systems, both outside and inside the farms. For the same reason, one component of the present UNDP/DFID project aimed at lining more than 4 km of conveyance canals of two important qanats in the area, namely, Eisavieh and Najmieh.

II-Agriculture in Bam

Bam District is located in an arid zone of Iran in Kerman Province. The long-term average precipitation of the district is about 60mm, which is among the lowest in the country. Even at this level of precipitation it has been hit by a long cycle of drought (some believe that this is the seventh year of drought in the area) and seasonal precipitation during fall 2003-Spring 2004 amounted to about 10mm, while daily max. temperatures in the spring were running mostly in higher 30's to lower 40's. Such high temperatures together with high wind velocities increase evaporation/evapotranspiration and seasonal water requirement of dates, citrus and alfalfa to values higher than 1000mm. As such, there is a tremendous difference between water needs of crops and rainfall in the area. Consequently, crop production in Bam is impossible without irrigation.

Despite its arid conditions, Bam District is considered as one of the important agricultural areas of Iran. Nationally, it is particularly famous for its dates (Mazafati cultivar), sweet oranges, and local cultivars of alfalfa. Latest figures on the land areas under date palms, citrus, and alfalfa are, respectively, 20,000, 10,000, and 12000 ha. In the case of date palms, 15000 ha are in fruiting age while 5000 ha are young plantations.

Production system in Bam is a mixed system: In most date palm plantations, citrus and/or alfalfa are grown in the space between palm trees. The idea

Alfalfa grown under date palms is one of the mixed production systems in Bam. Note that, in this case, leaf discoloration is due to frost damage in winter and not caused by water stress.



behind this system of production is one of maximizing production per unit land area and protecting citrus from direct intense sun rays in summer time.

Besides those major fruit trees and alfalfa, a variety of other agricultural crops are grown in the district. These include wheat (5000ha) barley (2500ha), henna (2000ha), pomegranates (180ha), and a host of other fruit trees and vegetables. The earthquake affected areas are mostly under date palm, citrus, pomegranate and alfalfa.

Yield figures are variable from orchard to orchard, depending on management and water availability. For dates, an average yield of about 7.5 tons/ha is written in Agricultural Statistics published by the Ministry of Jihad-e-Agriculture (MoJA, 1983). In normal years, annual total production of dates in the whole district is 100-130 thousands tons, a lot of which is exported.



Fields and orchards, particularly the date palm plantations, are usually small in size, in some cases less than 0.10 ha. This is particularly true for the ones situated in the town. The average farm size is less than 0.5 ha, while few people have several hectares in different locations. As is the case with water rights, fields are divided between the heirs/heiress and they usually build a wall around the inherited piece of land. Almost all farms are separated by mud walls of

different height, most of which collapsed due to the earthquake. In most cases, residential buildings are inside, or surrounded by, date palm plantations.

Livestock raising is also popular in the area with almost 1800 livestock production units in the earthquake affected area. Cattle, sheep and goat are raised in herds of different sizes, mainly in the villages. Livestock products of Bam, particularly milk, comprise the greatest share in Kerman Province. The total number of sheep and cattle heads is estimated at 70,000, including 15000 heads of milk cows. Prior to the earth quake, nearly 100 tons of milk was exported daily to milk factories in other cities of the province. During the earthquake, many stables of these animals were ruined and some 2000 cattle and 8000 sheep and goat were lost.

The government agency responsible for agricultural and livestock issues in the area is called Bam Directorate of Jihad-e- Agriculture.

III -Damages to water resources and agriculture

According to Bam Department of Jihad-e-Agriculture, 12% of the farmers and 25% of the agricultural staffs lost their lives in the quake. Next to the heavy human loss of life, water resources and, generally, agricultural sector were extensively damaged. In a meeting with Engineer Ehsani, Bam Director of Jihad-e-Agriculture, he put the estimate of the earthquake damages to agricultural sector at about \$ 220M. He was referring to the immediate and physical losses that consisted of a wide spectrum of damages to agricultural sector including the followings:

- Closure of about 75 qanats tunnels in certain locations due to the falling of earth walls (see Table 1).

Table 1-General information about the Qanats damaged in Bam and Baravat following the earth quake.

No.	Name of Village & Qanats	Lands Under Cultivation	Length of Qanats	Water Yield of Qanats		No. of Families	Water Yield loss
				<i>before</i>	<i>after</i>		Δ
		ha	m	l/s	l/s		l/s
1	Eish - Abad	40	14,000	100	0	10	-100
2	Sobhan - Abad	50	15,000	120	0	12	-120
3	Gazdar	160	6,000	120	80	40	-40
4	Dehshotor	200	3,000	200	100	50	-100
5	Owlia Baghchemak	100	2,000	80	40	25	-40
6	Pakam	100	4,000	180	100	26	-80
7	Asad - Abad Baghchemak	80	10,000	100	0	18	-100
8	Mohammad - Abad Bughchemak	200	20,000	100	60	49	-40
9	Masoomieh	120	20,000	100	0	31	-100
10	Eesavieh	120	30,000	100	0	30	-100
11	Najmieh Baghchemak	170	20,000	150	70	40	-80
12	Abbas - Abad Baghchemak	120	20,000	100	0	30	-100
13	Rahmanieh Baghchemak	170	20,000	150	60	42	-90
14	Fatemieh Baghchemak	200	20,000	100	0	50	-100
15	Mirza Baghchemak	120	2,000	100	0	31	-100
16	Hosseinieh Baghchemak	80	10,000	70	40	19	-30
17	Farah - Abad	80	5,000	70	0	18	-70
18	Dang Nim Seyed - Abad	140	5,000	140	40	32	-100
19	Hassan - Abad Nartich	40	5,000	30	25	7	-5
20	Bagheri	90	5,000	80	60	22	-20
21	Dang Nim Darestan	100	4,000	90	30	25	-60
22	Feiz - Abad Darestan	90	5,000	80	30	22	-50
23	Saeed - Abad Darestan	80	5,000	70	30	18	-40
24	Kakh Dehshotor	80	10,000	100	70	17	-30
25	Ghanbar - Abad Sheikhi	120	20,000	170	40	30	-130
26	Mehdi - Abad	90	20,000	80	30	20	-50
27	Hassan - Abad Baghdasht	60	25,000	50	20	14	-30
28	Lengeh Doreshteh Behjat - Abad & Farokh - Abad	150	25,000	120	40	35	-80
29	Akbar - Abad	80	25,000	70	0	20	-70
30	Hossein - Abad Baravat (upper)	30	6,000	50	0	7	-50
	SUBTOTAL 1 - 30 priority qanats	3,260	381,000	3,070	965	790	-2,105

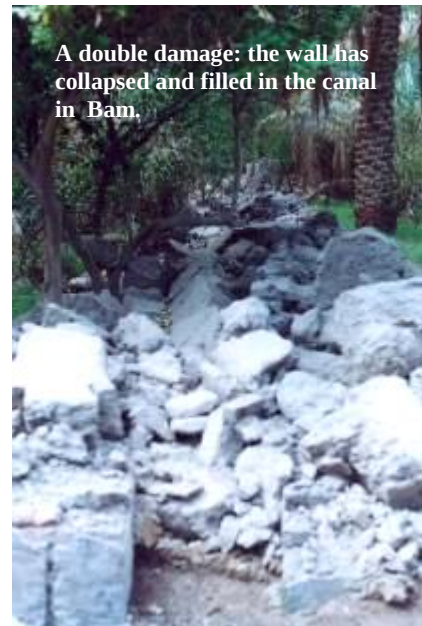
Table 1- Continued.

No.	Name of Village & Qanats	Lands Under Cultivation	Length of Qanats	Water Yield of Qanats		No. of Families	Water Yield loss
				<i>before</i>	<i>after</i>		Δ
		ha	m	l/s	l/s		l/s
31	Hossein-Abad Baravat (Middle)	100	4,000	120	0	24	-120
32	Kohneh Baravat	80	7,000	80	0	20	-80
33	Qanad - Ghaleh Mola Baravat	50	6,000	50	0	12	-50
34	Gardoon Baravat	70	4,000	70	0	16	-70
35	Mohammad - Abad Baravat	30	4,000	30	0	7	-30
36	Norooz - Abad Baravat	60	4,000	30	0	15	-30
37	Ghassem - Abad Baravat	100	4,000	100	0	25	-100
38	Saeed - Abad Baravat	20	5,000	20	0	4	-20
39	Hashar - Abad Baravat	15	5,000	15	0	3	-15
40	Mehdi - Abad Baravat	15	5,000	15	0	4	-15
41	Vakil - Abad Baravat	55	10,000	55	0	13	-55
42	Rashidi Baravat	30	2,000	30	0	8	-30
43	Sharik - Abad Baravat	30	1,000	30	0	7	-30
44	Ghaem - Abad Baravat	50	5,000	30	0	12	-30
45	Dolat - Abad Baravat	40	4,500	20	0	10	-20
46	Jahr Kenaro Baravat	20	3,000	15	0	5	-15
47	Haji - Abad Baravat	30	3,000	20	0	7	-20
48	Allah - Abad	40	5,000	20	0	10	-20
49	Hasan-Abad	50	4,800	50	0	12	-50
50	Salaf	30	3,000	25	0	8	-25
51	Akbar - Abad Baravat	150	4,000	150	20	36	-130
52	Hossein - Abad Baghdasht	30	4,000	50	7	7	-43
53	Shams-Abad	35	3,500	30	5	7	-25
54	Cheshmeh Posht - rood Markazi	60	20,000	50	10	15	-40
55	Hakem-Abad	45	2,500	50	10	11	-40
56	Hemeh Baravat	45	3,800	45	10	10	-35
57	Ali-homeh	40	5,000	45	10	10	-35
58	Ameri Mardazi	20	15,000	20	5	4	-15
59	Ghotb - Abad (lower)	50	5,000	40	10	13	-30
60	Loff - Abad	40	5,000	40	10	10	-30
61	Pij Olya	40	4,000	40	10	9	-30
62	No Hoomeh	40	4,500	30	10	9	-20
63	Ali - Abad Hoomeh	50	4,000	40	15	12	-25
64	Beheshtieh	60	10,000	60	25	16	-35
65	Mirzaee Baravat	50	4,500	30	15	13	-15
66	Bidoo Hoomeh	40	3,000	30	15	10	-15
67	Hojattieh	60	10,000	50	25	15	-25
68	Seyed Ahmadi Baravat	20	5,000	15	10	5	-5
69	Chaharbagh	40	6,000	30	20	9	-10
70	Ghotb - Abad (upper)	50	6,000	40	30	12	-10
SUBTOTAL 2 - 40 qanats		1,880	214,100	1,710	272	455	-1,438
Total 70 qanats		5,140	595,100	4,780	1,237	1,245	-3,543

- Collapse of 54 pump shelters (pump houses) and damages to pumps/engines and well casings that led to lower, or complete cessation of, water withdrawal from these wells.
- Destruction of livestock stables and shelters.
- Death of livestock (about 8000 sheep and 2000 dairy cattle).
- Collapse of mud walls around many orchards.
- Obstruction of irrigation water conveyance network by debris and rubble.
- Destruction of most of the cold houses facilities that had a capacity of about 100,000 tons and were mainly used for storage of dates.
- Losses and damages to different pieces of equipment used by the farmers.
- Damages to farmers' transportation vehicles.

The most immediate response of the local officials to the agricultural damages was to restore water supply system, even in a temporary manner. A number of heavy machinery, including bulldozers and hydraulic shovels, were sent to the affected areas to open the qanats by removing the upper-lying soil from the surface and exposing the tunnels. In certain parts of the qanats, due to the depth of the underground tunnels, specialized qanat-workers from local community or other areas of the country had to be employed for the cleaning operations. The wells were also partly restarted by repairing the damaged pumping units. Many small orchards, particularly those inside the city, that had become inaccessible for water conveyance through the canal network, were irrigated by water tankers hired by the Bam Department of Agriculture from private companies or brought in from other cities.

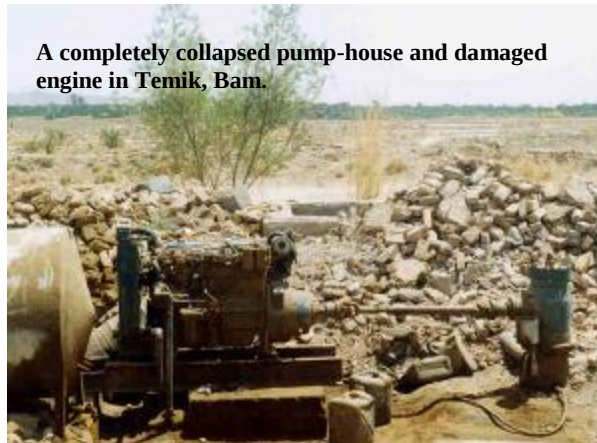
Such water restoration activities were not carried out at equal pace in different sections of the affected areas and some water stress did occur in certain date palm plantations (where other crops such as citrus and alfalfa are grown in mixture with date palms). The reasons for this included lack of adequate heavy machinery in the area, cessation of local market activities in Bam for providing equipment such as pumps, inadequate local contractors/operators, limitation of budget available to local authorities, death of the owners of many orchards and, consequently, temporary unawareness of the local officials about the needs in certain sections, and earthquake aftershocks that, sometimes, resulted in re-closure of newly opened qanats or new damages to wells.



A double damage: the wall has collapsed and filled in the canal in Bam.

The abovementioned damages were, of course, aggravated by the traumatic conditions that prevailed in the local community and also affected any person who had come to help. The social, economical, and administrative disruptions caused by the earthquake delayed or decreased the impacts of the mitigation practices adopted by the government officials and the international agencies who had come for helping with the situation.

It should also be mentioned that, during the month preceding the earthquake, severe cold and freezing temperatures had occurred for several nights, with minimum temperatures reaching -3 to -4 degrees centigrade. This was sufficiently cold to destroy most of the citrus crop, which were in the middle of harvesting, and damage the date palms in certain plantations. Less severe cold nights also followed the earthquake, causing further damage. Symptoms of these freezing temperatures on the leaves of date palms are similar to, but slightly whiter than, wilting symptoms due to water stress. Some farmers say that yield losses due to the freezing temperatures are higher than that caused by water shortage.



A completely collapsed pump-house and damaged engine in Temik, Bam.

IV- Project components and achievements

Due to the emergency nature of the situation, the original documents prepared for this project were based on the data and information gathered during the early days after the quake. As such, the emphasis of the activities, and the budget lines, was on restoration of water supply from qanats and wells. By the time the project was finally approved and a consultant/Project Manager was recruited, it was early March i.e. two and a half months after the main quake. Therefore, a new assessment was necessary and was carried out by the UNDP consultant. This led to some modifications that were proposed to the donor i.e. DFID, and following their agreement, the project started. The Deputy of the Land & Water of Kerman Directorate of Agriculture was appointed by the Ministry of Agriculture as the National Project Direct to manage directly the project activities in the field.

By early July, it was evident that the project would not be finished in the anticipated 4-month period. The delay was due to a number of reasons including the delay in budget accessibility in the early parts of the project, the limitations in the number of local technical personnel and labor, inadequate supply of different materials and equipment in the Bam market, and the continuation of the quake aftershocks. In the meantime, the UNDP consultant had to leave since his contract was finished and he had previously accepted another job starting Aug 2004. A new consultant was recruited and the work continued.

Fortunately, due to the increase in the budget funding, activities of the project were extended beyond the original commitments, with some time extension. The eventual components and achievements of the project are described in the following sections.

IV-1-Restoration of wells

- 1-1- Site selection procedure: When the project started, the complete list of the damaged wells had already been prepared by the Bam office of

MoJA. However, pumping equipment of some of the wells had been repaired or renewed by other agencies. The remaining sites were visited by the UNDP consultant, NPM and NPD or other local agricultural officials. Many selection criteria such as degree of poverty of the beneficiaries, the area served by one well, the number of beneficiaries served by one well, the age of the trees, the severity of the damages, and the location of the plantations with respect to the epicenter were in mind.

However, in practice, there were so many complexities and similarities in the sites visited that almost all seemed fit for the project. For example, in many sites, while many “smallholders” were using one well, few owners had a relatively larger farms and they also benefited from the project, even though they were not the target group. Besides, due to the death of some owners and the general disruption of the whole community, it proved impractical to gather information on every beneficiary of a well. Meanwhile, delays in implementation of the project due to scrutinizing detailed information and comparison between sites did not seem justifiable for this emergency project. As such, after several visits to different wells, site selections were based on evaluation of the conditions observed at each site on the list of Bam Department of Agriculture, except two sites that were beyond the radius of earthquake affected areas and were rejected by the UNDP.

- 1-2- Procurement procedure: According to project documents, the plan was that the specifications of the pumps and engines would be decided by the FAO expert. After the project approval, a team of experts from the office of Deputy Minister on Soil and Water (MoJA) and FAO¹ were invited to UNDP² for a meeting to discuss different aspects of the project. Following this meeting, a list of equipment (including pumps and engines) was sent to UNDP from MoJA. The list was reviewed and it was decided that certain items of the list, such as trucks equipped with large water tankers, could not be included in the project. However, a budget was allocated to 8 units of pumps and engines, which increased later on as new budget became available and the UK Pound became stronger against US dollar and Iranian Rials. Then, NPD was asked to follow the government procurement procedures and select the suppliers and submit the documents for the money transfer process according to NEX project procedures. This was somewhat delayed due to variations in market prices and unclear reliability of some suppliers. Eventually, NPD signed a contract with a local supplier in Kerman, the provincial capital of Kerman Province. However, he was recommended to revise the contract in such a way that the payments be divided in 3 installments, with the last payment

¹ Engineer Sadreddini and Dr Parehkar from MoJA and Dr Hakimi and Mr Klemm, from, respectively, FAO/CO and FAO Rome.

² Mr Saroj Jha, Assistant to RR, and members of the Disaster and Risk Management Team of UNDP, including the UNDP consultant, attended this meeting.

(25% of the total) to be made after all equipment are installed and tested.

- 1-3- **Achievements:** In the initial stage of the project, renovation of 8 wells was in the agenda. However, as time went on and further budgets were made available and site inspections revealed that some wells required only partial repair, more wells were selected and included for restoration. Eventually, a total of 33 wells were selected for the project, starting with the most important and severely damaged ones and progressively including others. These wells and their pumping equipment were damaged to different degrees. Two of the wells had to be bored in a new location since the main borehole and casing were damaged. The following table shows the details of the wells restored by the project. It is pointed out that this component of the project served about 2000 beneficiaries and helped in saving date palm trees and their yield in 1500 ha. It should also be mentioned that the discharge of some of the wells increased after the renovation/repair operations of the project, providing additional water for the users. No data were taken in this regard, though in one case the “new water” was overflowing the banks of the conveyance canal. In this part of the country, increased water availability is equivalent to higher income and improved livelihood of the farmers.

Table (2) - General information about the wells whose pump/engine parts were partly or completely renovated by the UNDP project.

Well no.	Name of the well	Location	Beneficiaries No.	Dates ha	Actual Yield(ton)	
					2003	2004
1	Dashtoeih 1	Bam	100	35	315	210
2	Dashtoeih 2	Bam	120	30	270	180
3	Ekteshafi	Baravat	130	33	297	198
4	Navabi	Bam	12	15	135	90
5	Shahrdari 2	Bam	15	20	180	120
6	Fatemi/Edalat	Baravat	100	40	360	240
7	Tamik	Bam	10	15	135	90
8	Aflatoonian	Bam	95	40	360	320
9	Akbar abad	Baravat	100	30	270	150
10	Golzar	Bam	150	45	405	270
11	Bongah Abaskhani	Baravat	50	47	423	282
12	Seid ahmadi	Baravat	82	52	468	312
13	Chehel mani	Baravat	85	40	360	240
14	Ghanbar M.Rezaei	Baravat	52	40	540	360
15	Sherkat Tavvoni	Baravat	40	170	1080	600
16	Fekri	Bam	30	30	270	240
17	Tadayon	Bam	45	45	405	360
18	Eishabad	Bam	40	40	360	320
19	Fatemi nohsad metri	Bam	110	100	900	600
20	Keshmeshoeieh	Baravat	110	110	990	660
21	Abas sarhang abad	Bam	95	95	855	760
22	Ferdous	Baravat	110	110	990	550
23	Esmaili	Bam	80	80	720	400
24	Hasamzadeh	Bam	10	15	120	75
25	Gazin 1	Baravat	110	33	297	198
26	Ghanbar M.Rezaei 2	Baravat				
27	Morad Abad	Roodab				
28	Zarrin Abad	Roodab				
29	Khanekhatoon Tahrood	Tahrood				
30	Milad-e 4	Darestan				
31	Rashidi	Roodab/Bam	24	20	180	120
32	Vali-e-Asr	Darestan/Bam	18	24	-	-
33	Milad-e 17	Darestan	19	7	-	-

1-4-

Sample Photos



Checking the list of equipment arrived at Dashtoeiyeh Well No 1. From left to right, Mr Siadat, UNDP Consultant, Mr Mustafaei and Mr Jafari from Bam and Kerman JoA.



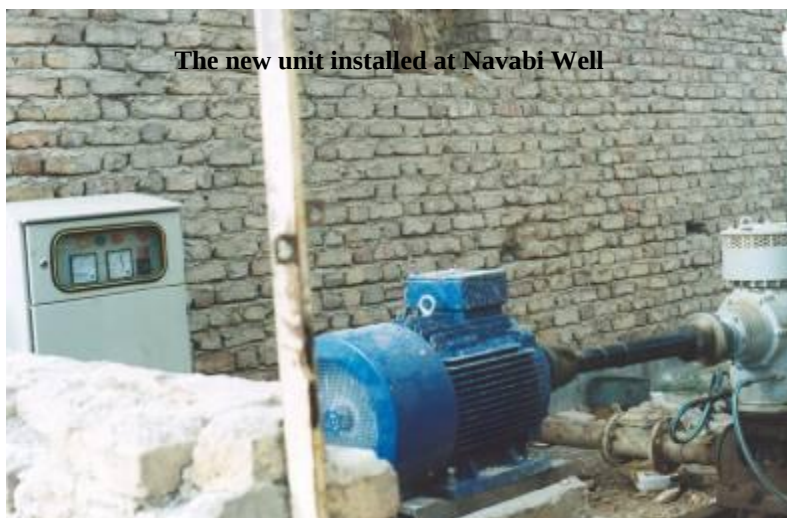
New gear box for Abaskhani well. Old casing pipes are being pulled out of the well.



The new pumping equipment with electric board in Ekteshafi Well in Baravat. The project also provided well casings.

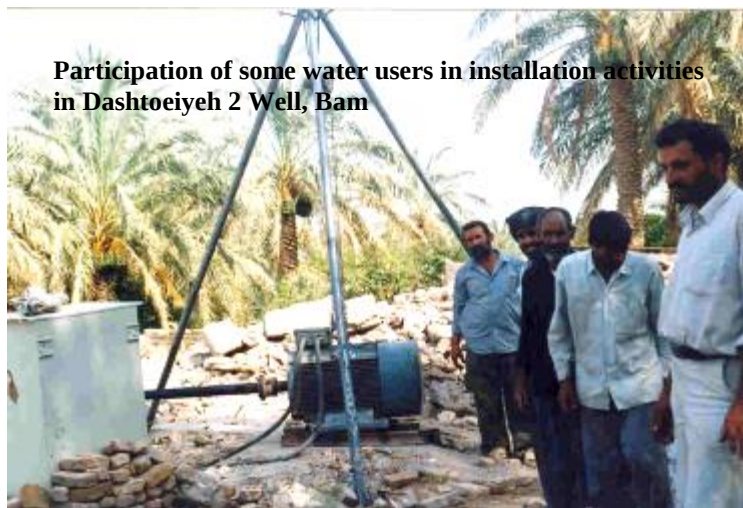


The old well and pumping equipment of Ekteshafi Well with collapsed shelter nearby the new site in above picture.



The new unit installed at Navabi Well

**Participation of some water users in installation activities
in Dashtoeiyeh 2 Well, Bam**



The pumping unit installed at Aflatoonian Well in Bam



Aflatoonian Well before the new units were installed



IV-2-Pump shelters

- 2-1- Selection procedure: Although the general procedure used for selection was similar to that of well pumps and engines, the final selection of sites was less time consuming. This was because a total of 53 well shelters had collapsed in the area and, after the need assessment by UNDP consultant, it was decided that construction of a large number of shelters should have priority. In the absence of shelters, the environment of the wells is dangerous for children and the equipment is also exposed to theft and manipulation by every passer by. Therefore, the project decided to construct 40 well-shelters and this included the majority of the possible choices¹.
- 2-2- Procurement: The collapsed pump shelters were all made of bricks and other masonry stuff. For the new shelters, however, it was decided to use metallic sheets joined together with nut and bolts and welding. This decision was made after a visit by the UNDP consultant, NPM and NPD to a number of pistachio orchards in Kerman area showed the durability and practicality of this structure. The whole shelter could be easily lifted and relocated, if need be. Besides, it is cheaper and could be constructed faster. Moreover, in case of another quake, there would be little risk of damage to pumping equipment due to the falling ceiling and walls. After deciding on the type of structure, the design was devolved by a company and the market was surveyed for a proper supplier. The intention was to select a local contractor in Bam City. However, the time limit of the project implementation, the necessity of a competitive price, and the need for a reliable supplier to carry out the job on time and with accuracy required a well-equipped contractor. This was not all available in Bam City. Finally, after some survey in Bam and in Kerman, 30 shelters were contracted with a supplier in Kerman and 10 were given to a local contractor. The original contracts were signed in such a way that all shelters would be constructed and delivered to the sites for installation within 50 days after the first of the three installments were received. Every day delay by the supplier would incur \$100 penalty upon him.
- In practice, however, some complications occurred. For example, it was realized that shelters needed a proper foundation many of the wells did not have. Besides, cleaning of the surrounding areas of the wells took some time and required some labor and cost. As such, the contracts and the time for construction had to be adjusted to accommodate these points.

¹ The UNDP consultant and other project staff raised this need in two meetings with other NGO's working in the area and two of them, namely, OXFAM and CARITAS have accepted to take care of another 10 shelters.

2-3 Achievements

A total of 40 metallic pump-houses were constructed and installed in different parts of Bam and Baravat, including most of the wells listed in Table 1. These shelters are preferred over the brick walls in areas such as Bam that are prone to earth quake. The reason is that the walls and ceilings are metallic plates and will not fall off like bricks. Also, in order to prevent heating of the shelter during the summer months, ventilation window and spaces between the ceiling and the walls have been included in the design. Besides, the walls are double plated, with glass wool insulators in between. A window in the ceiling of these shelters has been installed so that when the engine/pump require repair and need to be taken out of the well, the crane could reach them from the ceiling opening. Another advantage of the new shelters is that they are bolted to the foundation and, therefore, could be removed and displaced, if the well site is to change.

It should be noted that shelters have different roles such as prevention of accidents for children, who may get too close to the rotating shaft, and protection of the pump/engine parts from theft or unwanted manipulations by passersby.

2-4- Photos



Typical ruins of a pump shelter following the earthquake in Bam.



New shelter for Ekteshafi well is being lifted by a crane



IV-3-Conservation of Qanats waters

- 3-1- Site Selection. In the signed documents of the project, there was some emphasis on cleaning and opening of the qanats. This was in the light of the initial need assessment report prepared by FAO and based on the situation in the early days following the quake. At the time of start of this project in March, many things had changed in the area and most of the qanats were either open or were being cleaned. As such, the emergency condition for qanats had almost passed.

However, observations by the UNDP consultant indicated that a lot of water was being lost in open earth channels during conveyance from qanats mouths to the farms intake points. Therefore, it was decided to allocate one component of the project to lining of the conveyance canals in order to save on water losses. In this respect, there were several choices in terms of the location and lengths of canals. After several field visits, the twin qanats of Eisavieh and Najmieh were selected for the project. These two qanats serve Poshtrood Village and date palm plantations before that. Among advantages of the selected qanats is that the length of their conveyance canal is close to that predicted in the budget i.e. 4 km and the number of beneficiaries, who are mostly small landholders, is large.

Following the preliminary selection, contacts were made with the village council members and their reaction was quite encouraging. One point, though, was that they asked for an independent canal for each of the two qanats (presently, one canal is conveying the total flow of both). The UNDP consultant visited about 30 members of WUG (beneficiaries) and asked them about this and they all had the same request. This request was also supported by Bam Directorate of Agriculture. Nevertheless, the village council was asked to present a

written request signed by the council members and the beneficiaries. A copy of this request is in the Appendix II.

- 3-2 Procurement procedure. A consulting engineer was assigned by NPD to carry out elevation survey of the course of the canal and prepare a draft design. This draft was reviewed by UNDP consultant who asked for further investigation on annual variations of the maximum discharge rates so that overflow of water from the canals is prevented (the flow rate of the qanats at the time of designing the new canals was feared to be less than the normal flow). After the final draft was reviewed and approved by the technical committee of Kerman JoA Organization, the construction works started and were carried out under the supervision of NPD, technical staff of Kerman JoA and UNDP field monitors.

- 3-3 Achievements: About 4200 m of the course of water from the mouth of the twin qanats to Poshtrood Village have been lined and the necessary structures have been built along the canals. This component of the project has tremendous impacts on water saving due to prevention of seepage losses. Measurement of flow rates in the old earth channel (carried out by Mr Khodabakhsh zadeh, a local staff of the project) showed that the 183 l.s^{-1} flow at the beginning of the channel reduced to 43 l.s^{-1} , along a length of 2100m (almost half way to the village). Accordingly, with the new lined canals having almost no seepage loss, it is expected that water of the qanats reaching the village increases by more than four times compared with pre-project situation! This means increased water availability for the existing plantations and the extra amount may well be used to expand on the date palm plantations in the area. The economical impacts for the farmers are enormous.

Another very important consequence of this component of the project is that for the new lined canals operation and maintenance is fast and easy. For the old earth channel, O&M was very labor-intensive and difficult, particularly during the hot months of the year. Besides, weeds growing on the bank of the earth channel shed their seeds in the flowing water, which were then transported to the field and increased weed problems there. With the lined canals, this problem is minimal.

3-4 Photos



The twin qanats of Eisavieh and Najmieh and the conveyance canal downstream from their mouth. Lots of water was lost along the 4-km course of the channel due to seepage into the ground.



Members of Water Users Group of the twin qanats of Eisavieh and Najmieh during cleaning operations of the conveyance canal (May 2004). Concrete lining of this channel was included in the UNDP project. All members of the WUG requested that an independent canal be built for each qanat (unlike the original situation where one canal conveyed water of both qanats).





Photos showing different stages of construction of the new canals for conveyance of the Eisavieh and Najmieh Qanats water. Top: preparation of the foundation, Middle: cutting out the x-section, Bottom: lining in progress.

IV-4-Training

- 4-1 Selection. The most important topic of training for the emergency phase was operation and maintenance of well pumps and engines. It was decided that, for each well, two operators be invited for the training workshop. The list of the first group of participants was prepared with the help of Bam JoA and the Agricultural Extension Department of Kerman Province (AED KP).
- 4-2 Implementation. The training material was prepared by AED KP. Two one-day-long sessions of the workshop were held on 13 and 17 July 2004 in Bam. A local expert on pumps and engines taught some general points in a class and distribute a simple booklet on the subject. A documentary film was also be shown to the participants. Further instructions were given in the field at the site of one of the wells. The first group consisted of 20 farmers/operators. Eventually, operators of all wells in the affected area (53 wells) attended the training component of the project.



IV-5-Distribution of tool kits

In order to ensure the availability of the necessary tools for the trained pump operator 16 sets of tool kits were distributed among them. See photos.



Top photo shows the complete set of tools provided to each well by the project. In the bottom picture, one representative of the water users is signing the receipt of the tool kit.

V-Economical impacts of the project

V-1. General economical status in Bam area

Bam is a regional agricultural centre and it is known for its high-quality dates, citrus, henna, and dairy products. Many of the 400 surrounding villages and cities have close economic ties with Bam. The economies of these communities were severely stressed before the earthquake due to six-year drought. Business impact of the earthquake was extensive and to this day, the Bazar of Bam which was the main commercial centre has not been reconstructed. That still has a major impact on the economy of Bam and surrounding communities. However, after six month businesses gradually started operating in containers and makeshift sheds. As result of extensive damage to the qanats and irrigation system there was a great concern that high-value crops would be lost. However, repairs of the irrigations system progressed well and damages to agricultural production were mitigated.

Reconstruction of Bam region is still underway and it is expected that it takes at least two years to complete the ongoing projects. As a result of the heavy casualties, the structure of labor force in the region has changed, and many constructions as well as agricultural activities are performed by non-local work forces.

Table IV- 1- Share of the different economic sectors in the employment of the region 2003.

A r e a	Sector	% share
1. Bam region	a) agriculture	34.0
	b) Services	47.0
	c) Mining	3.4
	d) Construction	10.0
	e) Industry	5.6
2. Bam Town	a) Agriculture	7.0
	b) Services	73.0
	c) Industry, Mining, and Construction	20.0
3. Baravat Town	a) Agriculture	35.0
	b) Services	46.0
	c) Industry, Mining and Construction	19.0
4. Rural areas	a) Agriculture	55.0
	b) Services	27.0
	c) Industry, Mining and Construction	18.0

Source: Selected Statistics of Bam, Report No. 1, 2004 pp.11, Statistical Center of Iran

Before the occurrence of the earthquake, total population of Bam region was 232,000. About 85% of the population namely 197,000 people were above 10 years old. Some 34% of the populations with more than 10 years, or 67,000, were economically active. Among active population, 85% (57,000) were employed; most of them in service sector. The shares of different economic sectors are shown in Table IV-1.

As Table 1 shows, service sector has had the greatest role in jobs occupation of the region, especially in Bam. Despite its second rank in this regard, agricultural sector has had the highest contribution to income generation in the region. Table IV-2 compares the role of different sectors of the economy in both employment and income generation of Bam region.

Table IV- 2-Share of the different sectors of the economy in Bam region

Sector	%	
	Share in employment	Share in income
1. Agriculture	34.0	38.0
2. Industry	5.6	22.4
3. Mining	3.4	3.1
4. Construction	10.0	6.0
5. Services	47.0	30.5
Total	100.0	100.0

Source: Occupation and unemployment in Kerman Province, 2004, pp. 371, Statistical Center of Iran; and Selected Statistics of Bam, Report No.1, 2004, pp. 11 Statistical Center of Iran.

Agricultural activities are the main sources of income in Bam region. In fact, a considerable part of the service sector activities are related to and deeply dependent on agriculture. It is noteworthy that some of the members of the farmers' families are engaged in rendering agricultural services to other families in the sector. This in turn re-emphasizes the role of agriculture in the economy and livelihood of the individual farmers in Bam region.

V-2. Farms sizes and livelihoods

Total area of the fruiting date palms plantations in Bam region is approximately 18 thousand hectares, which constitutes about 0.85% of the total area of the region.¹ In 2003 and before the earthquake, there were 19,460 owners of date orchards in Bam region.² This means that, the average farm size for each beneficiary has been about 9250 m². In other words, each beneficiary owned only about 160 palm trees.³ In comparison, the average farm size for those beneficiaries covered by the UNDP project is about 6,800 m², well below the average of the region.

¹ Report of the estimation of the dates orchards in Kerman province ,Remote sensing.2003, pp. 40, MoJA.

²Based on the "Selected Statistics of Bam" pp. 12, 2003, Statistical Center of Iran"

³ Based on 175 fruiting palm trees per hectare.

Due to the small size of the holdings, normally in most cases, beneficiaries operate and work on their land with members of their families, numbering an average of 5 persons. With regard to the average farm size, and net average income per hectare of dates orchards, it can be concluded that, net annual income of each beneficiary family in the years of 2003 and 2004 was \$1423 and \$1320, respectively. According to the data published by the Statistical Center of Iran, in 2003, per family income in Bam region (both urban and rural) has been \$1,977. This means that, before the occurrence of earthquake, though small, however, on the average, holdings of dates orchards have been capable of generating over 70% of the family income for the beneficiary families in the region.

Depending on the size of their farm, the owners of date orchards have different living standard. To improve their livelihood, most of them embark on planting annual crops and or have already planted citrus trees between empty spaces of their palm trees. These measures are only one source of extra revenues for the owners of date orchards in the region.

In addition to the income derived from dates, the beneficiary families have access to other sources of income including:

1. Cultivation of other crops such as alfalfa in the space between the date trees
2. Rendering services to others for money, such as working in private companies and governmental agencies, and especially in the case of beneficiaries of small size farms, working in other farms during free time.

Although the amount of income from the above-mentioned sources are not clear, it is certain that in such an agricultural area with self-employment and small farm holdings, a considerable number of beneficiaries have alternative sources of income, which in some cases may outweigh their income from agricultural sources.

V-3. Production cost and yield per hectare of date plantations

a) Before the occurrence of the earthquake

In irrigated orchards, the number of field operations carried out for husbandry and harvesting dates (other than packing and storing) consists of ten separate activities. Date palm production is very much labor-intensive and, therefore, it is the main factor contributing to the high cost of production of dates. Indeed, work force plays an important part in all ten operations of the date production. According to some reports, labor cost constitutes about 63% of the total production costs .¹

In 2002, the average production cost of dates in irrigated orchards in Bam region was between M. Rls 1,525 to M.Rls 2,025 (\$1,790 to \$2,300) per hectare², depending on the quantity of yield. On the basis of direct investigations in the region and taking into account the annual increases in costs, in 2003, date production cost (excluding packing and storage cost) was \$2,160 to \$2,840 per hectare. In other words, the average cost of the production of dates in irrigated orchards of Bam region was \$0.31 per kg.

¹Based on the "Report on the survey of production costs of orchard outputs and guaranteed prices for 2002", table 13, pp.13, MoJA.

²Based on the " Survey of the production cost of the orchard output in 2002, pp. 5, Research Institute, MoJA; and Reports of Agricultural Dep. Of Bam.

The average country-wide yield of irrigated date orchards is about 5.2 tons per hectare.¹ The quantity of the yields in the irrigated orchards of Bam region varies depending on the variety of palm trees, soil conditions, and the farm management involved. According to a report published by the MoJA, the average yield for Kerman Province has been well above the average of the country and it is even greater in Bam region. In 2003 (before the occurrence of the earthquake) production of dates in Bam region ranged from 7 to 9 tons per hectare in irrigated orchards.² Published reports state that total date production in Bam region ranged between 80,000 to 85,000 tons in 2003.³

b) Post earthquake situation

In 2004, production of date decreased drastically. The main factors involved were the death of some of the owners of palm trees, hence lack of adequate superintendence over many of the orchards, a few freezing nights before the earth quake, reductions and or interruptions in the irrigation water during various time intervals, and the outbreak of some physiological problems in palm trees. According to the report of the Agricultural Dept. of Kerman Province, dates production in Bam region has sharply dropped from 80 to 85 thousand tons in 2003 to 60 to 65 thousands tons in 2004, which means a reduction of 20-30%. Accordingly, the average date production in the region has dropped from 7 to 9 tons to nearly 6 tons per hectare, still above the country's average.

In the meantime, production cost of the dates in Bam region increased as a result of two factors: general increases in inputs prices, and shortages of skilled manpower in the region, hence the increased labor cost.⁴ Overall, it is estimated that the average cost of dates production in irrigated orchards of Bam region increased by 30% in 2004. Consequently, the total cost per hectare amounted to Rls. 32.5 million (equivalent of \$3,700). Thus, the average production cost amounted to some \$0.46 per Kg of output.⁵

The cost of transportation of dates from the farm gate to the temporary storehouse for packing varies depending on the location of the plantation. On the average, however, it constitutes about 5% of the total cost.⁶

In 2004, as a result of the reduction in supply of labor force in the region, the share of the labor force in total production cost increased enormously. The effect could be a decrease in the percentage share of transportation cost in the total production costs. However, as the shortages of transportation means led to relatively higher charges, the relative share of transportation cost probably remained unchanged.

¹ op. cit.

² Report of the "Research Institute" of the MoJA, and Agricultural Dept. of Bam.

³ Report of the "Research Institute" of the MoJA, and Agricultural Dept. of Bam.

⁴ It is worth mentioning that some of the labor costs, especially the cost of manual impregnation of date palms clusters in some orchards was paid by the Agricultural Dept. of the region.

⁵ Based on the production cost index of the Central Bank of Iran.

⁶ Based on the "Report on the survey of production costs of orchard outputs and guaranteed prices for 2002", table 13, pp.13, MoJA.

V-4. Storage in cold houses

In order to allow the total harvested dates to be evenly supplied during the year, thus smoothing seasonal variations in selling prices, most of the produced dates are packed and kept in cold houses (about 70%)¹. In Iran, sales market for dates has been formed in such a way that most producers, especially small one, do not distribute their outputs by themselves. A considerable part of the lucrative operations like packing, storage and distributions (including exports) are done by the other parties instead. These highly value adding operations are performed by the brokers and the owners of packing workshops, and finally by the big traders.

As a result of inadequate working capital, and due to imperfect knowledge about the market, small scale producers have to sell their output in forward market, and or deliver them to brokers immediately after harvesting. These producers can not take advantage of the post harvest value added. In fact there are few producers who are able to play the role of brokers for themselves and for other producers².

Brokers of dates forward the selected outputs to packing workshops and factories where the dates are sorted, washed, disinfected and packed in different types of packages. After packing, the owners of these workshops store the output in cold houses and distribute and or export them in due time.³

For more accurate assessment of the impact of the project on the livelihood of the beneficiaries, the above-mentioned operations have been excluded from the framework of the farmers' income.

There are 95 cold houses active in Bam region.⁴ Nominal capacity of these cold houses is 93,000 tons, above annual production of dates in the region. The main space of these is allocated to store packed dates. Only a small fraction is used for storing citrus and perishable agricultural products.

There are also about 134 packing workshops in Bam region, of which only 20 are equipped with modern machinery. In these workshops sanitary criteria are fully observed.⁵ Those varieties of dates that are fit for exports are packed in these workshops. Other workshops do the packing in a traditional way in which all stages of packing are done manually. Sanitary criteria in these workshops are not observed the same as modern workshops. Out of the total produced dates in the region, 15% are packed in modern workshops.⁶

V-5. Recent sale prices and income from dates

a) Sales Prices

Depending on the variety, quality, kind of packing, and the time of supplying to the market, sales prices of dates, varies in different seasons of the year. The most important

¹ Based on the "Research on the production costs of outputs of orchards and guaranteed buying prices for 2002, Table 13, MoJA.

² "Survey of the situation of the production and exports of Iranian dates ", 2003, pp.45 , MoJA.

³ op. cit.

⁴ Report of the office of Governor in Bam

⁵ op. cit.

⁶ op. cit

variety of dates produced in Bam region, which is very much favored in export market, is called " Mazafati ".Due to the active involvement of several types of brokers between producers and consumers, in some cases, retail prices of dates are 4 times the price at the farm gate. This is especially the case for small holdings.¹

Indeed, brokers, owners of packing workshops and big traders share the most portions (about 70%) of the wholesale prices. It is to be noted that the retail prices of dates are 20% to 30% higher than that of the wholesale prices.

Prices of dates in 2003 were \$0.94 per one Kg. In 2004, as a result of decreases in the output of the region, and due to the general increases in prices, wholesale prices of dates amounted to about \$1.36 per one Kg.²

Like other areas in Iran, in Bam region, the outputs of dates orchards are sold at farm gate, and in some instances forward transaction also takes place. The price of dates at farm gate in Bam region is about 50% to 60% of the wholesale price.

b) Income from date production

In calculating the net income from dates in Bam region, 15% loss to the output during and after harvesting has been taken into consideration. The average net income derived from the production of dates in one hectare of the orchard in Bam region, has been \$1,932 and \$1,793 in 2003 and 2004 respectively. In other words, farmers of the region earned a net income equivalent to about \$0.22 and \$0.30 per Kg. of dates in 2003 and 2004, respectively.

Generally speaking, despite a drastic reduction in the yields of dates and the increase in labor and transportation costs in the region, the real decrease in the net income of date farmers is much less than expected. Indeed, 45% increase in the selling price and timely implementation of the UNDP and few other projects that worked in the restoration of wells and qanats waters, helped in controlling the drop the in net income.

V-6. Exports of dates to other cities and countries

Globally speaking, Iran is the biggest producer of dates in the world. In 2004, compared with the previous year, total production of dates in Iran decreased by 4% and amounted to about 925,000 tons. In some years, due to the reduction in the quantity of production, the rank of Iran falls to the second or even third place. Other main producers of dates are U.A.E., Iraq, Saudi Arabia, Egypt, Algeria and Pakistan. The same is true in the case of date exports. Main exporters of dates are Iran, U.A.E., Iraq, Algeria, Saudi Arabia and Egypt.

As a result of primitive harvesting methods, poor packing, inadequate storage facilities and inefficient post harvest disease control, more than 30% of Iran's total annual production of dates is wasted.³Of the remainder, about 45% are consumed in domestic market. According to the MoJA., per capita consumption of dates in Iran is about 7 to 7.5

¹ Based on the prevailing market prices.

² Based on the prevailing average market prices. and cost of dates production.

³ Survey of the Production and Exports of Dates in Iran, pp. 15, 2003, MoJA.

Kg. per year.¹In dates producing areas, per capita consumption is much more than the average of the country, reaching values close to 25 Kg. per year.²

During the past 10 years, the quantity of the exports of Iran's dates varied enormously, ranging from 100,000 to 200,000 tons, suggestive of severe fluctuations in both production and export capabilities of the country. In 2004, preliminary figures indicate that 120,000 tons of dates were exported.³

Export prices of dates vary according to the season, variety, quality and the types of packing of dates, ranging from \$1,000 to \$3,500 per ton. The average export price of Iran' dates in 2004 has been \$2300 per ton.⁴

In view of the relatively high elasticity of the demand for dates, export of this product is not only a source of income for the farmers, but also it is a means of phasing the excess supply out of the market, thus making domestic prices mark-up in favor of the producers as a whole. According to locally gathered information, and based on the survey conducted on the domestic market for dates, between 8 to 10 per cent of the total country exports of dates comes from Bam region.

As was previously mentioned, about 15% of the production of dates in Bam region is wasted as a result of different factors mentioned earlier. In 2004, of the total production of 60 to 65 thousand tons of dates in Bam region, about 7000 thousand tons were consumed locally,⁵ about 10,000 tons were exported to abroad⁶ and between 43- 48 thousands tons were sold to other cities of the country.

V-7. Quantitative economic impacts of the project

For a precise economical assessment, many different data had to be taken and recorded from the beginning of the project and extensive farm to farm interviews and measurements would have been necessary. However, due to the emergency nature of the project, the economical impact assessment was considered only toward the end of the project completion. Therefore, it is to be noted that the assessment presented in this section is only an expert estimate of the real economic impacts of the project. In making this assessment, the required data and information were gathered in the following manners:

- (1) Review of data and reports published by reliable and relevant resources.
- (2) Personal contacts and interviews with some local beneficiaries, institutions, and officials
- (3) Adding up of, and statistical inferences from, the gathered data and information.

Implementation of the project has had favorable impacts on socio-economic affairs of Bam region. The 25 wells that have been repaired or renovated by the project cover 8.5% of the total land under the cultivation of fruiting dates plantations. On the basis of the

¹ op. cit.

² op cit.

³ Customs of Islamic Republic of Iran, Preliminary Export Statistics, 2004.

⁴ op. cit.

⁵ Based on the average of per capita consumption rate of 25 Kg. in dates producing areas.

⁶ Customs of Islamic Republic of Iran, Preliminary Export Statistics, 2004.

data and information presented in preceding sections of this report, some important conclusions have been drawn as follows:

- 1) Date yield in project area: The quantity of dates produced on the plantations served by the 25 wells covered by the project was 7,825 tons during 2004, some 32% below the preceding year. The share of the date plantations irrigated by the 25 wells (or the share of the project) in the output of dates has been 14% of the total regional production in 2004.
- 2) Job saving/creation: Direct impact of the project on the employment opportunities in the region, is calculated according to a linear mathematical model based on the several facts, data and assumptions that are summarized below:
 - Before the earthquake, the total number of the employed people in Bam region was 57,000¹. This figure is used to compare the jobs created by the project with the total occupations in the region.
 - Labor cost comprises, at least, 63% of the total production cost of the date at the farm gate.
 - As previously stated, in 2004, the average cost of date production in the region was about \$0.46 (Rls. 4,000) per Kg.
 - Total area of date plantations irrigated by the 25 wells of the project is 1,280 hectares.
 - In 2003, the average yields of dates in the region were between 7 to 9 tons per hectare. This figure, according to the section of (1-a) and (1-b) of the present report dropped to nearly 6 tons per hectare in 2004.
 - The average wages of labor (both skilled & unskilled) is assumed at \$11.36 during the period.
 - The average irrigated period of dates is assumed to be about 9 months. For the 2003 season, the first irrigations coincided with the commencement of the project in the region and continued up to the end of harvesting. It should be noted, however, that the project activities carried out in different orchards/ wells did not begin at the same time: in some locations the project impact period was about 8 months while in other places it was less.
 - For normal production, fruiting palm trees need to be irrigated 9 months of the year with an interval of 10 days frequency. This means that the “labor season” for dates is 9 months and that, at least, 270 working days are needed for its production.
 - Multiplier effects of the employments of dates related business in the region is 1 to 4, in the sense that for one person employed in direct production of dates, 3 other jobs in ancillary activities are created. In other

¹ Selected Statistics of Bam. Statistical Center of Iran

words, for a single recruitment in date production process, a total of 4 persons are employed in the region.¹

Mathematical Model

$$K = (((Y * C * L / W) A) / N_d) * m / P_e$$

Where,

K= Share of the jobs created/saved by the project in total employments of the region (ratio).

Y= Quantity of the yields (Kg) per one hectare of dates in the region.

C= Unit cost of dates production per Kg.

L= Ratio of labor cost to total production cost.

W=Average daily wage rate of labor employed in dates orchards.

A= Total areas of dates orchards under the coverage of 25 wells of the project.

N_d= Number of working days required for the production of dates in the cropping period.

m= Multiplier employment effect of dates business related and its ancillary activities in the region.

P_e= Total employed population in Bam region in 2003.

Results on job saving/creation

The above-mentioned model is used to calculate the number of the workers engaged in producing the total quantity of dates harvested from the palm trees under the coverage of the project. In other words, by applying the linear, pertinent and consistent mathematical model, and taking into account the whole facts and figures mentioned earlier, the number of manpower directly employed as a result of the implementation of the project has been calculated and compared with the total employed people in the region before the earthquake.

In its executive phase, the project created several types of temporary job for native worker and other professions. In addition, with respect to the jobs related to dates business, it is estimated that the project has created at least 1,100 direct, and 3300 indirect, a total of 4,400 employment opportunities for the local and non-local people of the region, tantamount to at least 7.7% of the total employments in the region before the occurrence of earthquake.

3) Impact on the income

The occurrence of earthquake could have had more adverse effects on the income pattern of the farmers, if the government and UNDP projects had not been implemented and the wholesale prices of dates had not increased. For these reasons, in 2004, Bami date

¹ Extracted from the statistics released by Governor's Office in Bam Region, Jan. 2005

producers experienced only 7.2% decrease in their net income (see the following paragraphs).

As the dominant farm size ownership in Bam region is small holdings, and due to the large number of beneficiaries of the 25 wells and the two qanats, respectively, 1,881 and 500 families, direct contact and interview about their income and the effect of the project on their livelihood was practically impossible. Also, using the data gathered from a sample of interviewee could not be generalized since their farm sizes are not equal. The best way of assessing the income effect of the project on the region as a whole is to make a reliable estimation on the basis of a plausible mathematical model and pertinent assumptions/ data presented in this report.

a) Statistics used as input for the model

- Total population of Bam region before earthquake was 223,000 people, including 44,600 families.
- Average net family income of the region was \$1,977 (Rls. 17.4 million) in 2003.
- Total quantity of dates produced in the orchards under the coverage of the project in 2003 was 11,000 tons. However, the yields in these area dropped to 7,825 tons in 2004.¹
- Wholesale price of dates in Bam region was \$1.36 (Rls.1200) per Kg during 2003.

b) The model for income impact assessment

$$R = (y * p) / (f * I)$$

Where,

R= Ratio of 2004 share of the income generated by the project to total income of the region in 2003.

y= The quantity of dates produced in the areas covered by the project.

f= Total number of families residing in bam region in 2003.

I= Per family net income of the region in 2003.

c) Results of impact on regional income.

Summarizing, with respect to the above-mentioned model and on the basis of the assumptions described earlier, the directly generated gross income in the project area is estimated to be at least 15% of the total income of the region. This figure does not include the multiplier effects of the induced revenues.

¹ Bam Region Agricultural Organization, 2004

It should be noted that for preparation of this report, besides the abovementioned calculations, attempts were also made to come up with some figure(s) for the impacts of water restoration on yield in different plantations by surveying the beneficiaries' opinion. A number of representatives of the farmers' wells were interviewed and asked to give their estimates of the "positive" impacts of the project on the yield of dates. For example, Mr Piroozi of the Piroozi Well said that, with the help of the project the well engine was repaired quickly, while it would have taken the beneficiaries several months to repair the engine on their own resources. According to him, without the project, 50% of the plantations would have been lost and the decrease in yield would have been much more. Also, Mr Barani of the Ekteshafi Well said that they had 30% yield decrease in 2004 harvest compared with the previous season harvest; however, he said, the loss would amount to 80% without the UNDP project. Such figures are not precise, but, they show the "order of magnitude" of the project impact from the beneficiaries' point of view.

VI-Social Issues and social impacts of the project

Bam district as a whole has basically a mixture of rural and urban social character. Economically, elements of land, water, and number of date palms ownership have been, and still are, the criteria along which the society can be stratified into upper, middle, and lower layers. Most of the society may be categorized in the middle class, though their cultural behavior, particularly in gender issues, is somewhat different from that of a completely urban middle class of Iran. Besides, the district has for long suffered from wide spread drug addiction (mainly opium).

VI-1-Population issues

The gravest social impact of the earthquake was the great loss of lives that destroyed rich and poor families the same. The consequent situation led to unprecedented social trauma and even some social disturbances. Besides, in the early months after the quake, issues such as water shortage, redundancy, lack of cash, and, of course, inadequate and improper shelters were among the main factors aggravating the social dissatisfaction.

Major population shifts have occurred as a consequence of the earthquake. As result of close economic ties between the city and villages and its disruption due to earthquake, at the time many survivors left the area on at least a temporary basis, while stimulating migration into the city from surrounding regions, as villagers came to the city in search of temporary housing and other disaster-related services. Although after a year some returned to their villages, many have remained in the city, and in fact many more have come looking for jobs.

Thus, despite the high death toll, a few months after the quake, population of Bam City grew larger than before. This issue not only created problems for authorities in the early days after the earthquake, but it also created tensions within the local communities. The migrant population mostly lived in the newly built temporary shelters (in camps) that were not occupied by the residents of Bam and remained vacant. According to sociologists; the migrants issue created social tension and vulnerabilities and increasing concern about formation of ghettos and shanty towns around the city in the future. At the same time, according to the health officials, hygienic issues are becoming a health threat to the area.

The issue of migration became a major concern both for authorities and the residents of Bam. There was a fear among the population that, in certain respects, the city of Bam had lost its characteristics, originality and homogeneity forever: it will never be the same again. Indeed, present-day society in Bam is more diversified than it used to be. People from other parts of the country, who had come to Bam to find a job, have stayed and married locals, now raising mixed families.

VI-2-Education and schools

According to official statistics, two years after the quake, school enrolment returned to normal and many, who had left to the neighboring cities because of the education system,

have returned. At the same time, as more teachers have returned to work and the schools are functioning normally, the students have been encouraged to enroll. Where the reconstruction of schools is on-going, classes are held in containers within schools. However, some of the schools lack hygiene facilities and walls for protection of children. UNICEF in collaboration with local authorities and NGOs provided hygiene facilities. Two years after the quake, a major concern of the parents was the absence of walls in schools. Although according to education officials, lack of general facilities, and more importantly psychological impact of the earthquake on both teachers and students are the major problems. This may increase dropout rate among students for some years to come.

An important achievement of Iranian Welfare Organization (Behzisti) supported by international community has been the establishment of more than 36 early child care centers. This is including the reestablishment of 26 centers that existed prior to the earthquake. Establishment of additional 20 centers is planned. The Welfare Organization is also supporting 1916 female-headed households comparing to 625 households prior to earthquake. Welfare organization has emphasized that much needs to be done in the area of psychosocial support and for that there is a need for more expertise and resources to accommodate the great need among the population.

VI-3-Health and sanitations issues

Two years after the quake, health services in Bam were still suffering from major lack of resources, including drugs, equipments and personnel. Departure of international medical NGOs and IFRC/ICRC was a major blow to the health services. The system was not been able to replace neither the facility nor the staff. Unfortunately due to lack of sufficient hospital beds as well as doctors, nurses and major facilities for surgery and serious illness as well as ambulances, population suffers and some with major illness or accidents die. This is in addition to the fact that health services are no longer free of charge, as it was in the early period after the earthquake and people at times cannot simply afford to pay for the services.

Although sanitation has now improved, for a couple of years following the quake, it was still a major problem, both in Bam and Baravat. This was even more problematic for women. Very little sanitation facilities were constructed by the government for the temporary houses, be there in camps or on private plots. Some NGOs provided support for the camps, but none of the NGO's had the capacity to provide facilities for private temporary houses. At some stage in 2005, people attempted to rebuild their sanitation facilities in their old houses. However, this mostly remained for latrines. There were not enough public baths/showers and many houses did not have showers. This created both sanitation problem and, at the same time, made the life of women, who need to attend to their children and would like to have more privacy, very difficult.

Bam is located along a major drug-smuggling route, serving as a conduit point for drugs smuggled out of Afghanistan and bound for Europe. Although there are no exact figures, drug transport clearly contributes to the informal economy of the region. This has also caused addiction and vulnerability among the population, which is still something the

population suffers from. According to health workers, addiction among population is affecting their very livelihood and, in particular, the health of women and children, is a major problem.

It should also be noted that, due to the quake, there was also a 2.3% increase in the number of handicapped individuals and a large increase in the number of orphaned children: Prior to the earthquake there were only 150 orphans compared to the present figure of 5204 children.

VI-4-Shelter issues

Construction in the rural areas started very early. In other words, a few months after the quake, people and NGOs started reconstruction in the villages. However, the process took longer than anticipated, particularly in the cities of Bam and Baravat. The city plan was approved more than a year after the quake and reconstruction moved rather slowly. Accordingly, the people were unhappy about the progress, and many worried about the loans they were receiving. Some were wondering whether they will ever be able to pay them back, considering the unemployment and lack of business opportunities. Besides, the process of acquiring proper documents; material, signing contracts, etc was too difficult for some. The general feeling was that the system was not efficient enough. However, the authorities said that the number of permissions to be given and the volume of work were too high and hence it was not possible to shorten the process. But one major issue was that, in the past, people used to build their houses the way they wanted, while for the new buildings, many structural and planning considerations should be observed and people cannot build their houses as they wish. This created some tension.

The issue that has to be noted here is that, perhaps, more public participation in the process of reconstruction could have eliminated these problems and issues. Many people of Bam, including the city council, felt they were not included in the planning process and hence the plan, as well as many projects at times, was not considered people's desires or needs. The feeling of ownership was not high.

VI-5-NGO's activities

Immediately after the earthquake, more than 100 national and international NGO's and organizations came to Bam. However, many of these left Iran after six months. Some more finalized their activities and left by the end of 2004. Presently, less than 10 such organizations are still continuing their activities. These NGOs are mainly involved in reconstruction of houses in the rural areas. There has not been a comprehensive study and analysis of the activities of the NGOs in the last 15 months. However, some issues can be noted.

First, immediately following the disaster, UNDP and UNOCHA established and supported a mechanism in Bam called sectoral meetings to strengthen the government efforts for coordination. Through regular meetings various actors including local authorities, Int NGOs and UNDP who worked in livelihoods and agriculture sector shared information about their projects, assessments and explored areas for collaboration.

Although in general there was a good collaboration between the local authorities and the NGOs, the lack of common understanding of humanitarian principals and international laws which create responsibility both on the side of those who offer assistance as well as those who receive it, including the host country, was evident. Iran does not have a long history of working with international NGOs and hence it took a while for the two to find the common language. Secondly, it seems that most of the international NGOs did not work toward creating sustainability through capacity building. Unlike many other NGO's, however, the UNDP water project did carry out a capacity building program by organizing a pumps/engines operation and maintenance training for well operators and this was highly appreciated (see appendix II for activities of other NGO's with respect to water resources).

For achieving a greater impact, UNDP linked the project to other initiatives in Bam such as Support to Aid Coordination and Community-based Information Management. On the later, around 20 local volunteers were trained on information management and developed 26 editions of a local news sheet, which was published regularly in Bam till mid 2007. The news sheet provided useful and practical information on various aspects of efficient production in agriculture sector, relevant recovery programmes and people's entitlements to the local farmers at their simple language. The content of the newsheet used to be prepared in coordination with extensive programmes of the Bam Directorate of Agriculture.

VI-6-Impacts of UNDP project

Fortunately, quick actions by some government agencies and national and international NGO's (including different UN agencies), helped a lot to pacify the local society after the quake. The almost immediate arrival of so many such agencies at the destroyed sites was an important psychological boost to local people who realized that they would not be left alone. A wide spectrum of different emergency projects was put into action by these agencies.

Among these was the UNDP project that aimed at restoration of water resources for the date palm plantations. Although the main objective was to quickly provide more water for these plantations, the project has had many different impacts. Indeed, the impacts are in so many aspects that it is unrealistic to expect a precise and comprehensive assessment of all of them. For example, repair/renovation of pumping units helped the local community in the following ways:

- Increasing income security by providing water for the farmers (nearly 1900 beneficiaries) at different times during the growing season, with different impacts on yields in various locations (a short term impact)
- Decreasing long term livelihood risks by preventing the complete loss of trees in certain locations of the 1280 ha under the pump/engine component of the project
- Long-term improvement in livelihood by increased discharge of the wells in some cases
- Capacity building by providing training course for pump/engines operation and maintenance, thereby decreasing the chances of water shortage due to equipment

failure and decreasing operation costs due to better maintenance by trained operators.

- Created temporary jobs for the technicians and laborers working on different wells
- Provided a safe environment for some urban and rural neighborhoods by installing shelters around the pumping units.
- Provided water for domestic and health care uses during the time when pipe waters had not been restored by the government.

In a similar way, lining of the conveyance canals of the twin qanats has had various impacts such as the followings:

- Increased water delivery to Poshtrood Village (about 300 ha of dates) by preventing seepage losses in the conveyance canals. This will have tremendous economical impacts in the years to come and will greatly contribute to the improvement of livelihoods of the 500 families that are the beneficiaries of the Eisaviah and Najmieh qanats. The increased water could be used for the expansion of date palms plantations in the area.
- Improving sanitary situation through decreased water pollution problems due to decreased contact between water and soil during conveyance, lower chances of livestock crossing the channel and dropping dung in water, and prevention of stagnant water in shallow depressions along the banks.
- Prevention of, or drastic decrease in, dissemination of weed seeds to the date plantations since very little, if any, weeds will grow on the banks of the lined channels. The costs and troubles of weeding the plantations will be reduced.
- Much cheaper and easier operation and maintenance of the conveyance canals, thereby decreasing the hardship of such operations by the beneficiaries, particularly during the hot months of the year.
- Creation of temporary jobs for the technicians and laborers involved in the construction works.
- Termination of the occasional disputes and rural community unrest over water rights stemming from mixing of the two qanats waters, by separating the discharges into two different canals.

Quantification of these impacts in details is particularly difficult considering the large number of beneficiaries and the complexity of the post-quake situations in the area. In the meantime, uncontrollable factors also complicated analysis of the impacts. For example, although the project has helped in increasing water supplies in several locations, certain limiting factors such as the 2003 winter frost and 2004 pests damages prevented the full reflection of the effect of increased water availability in the harvested yield of date palms.

In an overall look at the impacts of the project, it is noteworthy that in many instances, the mere restoration of water supply, replacement of the old equipment with new ones, installation of new pump shelters, lining of the conveyance canals of the twin qanats, and other similar activities that showed the concerns of national and international communities towards the people of Bam, have had great humanitarian impacts. Frequently during the implementation phase, the beneficiaries, who had learned about the project and had come to know the staffs involved, expressed their gratitude in different ways. Some invited the staffs to their residents and some wished them



Kids cooling themselves in the heat of July in Baravat. This is Edalat (or Fatemi) Well repaired/renovated by the UNDP project in July 2004.

happiness. There were still some who did not know the project staff but their enjoyment with the water running in the ditches was so evident in their eyes that could not be ignored. In the heat of the summer sun in this area, the sight of young kids playing in water where there was only a dry ditch for months, is , perhaps, as important as any economical impact expected from the project.

VII-Constraints and Lessons Learned

Generally speaking, the original duration designated for the project was underestimated. This became evident in the face of the changes in the original project activities based on a new need assessment, the diversity of activities included in the project, the time it took for NPD nomination and official transfer of his signature, delays due to installation of a new financial software (ATLAS) globally by UNDP, and the traumatic social situation and economic disruptions prevailing in the area in the aftermath of the earthquake. Nevertheless, progress of the project activities was reasonable.

During the project implementation, many experiences were gained and every time a constraint was faced a solution was thought and employed. These experiences were varied in nature but were all valuable lessons. Some of these are summarized below:

- Working in traumatic situations, such as a grief-stricken community after an earth quake, requires a good deal of understanding and patience on the part of the project staff. In the earlier stages of the Bam Project, it was somewhat difficult to find counterparts or help from the local community for gathering information and need assessment and this situation slowed the progress. However, as time went on, contributions from the local/national authorities, experts, and ordinary

individuals of the society became dominant in decision making, planning, and execution. This participatory approach proved crucial in the successful completion of the project.

Emergency relief projects should only use a participatory approach for the target situation and should involve the local community in all stages of the project as much as possible. The sooner and the more extensive the local community gets involved and control over the project, the sooner and the more successful the project will be completed.

- Trust-building between the project and the target community is of great importance for attracting partners and collaborators for the project. One thing that may damage this trust is delayed or empty promises. Early in the Bam project, we experienced some dissatisfaction by a group of water users who had been told about repair of their well, but the equipment delivery was delayed due to factors out of our control. Fortunately, with eventual delivery of the equipment the group regained the trust and the activity was carried out with their help.

Delays in delivering promises should be avoided in order to sustain the community's trust and participation in the project activities. Also, project staff should avoid raising expectation of the target community about the project objectives.

- This project was considered as a national execution (NEX) project. However, there was no specific budget from the government side allocated to the project.
It is recommended that for similar projects in the future, a complete list of national project personnel, nomination of NPD, and budget commitments by the government be secured before the final signing of the documents by UNDP.
- Neither the consultant nor NPD were familiar with the rules and regulations concerning NEX projects. Therefore, in spite of the support provided by the UNDP CO, some problems were faced during implementation of the project.

It is recommended that, in the future projects, NPD and project staff/consultants should be instructed about these regulations at the beginning of the projects so that, during implementation, delays due to lack of familiarity with special NEX regulations (particularly those concerning procurement, recruitments, and other payments) are minimized.

- The dynamic and fluid situation prevailing in the area was a constraint in timely execution of the project. While the project was moving, the conditions on the ground kept changing. For example, the director decided not to inform or make advance promises to farmers for pump/engine installations until every thing was ready. This was decided since the situation was sensitive and any unpredictable

delay in timing or the change in the equipment by the project could have brought about complaints of the farmers and unrest. This cautious approach led to situations where some selected wells were already repaired or renewed (with the help of other agencies) when we got there. New wells had to be selected to replace the previous ones. Besides, the list of equipment for procurement had to be changed according to the findings of the pump specialist technician who tested the old equipment and installed the new ones. The actual equipment requirement was determined after these initial testing at the well site.

Another example of the dynamic situation in Bam was the impacts of aftershocks. Some of these shocks caused closure of newly opened qanats or collapse of well walls during digging operations. The latter was the case in Ekteshafi Well of this project and delayed the operation for a few days.

It should be realized that emergency situations are generally very dynamic and, therefore, the approach (financial/administrative) used in dealing with such instances should be flexible and open to changes as dictated by the prevailing conditions in real time.

- Although the project intended to count on the Bam market for procurement, economic activity of the local market was almost absent. Besides, the uncertainties in the prices and promises of few contractors in the area were strong. Indeed, some prices offered in Bam were higher than that offered in the provincial capital, even including transportation costs. The resolving the dilemma between helping the local Bam market and buying at competitive prices elsewhere caused some delay in procurement of equipment.

In executive projects, procurement prices should be competitive to carry out the project according to the plan. Certainly, under equal conditions, local market should be preferred.

- Due to traumatic social situation, absence of some beneficiaries (dead or migrated), the large number of beneficiaries, the relatively short duration of the project, and also the weather condition, survey and direct consultation with individual beneficiaries was carried out on relatively small percentage of the total population. However, village council (for the two qanats Eisaviyeh and Najmiyeh) and representatives of beneficiaries (for wells) were consulted.

Part Two: Addendum to Water Project as SGP/IPPM Project

I- Project Background and Objectives

While one of the objectives of the restoration of wells and qanats project was to increase water productivity in the Bam region, repeated reports by the governmental authorities warned that there was an immediate threat to date production posed by the escalation of Dubus Bug and increase in the “date dry up”. Accordingly, following a visit of the UNDP Programme Analyst to the area and her meeting with the Governor of Bam meeting an addendum to the project was prepared and signed with MJoAg that aimed at ensuring the survival of plantations and stimulate development by facilitating wider empowerment and participation of Water User Group Community and Government Officials in Water and Participatory Integrated, Production and Protection Management (IPPM) through SGP.

In late Dec 2004, this UNDP/GEF-SGP started an 18-months IPPM¹ project, entitled “Empowerment of Farmers/Water Users for Sustainable Management of Date Palm Plantations in Bam and Baravat”. With the overall goal of reducing/eliminating use of pesticides and helping the natural enemies of date palm pests as well as promoting suitable cultural practices, the project aimed at the following objectives:

- Capacity building of governmental and NGO agricultural experts for IPPM methods.
- Training of Facilitators through Farmers Field School (FFS) and workshops.
- Empowerment of farmers for management of their date palm plantations through IPM/FFS and farmer-farmer training.
- Establishment of field labs suitable for IPM purposes.

II- Project Organization and Staff

The UNDP project focal points were Engineer Daraie, and Ms Fariba Aghakhani, who got continuous support from UNDP concerned programme analyst and assistant. Besides her, Engineer Farsi, Head of Kerman Provincial Extension Services, was appointed by the Ministry of Agr as the national project direct. At the kick off of the project, IGRA, a national NGO, was nominated by UNDP to the Ministry of J-Ag² and, after their approval, this NGO acted as consultant and executive agency for carrying out the activities, with Engineer Heidari as the senior consultant/trainer.

In addition to the above staff, the local agricultural authorities of Bam were informed about the project and some relations were established with the local extension agents in Bam. However, this link was not strong. In my recent visit, I also heard that, during the 18-month period of the project, the relations between the Bam Ag Directorate and the

¹ Integrated Production and Protection Management

² The nomination was based on the performance of this NGO in a previous UNDP project with similar activities in rice fields of Caspian Coast area.

national manager (who was stationed in the Provincial Capital Kerman) were not smooth and the latter was usually questioning the procedures and benefits of the project. This could have been due to lack of, or inadequate, authority given to Bam Ag Directorate with respect to the project activities.

Stronger relation between the project and Bam Ag Directorate and Extension Authorities would have enhanced the achievements and sustainability of the project.

To start, the project invited many local agricultural graduates or students to join the activities. There were about 33 such persons, mostly female, who joined and started the work. By the end of the first phase, 28 had remained, while a total of 23 persons continued their cooperation until the end of the project in June 2006.

Presently, five persons are in contact with the project and these are the ones who have been Executive/ Active Director of the “cooperatives” established by the project after the second phase (see section C) or after the end of the 18 months.

III-Project Activities

The project work schedule was divided into 3 phases as follows

1. The first 7 months for project launching and training of trainers/ facilitators.
2. The next seven months: Site selection, FFS, and farmer-to-farmer training.
3. The last 4 months for establishing and equipping three field labs.

Basically, the activities carried out during the first and second phases of the project were according to the original objectives. Highlights of these can be summarized as follows¹:

- ✓ A large Project Launching workshop with some 90 participants, including local agricultural authorities and experts of Bam and Baravat
- ✓ Several training workshops for ToT and facilitators.
- ✓ Selection of proper sites (8sites covering 15 ha) and conducting a number of Farmers Field School programs.
- ✓ Preparation of activity and progress reports.
- ✓ Provision of three field labs for technical support needed for IPM.

After the second phase, the project management came to conclusion that sustainability of the participatory nature of the project depended on financial support to the farmers' groups and communities established in different sites. Then, the question was whether to establish private companies or cooperatives. Eventually, it was decided to have officially registered cooperatives in which farmers buy shares and establish a fund that would be supported by some grant money from the project budget.

Accordingly, in June and Oct 2006, five cooperatives were established in Bam and



Deh-Shotor site used for FFS. In the same village, Ms Ranjbarzadeh runs a successful cooperative for IPPM project.

¹ Details are presented in the draft of the Project Report, prepared by IGRA.

Baravat. The value of each share was put at Rials50, 000 (almost \$5) and this led to a total farmers' fund of about \$1000 in different cooperatives. A bank account was opened for each of them. Thus, the cooperatives continued for a while with monthly gatherings of the members upon invitation of their executive directors, who were among the original collaborators of the project.

The low price set for the shares of the cooperatives funds was inadequate for raising a large enough budgets needed for the continuation of the project activities. .

The type of activities and cooperation among the member farmers in different cooperatives varies and includes even manual help. In the one of the cooperatives that is still active¹, the number of the members has risen from the original of 30 to the present time of 80. However, the other cooperatives were relatively inactive due to financial shortages. This “dormancy” was mostly attributed to the fact that deposition of the grant money in the cooperative accounts had been repeatedly delayed. This delay developed a sense of dissatisfaction among some of the members, who were originally willingly participating in the activities of the project. Fortunately, the deposition of the grant in 2008 helped revival of activities.

The grant deposited in the account of each cooperative took into consideration the activities and number of the members.

IV-Project Achievements

The project was reasonably successful in capacity building of those involved in the project. This included farmers as well as governmental and NGO personnel. For example, the number of trained facilitators was 8 more than the project original commitment of 10. Similarly, 8 sites were selected and used for FFS, while the project original target was only 5.

Another achievement of the project was promotion of the idea of participatory research at farm-level². This could facilitate participation of farmers in similar programs in the future. In addition, training IPM methods among the collaborating farmers can lead to lowering or elimination of pesticide use in the area. It should be emphasized that such programs i.e. balanced use of agro-chemicals, are indeed needed for Bam/Baravat since the date palm plantations are situated within the residential areas and use of any agro-chemical substance can easily enter the living environment of the people. The risk of such pollutions is of great concern, particularly in case of aerial sprays.



Mr Zeinali pour, a member of the management board of Esfikan Cooperative, is standing in front of their Field Lab.

¹ Deh-Shotor Cooperative directed by Ms Ranjbarzadeh.

² For future studies in this respect, it is highly recommended that research specialist be consulted for design and implementation methods.

One of the project activities appreciated by the experts of Ministry of Agriculture¹ is promotion of agricultural practices that resulted “in improved fruit quality and lower use of pesticides”. This is a reflection of the satisfaction of the governmental stakeholders.

In the same line, the project management attempted to publicize the concept of organic farming and “healthy food”. In practice, they marketed about 2 tons of dates (from orchards that had not used pesticides) in specially-designed boxes. Unfortunately, this activity has not been well documented, but local people say that the markets as well as the producers were willingly receptive to this idea.

While establishment of Field Labs may also be cited as an achievement, they were not used frequently and the equipment were mostly being kept in the houses of the cooperative Directors, for reason of safety from theft. An important point with respect to the equipment is the skill of using them. Proper training on the use of the relatively complex equipment such as microscope should be in the agenda.

An interesting achievement of the project, at least in the cooperatives run by Ms Ranjbarzadeh (Deh-shotor Village) and Ms Eghbalizadeh (Esfikan Village), is the



Some home-made food products from dates, prepared by women members of some cooperatives run by the project collaborators.

training of the women members on handicrafts using dates or residues from date palm pruning. Different food products such as home-made date chocolates, date sugar cubes, date vinegar, and date paste/dough, were among the products produced by the trainees. This could become a new source of income for the families of the farmers, especially those with small orchards. Use of leaves and branches (cut during pruning) for composting and production of Bio-

fertilizers is also under way in some orchards. This kind of activities is environment-friendly and should receive further emphasis.

V- Impacts and lessons learned

Generally speaking, the SGP/IPPM project has had positive impacts and achievements in line with the objectives that were originally set for it. This is particularly true for the execution period of the first 18 months².

¹ Appraisal Report of the project by the experts of the International Affairs Dept, Ministry of Jihad Agriculture.

² The evidence to this is the positive statements by Engineer Shojaoldini, the recently appointed Director of Bam Jihad-e-Agriculture, who, upon my request, made an opinion survey of some farmers involved in the project. In a telephone conversation after my visit, he said that almost all previously involved farmers were asking for re-vitalization of the project activities, particularly the technical support.

Following termination of the project, attempts to form cooperatives in different villages were successful and five cooperatives were established. These institutions started with high expectations of providing technical support to their members and finding markets for their “healthy” products. After a while, monetary limitations, weak links with local authorities, and inadequate technical supervision and monitoring led to a period of dormancy that left some cooperative members with dissatisfaction and loss of interest. Fortunately, with some recent financial support provided by UNDP the cooperatives have become active.

Some points, (however theoretical) with respect to socio-economics impacts of this project are noteworthy. A general acceptance of the principles of IPM by the farmers can have great impact on the economy of date production in the area. On one hand, the farmers’ cost of production can decrease due to lower costs of pesticides application. In the meantime, a pesticide-free product is healthier and reduces health risks for the consumers. Therefore, the price of healthier food can be expected to be higher, thereby ensuring more income for the farmers. It is very important to note that Bam is a “garden city” with the orchards located within the residential areas; thus, prevention of over-use of pesticides can reduce health risks for the city resident as a whole, and not just the farmers.

As lessons learned from this project point out, for more extensive and lasting impacts by such a project in the future, the following points require more attention:

- ✓ Such a project needs to have solid and strong links with local (Bam) agricultural extension services so that these institutions develop a stronger feeling of ownership to follow up the work after the project terminates. In the case of the SGP/IPPM project, the link was more with Kerman authorities than Bam Ag authorities. This contributed to the relatively "slow" progress after the 18-month period.
- ✓ Any selection/monitoring of the work of technical consultants should be done in full coordination and consultation with the NPD. The NPD of the SGP component, in later stages of the project implementation, become unsatisfied with the quality and quantity of IGRA NGO technical and monitoring contributions to the project and consequently stopped project delivery for a while which adversely affected timely establishment of the farmers’ cooperatives and releasing funds for them. Keeping closer and more effective lines of communication between SGP, the NPD and local and national level authorities could have prevented this.
- ✓ Provision of more technical support/training in different aspects, including irrigation and use of lab equipment, for the facilitators. Emphasis of the present project was on integrated pest management, while other farm practices such as irrigation and proper soil management were not given due training. These could become limiting factors even after pest management is solved.
- ✓ Provision of timely financial support for the cooperatives funds. Generally, promises to the farmers should be fulfilled in due time to keep their trust. Besides, delay in financial support may limit the ability of carrying out some of the recommended practices and cause resentment among some facilitators and

- farmers, ex.: special machinery may be needed for weeding/cultivation and no farmer is ready to pay for it, though it can be very helpful.
- ✓ Development of a system for monitoring the progress of cooperatives activities. Presently, I did not see such system in place, while it is very much needed for sustainability of the project and proper assessment of its success.
 - ✓ Documentation of activities and results is necessary for out-scaling the lessons learned to future similar programs.
 - ✓ Up-scaling of results to local decision makers. The present project was mostly concerned with farmers' communities while the governmental stakeholders/decision makers were not continuously involved. Experiences gained should be up-scaled into governments' policies and regulations.

Part Three: Final Review Workshop and Lessons Learned

Introduction

The lessons learned from this project are useful not only for ensuring sustainability of the project outputs in the Bam area but they can also be used as a guide for planning and implementing such projects in similar situations elsewhere. Besides, sustainable development plans are highly needed in this area and should be discussed with technical experts and all stakeholders, including the private sector and farmers' representatives.

Objectives of the meeting

- Review the activities and experiences gained during the project implementation.
- Discuss and disseminate the lessons learned.
- Facilitate interactions between government authorities, NGO's, farmers' groups and private sector on lessons learned from relief/recovery activities in agriculture sector following the Bam earthquake.

Workshop Agenda

Time	Speaker/Organization	Topic
08:00-08:30		Registration
	Dr H.Siadat/UNDP Consultant, Project Reviewer	Announcement of the agenda
08:30-08:45	Mr Etemadi/Governor of Bam	Inauguration
08:45-09:00	Dr Takalozadeh/ DG, Kerman Provincial J-e-Agr.	Welcome Address
09:00-09:15	Mr Knut Ostby, UNDP Resident Representative	Statement on UNDP activities in Bam and lessons learned
09:15-09:45	Eng'r Ehsani/Head of Bam Directorate of J-e-Agr at the time	Damages inflicted by the Quake and Government

	of the quake.	activities for recovery of Bam Irrigation System
09:45-10:00	Eng'r Ganji Saffar/ National Project Director.	Rehabilitation Project after the quake
10:00-10:15	Video on Bam Reconstruction	
10:15-10:30	Break	
10:30-10:50	Ms Ranjabarzadeh/ SGP facilitator and head of Deh-Shotor Farmers Cooperative	Integrated Production and Protection Management Project of Date Palms in Bam: Farmers Field School
10:50-11:00	Eng'r Farsi/ SGP IPPM National Project Director	IPPM-SGP activities for empowering farmers groups in Bam
11:00-11:20	Dr Siadat/ UNDP Consultant	Activities, impacts, and lessons learned from the Bam Water Project
11:20-11:30	Mr Nikfar/ Date palm grower and CEO of Date Processing Industrial Complex	Date Processing Industry and Products
11:30-11:35	Mr Barani/Date palm grower	Farmers' Viewpoint of the project
11:35-11:45	Eng'r Behzadpour/ Representative of Farmers' Home in Bam	Statement on Bam EQ and development activities
11:45-12:45	Open General Discussion	
12:45-14:00	Lunch	
14:00-16:00	Field visit to the project sites	

Panel Memebers:

Dr Takalozadeh, Mr Ostby, Mr Ganjisafar and Dr. Kianpour

Participants:

- Representatives of Ministry of Jihad-e-Agriculture and experts from some other provinces with similar irrigation infra structures and prone to natural disasters (Yazd, Fars, ..).
- Representatives of farmers' water user groups and Islamic Council of Poshtrood Village (Bam) and representatives of shareholders of wells in Bam and Baravat.
- Honorable Governor of Bam
- UNDP CO RR, Programme Analyst and Assistant
- Representatives of Bam/Kerman Agricultural Research Centers

- Representative of Bam Farmers' Home
- A representative from private sector in Date Processing and Storage Industries.
- Representative from NGO's and cooperatives active in Bam Agricultural sector
- Local Volunteers of the UNDP Project: Community-based Information Management in Bam
- Media Representatives

Venue: ARG-e-Jadid Hotel, BAM

Language: Persian with some English translation



Final review meeting on Lessons Learned

**Excerpts from the Speech by Honorable Governor of Bam:
Mr Etemadi**

- *I extend my gratitude to Mr Ostby, UNDP, RR, and his colleagues and I am grateful for the efforts of all national and international organizations and all the people who helped in Bam reconstruction.*
- *Bam agriculture is facing a series of problems including drought, Dubas Bug, and strong dusty winds. I hope that with proper planning, coordination, and use of global experiences, we will overcome all these difficulties.*

- *Most of the water in Bam is used in agriculture and its related expenses are on the rise .With the Jihad-e-Agriculture Organization having the central role in Bam water issues, I hope we will be able to bring about new developments in the use of water and increase water productivity.*
- *I hope that issues of credit for the date growers will soon be tackled by the Kerman J-e- Agri.*
- *I strongly recommend to our date palm growers to prepare project proposals for expansion of the date processing and storage industry and present it to the authorities.*
- *Although our farmers and date palm growers have recruited agricultural experts and are carrying simple research to protect their crops from pests and plant diseases, they could also contact international organizations for this purpose.*

**Excerpts from the
Speech by the DG of Kerman J-e-Agri Organization:
Dr Takalozadeh**

- *The quake inflicted severe damages to agriculture in general and water resources. Discharge of many Qanats dropped to one quarter of the original out flow. A total of 60-70 Qanats were damaged and their total outflow of more than 4000 l.s⁻¹ dropped to 1200 l.s⁻¹. Even today, the discharge of these Qanats is below the values prior to the quake, partly due to the prevailing drought conditions.*
- *According to the latest weather data, the average annual rainfall of Bam has definitely dropped to values below 60mm. This, together with dusty winds, hot weather, and attack of dubas bug, has caused a critical condition that is difficult for living as well as working. However, the blessings are also there: we have 373 qanats in Bam one of which has a discharge of 496 l.s⁻¹, the highest in the country. In addition, there are 1065 wells in the district. Overall, groundwater resources are providing 900 Mm3 for this region that constitute about 11.5 % of the Provincial value.*
- *The damaged Qanats and some 80 wells affected by the quake to different degrees were quickly identified and rehabilitation actions were started by the government organization, particularly the staff of J-e-Agriculture Organization of Kerman and other provinces, and international organizations such as UNDP. Their efforts in those critical days saved the date palm trees. This was of great importance to the economy of the region and partly saved the livelihood of the people that was dependent on agriculture. Therefore, we are grateful to those who tirelessly helped in the rehabilitation programs.*
- *In the follow up of the reconstruction programs, the government has provided large budgets for improvement of water resources. Since 2003, some 120 Billion Rials has been allocated for this purpose. A total of 200km of canals have been lined or piped and this has saved considerable amount of water. Also, many Qanats have been rehabilitated and improved.*

- Presently, date production stands at 350,000 tons per year. With the help of producers, traders, and industry, date could become an important export product similar to pistachio.

**Excerpts from the
Speech by the UNDP, RR,
Mr K.Ostby**

- *I thank the Ministry of Jihad-e-Agriculture and Kerman and Bam Directorates for co-organizing this meeting that provides us with an excellent opportunity to learn from each other's experiences and to identify best practices that can be applied to the design and implementation of the recovery programmes in future.*
- *Lessons learned are often neglected. We are often concerned to get a job done but not concerned about learning from the job we have done. The work of development and rehabilitation after a disaster is a new science and new discipline. It is, therefore, crucial to try to learn from what we do because this science has to develop over the years and we have to become better at what we do.*
- *Even though we are still learning, there is something that we have already learned and that is (the fact that) development takes place by the people concerned. It never takes place by somebody from outside. Therefore, it has been so important that the rebuilding of Bam has been led by the local authorities and people themselves and they are taking part in this meeting as well.*
- *We all were moved by the extent of the devastation made by the Bam earthquake on 26 December 2003, and more importantly its adverse effects on people's lives. In particular, livelihoods that revolved around agriculture and date-palm plantations were overnight severely threatened.*
- *I here pay tribute to the very impressive response by the authorities and people to the first emergency phase of the Bam disaster. The UNDP is proud to have played its part right from the early hours of the humanitarian crisis, and continued to work closely with the population and with the regional authorities in Bam, as well as with central Government for sustainable reconstruction.*
- *The experience we gained from recovery aftermath the Bam earthquake proved that the key for success in any recovery program is participation of the affected people. There is a need to look into the best ways to achieve the sustainable recovery in consultation with the affected people, the disaster victims themselves, bearing in mind that every individual affected by the disaster has his or her own dreams about the future. The dreams of the affected people should ultimately guide us in our deliberations for the reconstruction.*
- *I propose that we emphasize documenting systems that were established to facilitate full consultation with the affected people for re-building their lives. The Bam earthquake showed that the reconstruction of the social and livelihood sectors is as important and catalyze/speeds-up the reconstruction of housing and physical*

infrastructures. These processes are, of course, highly inter-linked. A sound reconstruction strategy must therefore:

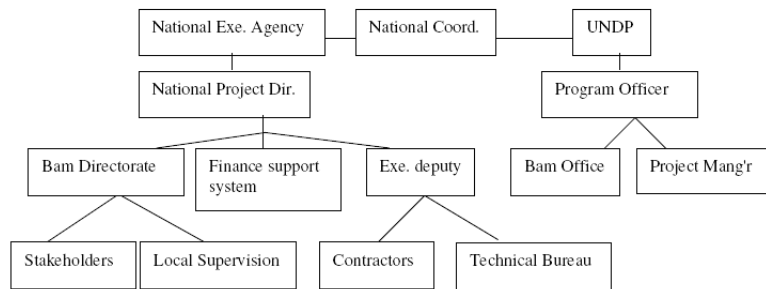
- create employment for local people;
 - identify and improve local human and material resources with appropriate training and capacity building programs;
 - ensure owner-driven processes in reconstruction with easy access to knowledge, credit and institutions responsible for these services;
 - promote community-led social and physical infrastructure with due concern for vulnerable groups;
 - rebuild physical infrastructures which are not only seismic-resistant, but which also remain functional during natural disasters;
 - rebuild disaster-proof houses.
- This meeting must therefore facilitate an exchange of experiences, and not only on “what worked well”, but also on “what did not work so well”. The lessons from the joint project must be absorbed and assimilated, as they will help in designing a robust institutional, technological and financial framework for reconstruction programs in future in this disaster prone country.
- Last but not least, I would like to address the important and critical role of women in recovery programs. Women must be given equal opportunities to livelihoods, including access to land and credit. It is experienced that wherever women are empowered to lead recovery projects, the recovery speeds –up significantly. When disaster affects adversely the crop and livestock productivity, reduction of income forces women to take more responsibilities for their families’ livelihoods, while generally they do not have equal access to community services, decision-making power, and financial, technological and other resources. Lessons from projects supported by the International Funds elsewhere and the experience of the joint project in hiring local women facilitators to empower farmer groups in Farmers Field Schools for more efficient production management and Integrated Pest Management, show that both women and men benefit from a gender approach that reinforces their joint participation in restoring the livelihoods. Any approach should ensure that women are involved in planning and carrying out recovery activities such as formation of community groups or village development groups, mobilization of internal saving funds to provide alternative livelihoods. Women can be trained to become the trainers for other fellow community members on agricultural extension programs, participatory resource management, need assessment, planning, implementation, monitoring and evaluation of the socio-economic recovery and development activities.
- Individuals, families and communities can be inspired by women’s motivations as they network easily within communities. We need to do our part in empowering women and engaging them as full partners in efforts for recovery and sustainable development of the disaster affected areas.

**Excerpts from the Speech by the
Director of Bam J-e-Agri. at the Time of the Quake:
Engineer Ehsani**

- *Peace be upon the people who died in the horrible quake of Dec 2003. We lost many of our colleagues and farmers.*
- *We are grateful to all those who helped us during the hard times following the earthquake, including the staff of J-e-Ag who came from other provinces such as Fars, Yazd, Isfahan, and Tehra. Among the international organizations, UNDP and FAO came to us and asked to know how they could help. UNDP quickly allocated funds and started the restoration of wells. On behalf of myself and other people of Bam I extend sincere gratitude and wish them success in their activities.*
- *Two days after the catastrophe, those of us who had survived, got together and we decided to be patient and start the rehabilitation and relief operations immediately.*
- *First, we carried out a general survey to identify the damages. Many qanats had collapsed and were fully or partially blocked. These had to be opened soon; otherwise the rise of water inside the tunnels would have caused further collapse and damage. The irrigation canals were filled up with the rubbles of the falling walls and buildings and needed cleaning. The dead bodies of the livestock under the rubble were decaying and had to be removed and destroyed. This was done with the help of our colleagues in the veterinary department.*
- *As an emergency operation, we provided some water tankers for water delivery to orchards. With the opening of each qanat or renewed operation of each well, there was great joy among the people who were living in tents. Water brought life to the community.*
- *Participatory action was the key element in our achievements. We divided the city into several districts and assigned one of our local colleagues as the person in charge of each district together with two to three farmers of the same area. This team had to decide on the priority actions to be carried out in each district. We tried to get the local people involved in the relief and reconstruction activities and in this way we also helped them in forgetting their emotional shocks and trauma.*
- *I propose that UNDP provides some budget for further rehabilitation of Bam qanats that are also part of the cultural heritage of this city. Also, considering the total area of date plantations in Bam that amounts to about 20,000ha, and 100-200 kg.ha⁻¹ of woody material that is pruned from the trees per year, there is great potential for paper industry. It will be highly appreciated if UNDP could consider a project on this issue for Bam.*

**Excerpts from the Speech on:
Bam Irrigation System Rehabilitation Project After the Quake**
Eng'r Ganji Saffar, National Project Director

- *Groundwater is the main source of water in Bam district. There are 373 qanats in this region with an average annual discharge of 457M m³. The average length of these Qanats is 4.2 km, while the longest one is 18 km. The largest discharge is about 496 l.s⁻¹ and belongs to Ghanbar abad. In addition to qanats, there are 945 deep and semi-deep wells with an average total annual abstraction of 420 Mm³.*
- *The quake damaged these resources to different degrees. Some qanats were damaged more than 70% and stopped discharging water. Others were either almost intact or partially closed with a consequent reduction in their flow. In the case of the wells affected by the quake, damages consisted of complete destruction of the shelters and damages to the pumps, engines, and the well casings.*
- *While the initial objectives of the joint project were set at restoring/repairing 8 wells, in the end of the project 33 pumps with capacities ranging between 30-100 l.s⁻¹ and 13 electrical engines of 125-150hp had been procured and installed. Besides, in 40 locations, the ruined traditional pump shelters made of bricks were replaced by metallic shelters that were easily removable and safe against earth quake. Also, 50 persons were trained for operation and maintenance of pumps and engines and 16 tool kits were distributed among some of the well operators. As to the rehabilitation of qanats, the "twin qnats" of Eisavieyeh and Najmieh were separated and their conveyance canal was lined all the way to the village (4200m).*
- *The organizational chart of the project was as follows:*



- *Selection of contractors consisted of the following steps:*
 - *Identification of qualified contractors*
 - *Invitation to participate in the bid*
 - *Review of the proposals in the procurement commission*
 - *Selection of the qualified contractor*
 - *Signing of the contract including the necessary guarantees.*
- *A technical bureau was developed for the project to carry out the following activities:*
 - *Preparation of suitable maps and design drawings.*
 - *Analysis of different work items for bidding purposes.*
 - *Commissioning of the execution designs/maps to the contractor*

- Supervision of the implementation of various activities.
- Monitoring the quality of the materials used in the workshop
- Review of the progress reports and work-done bill
- Holding of meetings and documentation
- Financial management of the project was such that most of the payments were made by installment according to the contract, directly to the contractor or supplier, and petty cash was insignificant. Payment procedure consisted of:
 - Submission of the request for payment by the contractor
 - Review of the progress and work-done bill
 - Preparation of the RDP form and approval by the NPD
 - Submission of these forms to UNDP
 - Follow up of the payment by UNDP and getting receipt of the deposited money from the contractor.
- Strengths of the project and lessons learned:
 - The project was executed by national institutions (NEX project). This was very helpful and expedited implementation of the activities.
 - Direct payments to suppliers and contractors and avoidance of depositing the payments in governmental accounts are effective in reducing bureaucracy.
 - Preparation of an organization chart for the project and assignment of clear terms of reference for each unit is necessary.
 - In selection of the project staff, work experience of all team members should be carefully considered.
 - Selection of the contractors should be based on their technical qualifications and financial capabilities.
 - Continuous supervision by local and provincial colleagues is necessary.
 - Participation of stakeholders and water users in decision making and monitoring project implementation is necessary.

**Excerpts from the Speech by the
Facilitator of IPPM Project (SGP) and Head of Dehshotor Farmers' Cooperative in
Bam:**

Ms Ranjbarzadeh

- Our project focused on Integrated Pest Management and our training method was Farmers' Field School.
- At the beginning, date palm growers were not familiar with pests that attacked their orchards and they were also unfamiliar with the beneficial insects that could control the pests biologically. Prior to our trainings, farmers noticed the pests only after it was too late and the damages had been inflicted.
- During the project, we arranged weekly meetings with the farmers in a selected orchard. In these meetings the farmers learned how to identify the pests and the beneficial insects. We did not eradicate the pests, but our objective was to reduce the use of pesticides, herbicides, and agrochemicals in orchards to prevent environmental pollution and save the beneficial insects.
- We taught date palm growers how to use the pesticides and herbicides in the proper way in localized spots and parts of the trees. We did not want their production to

decrease because, then, they had to sell at higher prices. Instead, we tried to reduce their expenses by lowering pesticide application.

- Some problems came from those neighboring orchards that were not covered by our services and did not follow our practices. We hope that both governmental and non-governmental organizations try to encourage these growers to follow the same practices as our cooperative so that they also benefit from similar results and those who have realized the advantages of reduction in pesticides application could continue to do so. It should be realized that we are working with trees that have a long life and we should not expect to see all the results immediately. It takes 8 years for date palms to start economical production.*
- Some of the main problems we are facing are as follows:*
 - Poor nutrition (fertilizer management) of date palm trees.*
 - Low price of date palm compared to other products that are being exported Most of the benefits go to the middle men.*
 - Shortage of labor for packaging.*
 - Inadequacy of water in certain locations*
 - Lack of proper mechanical equipment for pruning*
 - Inadequate use of date waste materials and pruned branches of the trees. We can use these for producing compost and this could be an excellent project for the future.*
- I am thankful to all those who helped us in this project.*

**Excerpts from the Speech by the
National Project Director of SGP- IPPM Bam Project:
Engineer Farsi, Kerman J-e-Ag Organization**

- This UNDP/GEF-SGP project was defined and implemented during 18 months to empower farmers for management of their date palm plantations through IPM/FFS and farmer-farmer training. This was in response to the date growers complains that Dubas Bug was threatening Bam agriculture.*
- In the traditional method of agricultural extension, an extension agent (instructor) gathers some farmers in one locations and gives them technical advice and guidelines. But, in the FFS method the extension agent is no more an instructor; rather, he/she acts as consultant and helps the date growers to get to know their ecosystem and their orchard. They are helped to understand what is going on in their orchard and to solve their problems themselves.*
- The FFS method enabled the growers to develop an inquiring mind and to identify their problems and the solutions.*
- Another objective was to help the farmers identify the biological enemies of the Dubas Bug and to eliminate application of pesticides to prevent the loss of beneficial insects.*
- During the project we succeeded in forming groups of facilitators who would guide farmers and developed a network of relatively advanced farmers and date growers who were more receptive and ready to participate in the program.*
- We hope that with the help of J-e-Ag organization, and even UNDP, and GEF/SGP, we shall be able to form a more extensive and public network for this purpose.*

- *Fortunately, at the end of the project, the date growers themselves established eight Local Funds and Cooperatives whose executives directors are the same facilitators trained by the project. The board of these cooperative includes date growers who are accepted by others in their community.*
- *I am grateful to all those colleagues in the J-e-Ag Organization, the Ministry of J-e-Ag, Dr Takalozadeh, UNDP and SGP who helped in provision of the needed budget, as well as the 22 facilitators and experts who actively worked in the project, and few others who contributed to the training programs. I also thank the Green Village of Iran (IGRA) as an NGO and their consultant who helped us.*
- *What we now have in this region is a typical model that can be used for other areas. In other words, if we identify the problems ourselves and look for the solutions, we'll be faster in removing the problems than when the directives and guidelines come from outside the region.*

**Excerpts from the Speech on:
Activities, Impacts, and Lessons Learned from the Joint Project on Restoration of
Bam Water Supply System
Dr H. Siadat, UNDP Consultant**

- *After the devastating earthquake of Dec 2003 in Bam District and in response to the government request, an emergency relief program i.e. a NEX project, entitled “Restoration of Water Supply Infrastructure Systems for Earthquake-affected Smallholder Date Palm Plantations in Bam” was prepared by UNDP/CO in coordination and cooperation with the national experts of the Ministry of Jihad-e-Agriculture (MoJA). After approval by the donor i.e. DFID, it was presented to the Government of I.R. Iran and was signed on 3March, 2004 with MoJA.*
- *The criteria used for selection of the wells and qanats for the project were as follows: (1) appreciable reduction in the discharge rate after the quake,(2) number of families and stakeholders affected,(3) small-land owners, (4) degree of participation of the stakeholders, (6) area of the plantations and number of trees.*
- *Activities included in the project were as follow:*
 - *Restoration of wells: A total of 33 wells were selected for the project, starting with the most important and severely damaged ones and progressively including others. This component of the project served about 1900 beneficiaries and helped in saving date palm trees and their yield in about 1500ha.*
 - *Construction of new pump houses: A total of 40 metallic pump-houses were constructed and installed in different parts of Bam and Baravat, including the wells restored by the project.*
 - *Conservation of Qanats waters: More than four kilometers of the course of water from the mouth of the twin qanats (Eisavieh and Najmieh Qanats) to Poshtrood Village were lined and the necessary structures were built along the canals.*
 - *Training: Operation and maintenance of well pumps and engines were identified as the most important topic of training for the emergency phase. Therefore, training was provided for 50 operators of all wells in the affected area.*
 - *Distribution of tool kits: In order to ensure the availability of the necessary tools for the trained pump operator 16 sets of tool kits were distributed among them.*

- *Socio-economic impacts of the project were relatively extensive and diversified. In the case of wells, social impacts included supply of water for some 1900 people, provision of safe shelter around the running engines/pumps that were close to residential areas, creation of temporary jobs for some people, training of 50 local residents for operation and maintenance of the pumping units, and distribution of some pump maintenance tool kits. The economic impacts of this component of the project were also appreciable since some 1500 ha of date palm plantations were saved and discharges of few wells increased, providing water for adequate irrigation of the trees.*
- *In the case of the two Qanats, an important social impact of the project was the resolution of a long-standing dispute between the two groups of water users. Water discharge of the two qanats had been mixed for some years and the users asked the project management to not only rehabilitate the damages of the quake, but, also separate the two flows. Doing this resolved their differences over the proper share of water. Another socially important impact was the fact that lining of the canals prevented direct contact of water with the soil that was usually covered by the livestock dung. Lining helped in reducing health risk associated with pollution. Besides, economical impacts of this component of the project were also significant. First, the conveyance losses due to seepage in earth canals were reduced by lining and saved about 700,000 m³ per year. Besides, lining of the canals prevented weed growth in the waterway and, consequently, maintenance operations have become much easier and less expensive. Also, transport of weed seeds to the fields has decreased after lining and farmers and date growers have fewer problems with weed control.*
- *Many lessons were learned during this project that can be used for similar situations. First of all, it was realized that participation of the stakeholders and contributions by different NGO's are of great importance to the successful completion of emergency projects. Such participation should be encouraged and welcomed by the authorities. Besides, it was learned that management practices of such projects need to be adapted to the dynamic nature of the situations and accommodate the changing environmental and social conditions following an earth quake.*

Another point to emphasize is that the project proposal for an emergency situation should be prepared and signed swiftly so as to prevent further socio-economical damages to the affected community due to delayed actions. This is particularly important for the instances in which the more vulnerable parts of the community i.e. children and women, are at risk. The response of the authorities to the proposal of donor organizations needs to be quick and nomination of the national collaborators should follow soon after the signing of the MoU. It is best that these collaborators be assigned to the project as full-time personnel since the work is very time-demanding in the short term following the start of the project.

The last, but not the least, lesson is that such projects require suitable capacity building programs to assure sustainability of the achievements.

Excerpts from the Speeches of Some NG Stakeholders

Mr Nikfar: Date palm grower and executive officer of the first Date Processing Industrial Complex in Bam:

- We are grateful to those who rapidly restored water resources of Bam after the quake.
- In Bam area with date palm as a mono-culture, it is of utmost importance to have processing plant for this product. That is why we started our industrial complex four years ago. , our company played an important role in encouraging people to return to Bam and continue their agricultural activities.
- We now have grading and packaging facilities and 2000-ton cold house storage. For grading and packaging, we can provide services to all date producers. We have 200 workers who work in 3 shifts. We have been selected as one of the distinguished job creators in the district.
- We also have two other projects: production of date chocolate and beverage. As you know, out of 120,000 tons of date produced here, close to 30,000 ton is somehow wasted. Therefore, we plan to pack the grade one and two dates and use grade three and four for other products such as date paste and chocolate. Dates of lower grade and the wastes of the processing plants and the dates fallen on the ground in orchards will be used for production of livestock feed.

Mr Barani, a date palm grower:

- I thank the UNDP and Bam J-e-Agri who worked for us sincerely.

Mr Behzadpour, Bam Representative of Farmers' House:

- We are thankful to those who helped us with love and sincerity in those hard days after the quake.
- Bam has a unique ecosystem located between two Deserts, Kavir Lut and Kavir Markazi and close to high ranges of mountains. Here, the difference in day and night temperature is large and this helps production of quality date that is among the best in the world.

Questions and Answers Session

Q: Mr Shayanfar, from Baravat: 1) these presentations were about the works done in the past. What does UNDP have for the future?

2) How should we conserve water when rainfall is so low?

Answers: 1) Mr Ostby: This project was supported by a special emergency funds. UNDP has other projects in different parts of Iran on issues such as environment, poverty, governance, and the third millennium development goals. We also have a capacity building program with the government (the executive deputy of Kerman Governor) for risk reduction in Kerman. Besides, we have asked the I.R. Iran government to inform us about their needs for the next 5-year plan.

2) Engineer Shahsavari: We have some programs for optimization of water use and rehabilitation of qanats in Baravat. A total of 5000 ha is considered for use of pressurized irrigation systems. Date palm growers can apply for credit and loans allocated to these projects and benefit from the 50% governmental grant. Lining of canals and construction of ponds and small water reservoirs are also in our agenda.

Q: Mr Barkhordar, a date palm grower: 1) I thank the Bam J-e-Ag. There is one unfinished project for a well 30km from here and Qanat of Akbar Azimi. Are you going to finish that?

2) We are grateful to UNDP for their contributions especially for the FSS activities from which we learned a lot. We kept the larva of the bug in a jar and observed its transformation to a large beetle with horn.

Answers: Engineer Dehghan: 1) From the 20 B Rial budget of last year, we constructed one km of canal for the Azimi qanat and will continue the work during the current year.

Q: Mr Dorjoosh, from Yazd; why did you line the qanats?

Answer: Mr Ganji Safar: The qanat tunnels were not lined. Lining was done downstream from the mouth of the qanats to decrease seepage losses.

Q: Engineer Rastegar, from Fars J-e-Ag Org.: For saving water flowing out of qanats during winter months, I suggest that you study the issue with the help of University researchers. We did this successfully in Fars Province.

Answer: Dr Takalozaheh: I have asked our research centers in the province to study the possibility of saving winter outflow of qanats. It requires careful investigation so that no problem arises.

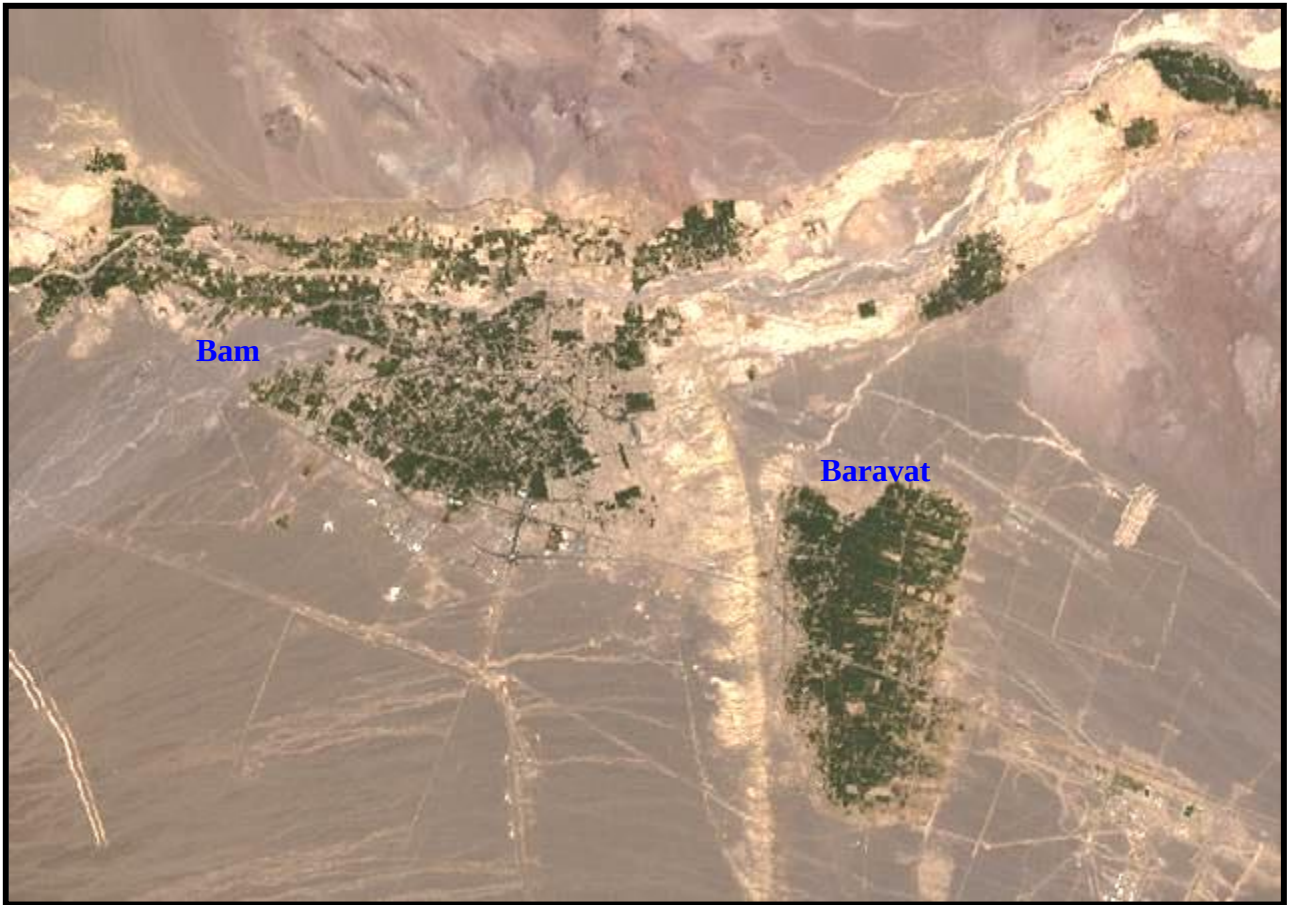
Q: Ms Eghbalizadeh, FFS facilitator: 1) I am environmental specialist and would like to know if UNDP has any project about environmental issues in Bam. Most of the current activities of the government are on water issues.

2) The outflow from Hoseinieh Qanat has decreased to a quarter of its original flow. Are you going to do something about it?

Answers: 1) Mr Ostby: *UNDP has some capacity building programs with Iranian Department of Environment (DoE). However, we are not covering everything. You can contact DoE and tell them about your needs. They can refer your suggestions to us. Our actions are based on government needs and request. We are planning our 5-year plan of actions and we are talking with DoE and Ministry of J-e-Agriculture. The priorities have not been finalized yet. I'll be happy to receive your suggestions. You can also contact us through e-mail as well.*

2) Engineer Shahsavari: *We have some budget for Hoseinieh Qanat and will work on it.*

Appendix 1
A general satellite image of Bam and Baravat



Appendix II

IV- Request of Poshtrood Farmers for Restoration and Separation of the two Qanats

بسمه تعالی
 مدیریت محترم جهاد کشاورزی شهرستان خرمین
 سلام

احتراماً به استحضار می‌رسانم اینجانبان امضاء کنندگان ذیل مالکین قنات عسویه و بنحیه زمین قنات سرگرد
 این زحمت بی وقفه و تلاش‌ها جهت احیای قنات محترم که از جهت خدمت رسانی به کثرت دریا برای میوه‌ها
 تولید می‌تواند از این قنات فوق‌الذکر طرح احداث کانال با کسب بختی منظور نموده امثال تسکین را داریم
 لازم به توضیح است که قبلاً از نظر قنات حدوداً ۱۵ و ۱۶ کلوستر کانال‌های قنات فوق‌الذکر فته شده و به علت
 مشکلات از قبیل نیکل به درخت آب قنات و همچنین مشکل قنات آب در طول مسیر قنات‌ها داریم
 دستور فرمایید که برای ادامه مسیر کانال با کسب بختی قنات‌ها تا روستای بیت بر در مدیریت جهاد کشاورزی فته
 شده در سادت و رعایت فضا بعال که بنده می‌فرمایید امثال تسکین را داریم

۱- احمد دهقانی	۱۲- محمد ابراهیم	۲۶- عبدالرحیم
۲- علی دهقانی	۱۳- محمد ابراهیم	۲۷- محمد ابراهیم
۳- حسین دهقانی	۱۴- حسن دهقانی	۲۸- محمد ابراهیم
۴- رضا دهقانی	۱۵- حسن دهقانی	۲۹- احمد دهقانی
۵- علی دهقانی	۱۶- محمود دهقانی	۳۰- احمد دهقانی
۶- محمد ابراهیم	۱۷- محمد ابراهیم	۳۱- اکبر دهقانی
۷- احمد دهقانی	۱۸- محمد ابراهیم	۳۲- عباسی حسن زاده
۸- محمد دهقانی	۱۹- حسن دهقانی	۳۳- علی حسن زاده
۹- یحیی دهقانی	۲۰- محمد دهقانی	۳۴- جواد دهقانی
۱۰- حسن دهقانی	۲۱- محمد دهقانی	۳۵- محمد دهقانی
۱۱- علی دهقانی	۲۲- محمد دهقانی	۳۶- محمد دهقانی
۱۲- محمد دهقانی	۲۳- محمد دهقانی	۳۷- محمد دهقانی
۱۳- محمد دهقانی	۲۴- محمد دهقانی	۳۸- محمد دهقانی
۱۴- محمد دهقانی	۲۵- محمد دهقانی	۳۹- محمد دهقانی
۱۵- محمد دهقانی	۲۶- محمد دهقانی	۴۰- محمد دهقانی



Appendix III

Similar activities by other NGO's

Following the earth quake, many governmental organizations and NGO's rushed to Bam for help. For a time in early 2004, some 45 NGO's were working in the area providing different types of assistances. Some of these got involved with the farmers and agricultural sector. The spectrum of their helps is beyond the scope of this report; however, a short outline of their activities related to water issues is presented in the following table.

Table(5)- Agricultural water activities of other NGO's

NGO	Location	Agricultural water related activities
World Vision	Pakam qanat	Dredging 2500m,
	Sheikhabad qanat:	Dredging:3000m Concrete underground conveyance canal 500m
	Dehshotor qanat:	Concrete underground conveyance canal 1000m
	Akbar abad qanat:	Dredging:6500m Pre-cast lining:100m Gallery boring: 300m
	Eishabad qanat	Dredging 6000m Pre-cast lining:500m
	Gardoona qanat	Dredging 6000m Gallery boring: 350m
	Lotf abad Poshtrood	Dredging 1600m Pre-cast lining:600m
	Hemmat abad	Dredging 500m Pre-cast lining:100m
ACF	Sobhanabad	Dredging qanat 6000m Pre-cast lining of qanat:300m Repairing pump
Oxfam	Haj Ali qanat	Dredging 1200m
	Different locations	8 pump shelters
Medair	Hoseinieh qanat	Lined canal 300m Concrete underground conveyance canal 500m
	Asad abad	Concrete underground conveyance canal 200m Concrete canal 1300m Pipes installation 500m
	Different locations	Concrete pipe installation 535 pieces
	Poshtrood	187 irrigation gates
Mercy Corp	Different locations	Pump shelters: 3
Dutch Carits	Nartij	Concrete canal 4000m Boring new well:1 Pump shelter:1 Dredging irrigation canals
	Zoran	Pump/engine unit:1
	Meshk	Pump/engine unit:1
French Red-X	Baravat villages	Concrete canal 2500m Concrete underground conveyance canal 3000m

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Appendix IV

UNDP/SDC supported news sheet in Bam

