Impact of irrigation on livelihood and food security in the modern Hare river irrigation scheme in Southern Ethiopia

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Abstract

The purpose of the undertaken study was to evaluate the impact that the modern Hare river irrigation scheme had on household food security as well as on lifestyle changes of the population in the study site Chano Chalba. This was done on the basis of the FAO food security pillars access to food, availability of food, utilization of food and the overall factor of food stability. RRA tools were used to conduct a before-after comparison, considering a ten years period. The quantitative data was analysed using SPSS and/or Excel and simple statistical measures such as cross tabulations, frequencies, percentages and means gave a visible overview of the outcomes.
The modern irrigation scheme did not affect the livelihood and food situation directly but indirectly through other modernizations that came with and after the construction of the modern main canal, e.g. road, merchants, agricultural office, health centre, drinking water points, school, electricity etc.
The major trigger was the introduction of a new banana type so that farmers changed from food crops to cash crops to earn a higher income. Following, the wealth situation of the population ameliorated but less food crops are produced and people become more dependent on the local market. The infrastructure of the study site developed in a positive way but still education, especially on food issues, are needed to have a sustainable repercussion and to secure people's health and food situation. Further positive changes on the food situation could be able if the higher income was utilized more efficiently and if the construction of the modern irrigation scheme had been more appropriate and by incorporating the farmer's requests.

Key-words: poverty, irrigation, livelihood, food security

1. Introduction

1.1. Background on food security and irrigation

In the 1996 Rome Declaration on World Food Security, food security is defined as "Food that is available at all times, to which all persons have means of access, that is nutritionally adequate in terms of quantity, quality and variety, and is acceptable within the given culture."
Further, the FAO speaks of food security on household basis when all members of a household can be supplied with sufficient and adequate food, whether through their own production or through buying of food.

According to the Aggregate Household Food Security Index (AHFSI)[18], established by the FAO (1995), Ethiopia had an index below 65, i.e. critical food security status, between 1991 and 1993.

[18].The AHFSI calculates the "food gap" between the undernourished and average national requirements, the instability of the annual food supply and the proportion of undernourished in the total population. The index ranges from 0 to 100, with 100 representing complete, risk-free food security and zero, total famine (FAO, 1995).

In Ethiopia, irrigation has a long tradition (Kloos, 1990). One of the main targets of irrigation systems is to fortunate agricultural production in qualitative as well as in quantitative meaning (Mengistu, 2003). Harvests shall be enlarged so that people either produce enough food for the non-harvest time or to sell their overproduction and earn some money to buy food. Another opportunity to produce more food crops is irrigated gardening, an activity mainly done by women.

In Ethiopia, there has been a revival of irrigation during the last decades in order to enhance rural development and food security (FAO/WFP, 2006). Given that 85 percent of the people are employed in agriculture (Mengistu, 2003), developing this sector could help to reduce poverty and enhance food security of the majority of the Ethiopian people.
As Lankford (2003) argues there must be a positive balance of benefits against risks and costs of irrigation. A more secure and increased crop productivity, improved planning and timing of start of the cropping season and extended harvest season, raised number of jobs and income are some knock-on effects that show how irrigation facilitates economic transactions and improves livelihoods and the wealth and infrastructure of whole villages (Lankford, 2003).

1.2. Irrigation and food security in Ethiopia

Case studies undertaken by Thompson (1991), Lall and Broadway (1994) and Adem (2001) already highlighted the positive impacts of enhanced accessibility to water for irrigation. Besides an extended growing period, a higher variety in food and cash crops and, as a result, an increase of cash income, food shortages could be reduced. Nearby, the target communities improved the infrastructure of their village and standard of living in general.
Negative impacts of the projects were over watering of some fields, overproduction of certain crops and competition for water from nearby communities.

Kennedy et al. (1992) compared the effects of cash crop schemes on health and nutrition in six countries. They concluded that "increases in income have to be accompanied by improvements in the health environment in order to have a significant effect in reducing preschooler morbidity and improving child nutritional status."
Among the reasons for negative impacts were reduction in the household's production of food crops, increased food prices, loss of household access to land due to changing tenure relations and household expenditure patterns favouring durable consumer goods.

1.3. Statement of the problem

High reliance of the people on their own food production has a direct impact on local food availability and on accessibility. Some coping strategies, which are eroding the household asset base, are used by the most vulnerable population to survive (FAO/WFP 2006).

As IFAD stated in 2005, irrigation has the potential to reduce food insecurity by several factors. "For the farmer, the soils, crops, livestock, weather, water, nutrients, pests, markets, income, outgoings, shelter, transport, fuel, property, family and social networks, and much more, all form part of the integrated environment in which he or she makes a livelihood. Improving food security through irrigation affects or is affected by each of these aspects. A major challenge is to design meaningful integrated solutions to the real problems faced by farmers" (IFAD, 2005).

Therefore the consequences of irrigation systems both positive and negative have to be assessed so that policy makers, government and other NGOs can react and, finally, burst the vicious circle of poverty and enhance food security.

1.4. Objectives of the study

As irrigation development is often associated with cash crops, irrigation investments' contribution to food security is often questioned. This study gives, among other things, an answer to this question, in case of Chano Chalba and the modern Hare river irrigation scheme.
It is figured out how the modern irrigation canal changed the agricultural production and livestock holdings/population, income sources and expenditures, health situation, hygienic standards, market situation, lifestyle of the households and the infrastructure of the study site.

For the purpose of investigating the perceptions of household food security, the research focused on the four dimensions of food security: availability of food, access to food, utilization of food and the overall factor of food stability.
Following, the established hypothesis concerning the four dimensions of food security, were:

1. Availability: Since the modern irrigation scheme was introduced, households have a better and more sustainable availability to food than before (whether through their own production and/or buying).
2. Access: The access to food and other assets are better developed today compared to ten years ago. (markets are better available; enough money to buy food)
   Since the construction of the modern canal, people have a more varying and balanced diet.
3. Utilization: Since the construction of the modern canal, people have more time for cooking and education thus people have a better knowledge of a balanced diet and related effects.
   Since the construction of the modern canal, people have more meals a day, are not restricted in the choice of their food, and are healthier and physically stronger.
4. Stability: The food security situation is more solid and offers more stability throughout the year and periods of stresses, shocks and in terms of seasonality.

In concrete, the results of this case study provide an insight of the impacts that the modern Hare irrigation scheme has primarily on household food-security but also on the environment, economy and society. It contributes to the project "Impact of Irrigation Development on Rural Poverty and Environment", coordinated by the International Water Management Institute (IWMI), the University of Natural Resources and Applied Life Sciences Vienna (BOKU) and ARC Seibersdorf Research in association with the BOKU Research for Development Forum (DEV-FORUM).

The externalities shall also be valuable for other researchers and stakeholders and influence the thinking on approaches to irrigation development. The concerned population gets a better view of their present situation, impact of outside interventions on their livelihoods and consequently are enabled to make better-informed decisions about their future livelihood strategies.

Thus the study focused only on the named study site, the gained results are just valid at local level and cannot be generalized to a larger population.

2. Description of the study area

2.1. General description of the country

Ethiopia is a landlocked country in the horn of Africa. It comprehends 1 120 000 square kilometres total land area, whereof 8 percent are farmed by smallholder peasants and about 3 100 000 hectares are fallow. The total area of grazing and browse is estimated to be up to 65 000 000 hectares, of which 12 percent is in mixed faming, the rest in pastoral areas (MoA, 2000 as cited by Mengistu, 2003).
Agriculture plays a central role in economic and social life. It is the leading sector in national economy, composing 40 – 50 percent of GDP and around 90 percent of export earnings. About 6 million people are chronically food insecure and depend on food aid throughout the year, another 10 million are considered as vulnerable (FAO/WFP, 2006).
Subsistence agriculture is almost entirely rain fed and yields are generally low. The existing irrigation potential is far from being reached (Mengistu, 2003).

The population is estimated to 76.5 million (World Bank, 2007) and is growing rapidly, with about 2.9 percent annually (Kebede, 2003).
38 percent of the population are underweight, another 47 percent stunted. Infant mortality rate is 107 per 1000, 47 percent of children

aged under five are malnourished and 10.5 percent affected by wasting (FAO/WFP, 2006).

2.2. Description of the study site[19]

2.2.1. Location of the study site and the modern irrigation scheme

Chano Chalba is a Peasants Association that lies in the SNNPR, Gamo Gofa Zone, in the South of Ethiopia. Hare River is one of the four main rivers draining to the nearby located Lake Abaya.

The Hare irrigation scheme comprises a total irrigable area of 2224 ha and there exist three different irrigation schemes. In Chano Chalba, the modern Hare right side irrigation scheme is used (Bantero, 2006). The community has a common diversion weir with the neighboring Kebele Chano Mile. This weir is located next to the asphalt road, leading both to Addis Abeba and Arba Minch.

2.2.2. Climate

Chano Chalba, lying in the lowlands at 1169 m a.s.l. near to Arba Minch, has a tropical climate with maximum and minimum temperatures between 30.3°C and 17.4°C, respectively.
February and March are the hottest months with rare rainfall, while June to August and November to January are more moderate with higher precipitation. The monthly average rainfall recorded from 1970 to 2006 at the Arba Minch Farm and Arba Minch University station is in total 829.3 mm, respectively (Bantero, 2006).

2.2.3. Soil fertility

Along the modern irrigation canal in Chano Chalba, soil is sandy at the head of the modern main canal where soil fertility is poor. In the middle parts, there is loam and soil fertility is very good. At the tail of the canal, people brought soil from another place to increase soil fertility. Beside this soil, there exists silty loam and soil fertility is also good (Agricultural Office, 2007).

2.2.4. Farming system and cropping season

From February to May, food crops (e.g. maize, sweet potato) are planted while cash crops are both planted and harvested. During the summer months, from June to September, food crops are harvested and, as it is rainy season, cash crops are also planted and harvested. From November to January, when it is dry season and the most critical time during the year, there are no agricultural activities undertaken (Agricultural Office, 2007).

The more recently introduced cash crops banana, mango, avocado and papaya have the advantage that they have to be planted only once (trees!). From then on, they are less time consuming because weeding is not that important compared to sweet potato or maize.
Moreover, these cash crops, especially the banana, can be harvested nearly every two months depending on the effort the farmer has taken.

2.2.5. Land holdings and distribution

Chano Chalba comprises a total area of 799 ha of which 649 ha are cultivated, in average landholdings from 0.5 to 3.50 ha. 199 ha are cropped annual, 450 ha perennial, and all of the agricultural land is irrigated. Forests cover 40 ha, grassland 20 ha and 90 ha are occupied by others (Bantero, 2006).
Because of the high population growth, the resettlement and return of soldiers, land holdings became smaller compared to former times and it is not possible to increase the land size. The only possibility is to rent land from poor people, their way to increase cash income (Group discussion, 2007).

2.2.6. Population and family constitution

As already mentioned, Ethiopia's population is growing rapidly. In Chano Chalba, a total population of 2980 people was recorded in 1988 and increased to 6200 inhabitants in 2005 (Catholic Church Mission, 1988; Agricultural Office, 2007). Households increased from 445 in 1998 up to 732 households in 2005 (Agricultural Office, 2007).

[19] During the realisation of this study, rare data on the study site were available. Therefore, the information given in the chapter "Description of the study area" is based on the statements from key informant interviews and group discussions.

The interviewed households consisted in average of 8.5 members.

2.2.7. Problems and advantages of the modern irrigation scheme

The modern irrigation system was built up and paid by the Chinese Government in cooperation with the Ethiopian Government. Main purpose of its construction was to increase the amount of irrigation water, enhance cash crop (cotton) and food crop (beetroot) production and to decrease water losses (Agricultural Office, 2007; Belete, 2006).

During the construction, there was a disagreement between the Ethiopian and Chinese Government because the Chinese did not build the main canal the way the Ethiopians wanted so the Ethiopian Government redrew every responsibility for the project. However, the Ministry of Agriculture brought the material to construct also modern field canals but unfortunately the Chinese had already stopped before the main canal was finished.

Although the modern canal led to a lot of advantages, one of the main objectives of the construction has failed because water loss is still a problem. Moreover, increased water usage by farmers and salinity are constraints for adequate irrigation practices.
At the head of the modern canal, the field canals break when there is too much water, especially during rainy season. In the middle, the canal is lower than the fields and if there is not enough water in the canal, people cannot irrigate their fields. The construction of a dam is seen as solution to this problem. Further problems in this part of the canal are siltation and damage by farmers.

One of the main advantages of the concrete canal is its robustness. Digging the destroyed and blocked canals (e.g. after heavy rains) again and again to make the water flow was a time consuming activity. Besides, if the water was standing too long, people as well as livestock that drank from that water became ill easily. Unfortunately, the field canals are still traditional.

3. Methodology

3.1. Sampling procedure

Purposive sampling was used to examine the impacts the modern irrigation canal had all over its longitude. Indicators for the sampling were the household's wealth situation, average size of land holdings, and the use of both the modern scheme today and the traditional before, so that the changes of a ten years period could be deducted. The sampling included 9 households each from the head and tail of the main canal while 11 are from the middle (Table 1). The difference of two more in the middle is a result of the unreliable sampling procedure of the Kebele officer that the researcher faced in the beginning.

Table 1: Sampling scheme of households for household interviews

Location of main farmland	Head			Middle			Tail		
Wealth Category of HH	3 R	3 A	3 P	4 R	3 A	4 P	3 R	3 A	3 P
Total HH interviewed	29								

3.2. Data collection methods

Due to time and finance limitations but to get reliable in-depth information, rapid rural appraisal tools were used.
Primary data was collected from key informants, local people, focus groups, experts, observation, transect walks and questionnaires from the selected households.
Maps and timelines were established in cooperation with the participants and gave a visible overview about the construction of the modern irrigation canal, availability of irrigation water throughout the year and agricultural practices.

Rankings accompanied the household interviews and were used to evaluate preferences or importance of main crops planted, income sources and expenditures.
Secondary data was obtained by comprehensive literature review and from offices operating in the area, to get the necessary data on agricultural production data and market prices.

3.3. Data management and analysis

The collected data was recorded in a laptop to avoid data loss. Descriptive data was coded and analysed in the light of the literature reviews. Quantitative data was introduced into SPSS and/or Excel and simple statistical measures such as cross tabulations, frequencies, percentages and means were used to reduce the volume of data, making it easier to understand.

4. Results and discussion

4.1. Availability of food

4.1.1. Agricultural practices: From food crops to cash crops

Cropping patterns changed definitively since the modern irrigation system was built and since the Kebele got its own Agricultural Office in 1996 that introduced a new banana type (Asmara banana) in order to increase farmer's income and to improve their livelihoods.
This banana tree is smaller, easier to plant and harvest and harvest-outputs are higher; it needs less treatment thus is less labour- and time-consuming. The linear form of the fruit makes it better transportable than the "older" banana type (Hawesh banana). The only disadvantage of the Asmara banana compared to the Hawesha banana is its higher water demand.

In former times, farmers were mainly planting food crops (maize, teff, sweet potato, beetroot) for their own consumption as well as cotton as cash crop. In the meantime, nearly all of the farmers changed totally to cash crop production (banana, mango, avocado), defined as crops that are mainly planted for selling. Some of the farmers still have a little piece of land where they plant at least some food crops for the household's own consumption while others divide their plot into different parts to plant on one half cash crops and on the other half food crops.

Data from the Agricultural Office in Chano Chalba showed the increase in production both of cash crops and food crops during the last ten years. The increase in food crops is explained with the growing population size, the higher cash crop production by the shift to monoculture of banana and mango.
According to the statement above, the situation of food produced by the households for their own consumption was better in the past. At the time this study was carried out, cash crops supplied the households with the necessary money to buy food from the markets.

The magnitude of the shift to cash crop banana is also shown in Table 2 below. For 27 of the 29 interviewed farmers (93.1%), banana is the most important crop today. On second rank comes maize (13 people, 44.8%), followed by the recently introduced cash crop mango (8 people, 27.6%).

Table 2: Importance ranking of crops (CC = cash crops; FC = food crops); first three ranks

Rank	Today			Before		
1	Banana (CC) 93.1%	Maize (FC) 44.8%	Mango (CC) 27.6%	Cotton (CC) 37.9%	Maize (FC) 27.6%	Sweet potato (FC) 10.3%
2	Maize (FC) 44.8%	Mango (CC) 27.6%	Sweet potato (FC) 17.2%	Sweet potato (FC) 37.9%	Cotton (CC) 20.7%	Maize (FC) 17.2%
3	Cotton (CC), (FC) Each 20.7%	Sweet potato (FC), Maize		Maize (FC) 34.5%	Sweet potato (FC) 27.6%	Cotton (CC) 24.1%

Source: Household interviews/rankings, 2007.

Concerning the diversity of crops being grown, there is less different kind of food crops but more different kind of cash crops grown on the main field today.
In average, farmers are planting 2.14 different kinds of food crops and 2.21 cash crops today, compared to 2.52 food crops and 1.72 cash crops before.

Reason number one for the change to mono cropping is the higher income farmers get from the recently introduced cash crops banana and mango. Although the new banana type needs more water, it seems to be more resistant against drought, compared to maize. Moreover, food crops do not grow properly next to the big banana trees that consume all of the water and give a big shadow.
Other recently introduced fruit trees, especially mango but also papaya, already show to be a big success, not like the attempt of a local cereal called "Taleba" where soil-fertility did not fit and the crop was abolished soon.

Since the farm size of the households has decreased, people have to make a more precise choice on what to grow thus food crops have declined for the benefit of cash crops and the related higher income.
More detailed, 14 farmers (48.3%) use more, 9 (31%) less and 6 (20.7%) the same space on their plot to grow cash crops today.

4.1.2. Practices to keep soil fertility

People had another cropping pattern before the modern canal was constructed. They changed the crops on the field or even left a part fallow so that it could regenerate; livestock was hold close to the fields and its dung was used as a natural fertilizer.
Since changing to mono cropping banana, soil is loosing steadily its fertility (Agricultural Office, 2007). Furthermore, the farmers are not familiar with the use of industrial fertilizer and have little knowledge and practice. The attempt of the Agricultural Office (1994) to keep soil fertility by applying chemical fertilizer was abolished soon because of the high costs and the bad introduction and performance (Agricultural Office, 2007).
Instead, the Agricultural Office started recently to give lessons on generating compost. While it was only 9 farmers out of 29 (31%) who were using organic fertilizer before, the number increased to 24 (82.8%) who started to use compost recently to keep and increase soil fertility.

4.1.3. Use and practices of irrigation water

Farmers in Chano Chalba were irrigating with a traditional system since long time ago. Today, all farmers in Chano Chalba are irrigating both their main field and garden.
Regarding the irrigation time, the Head of Water User Association who is in charge with coordinating the irrigation scheme, allows the farmers to irrigate two or three times a year but irrigation time also depends on soil type, crop type and on the weather conditions.

From the 29 interviewed people, 25 (92.6%) are irrigating temporary, i.e. two to maximum four times during the year, and 2 persons (7.4%) use the irrigation water for their crops all over the year. No further explanations were given to explain this case.

By contrast, ten years ago it was 15 farmers (57.7%) who irrigated temporary while 11 (42.3%) irrigated all over the year.

One of the main purposes of irrigation is to increase the agricultural production. But in case of Chano Chalba it is difficult to compare the different crop types and, comparing the information with the data given by the Agricultural Office it is hard to believe that half of the people stated that their harvest has decreased compared to ten years ago.
It is more reasonable and believable that 25 of the interviewees (86.2%) claimed that their agricultural production is still influenced by lack of rain.

4.1.4. Storage of food crops and cash crops

In the past, when people were mainly growing maize as food crop, they stored the harvest in a barn next to the house. Today, the cash crops banana and mango are usually sold directly to the merchants and the small amount of maize farmers still plant is often not necessary to store. While all of the 29 interviewed farmers had stocks ten years ago, it is only 16 (55.2%) today. From the ones who still have maize stocks today, 7 (24.1%) said that their reserves last longer, 8 (27.6%) shorter and for 1 farmer (3.4%) it remained the same.

4.1.5 Home gardens

The importance of the home gardens lies on the bigger variety of food for the household's consumption and for women to get their own income by selling the surplus of these crops.

In the study site, only 15 (51.7%) of the 29 interviewed households had a home garden ten years ago while everyone (100%) is in possession of one today. One of the reasons is that their fields were nearer to their houses, so they did not need a garden but planted their food crops directly on the field.
Concerning the above mentioned diversity of food, farmers are planting 4.43 different crop types, mainly food crops, in their gardens today. Ten years ago, the 15 households who had a garden had only 1.46 different food crops.

According to this result, the people have a bigger choice in food, especially in fruits like mango, avocado, papaya, and can enrich their diet above all with micro-nutrients like vitamins and minerals. The left-over is sold by the women and girls on the local market or on the street to earn some money that they can manage themselves.

4.1.6. Livestock

In Chano Chalba, oxen, cows, goats, chicken, donkeys and sheep are and were kept as cattle. Livestock is generally a household asset and needed to overcome periods of food shortages. Therefore, it is usually used for the households own consumption and only in certain cases, mainly from wealthier farmers, sold.
Meat, eggs, milk and butter are incorporated in the daily diary but not consumed often. Milk is known to be healthy and therefore saved for young children and pregnant or lactating women.

The given data on livestock changes are controversial. According to the information of the Agricultural Office of the Kebele, livestock population on household basis doubled since 1997. But 24 (82.8%) of the 29 interviewed people claimed that they have less livestock today compared to ten years ago.
The reason for the decrease of livestock has nothing to do with the construction of the modern canal but is a problem of the small landholdings and the high population density. Thus, the cattle have to be brought to the highlands or near to the lake while ten years ago there was enough space near to the fields and the cattle's dung was used as natural fertilizer.
Moreover, most of the animals died because of the sleeping-sickness that is transfused by the tse-tse-fly. That problem was removed five years ago when they got nylon nets that caught and killed the flies. Furthermore, the Agricultural Office started with livestock vaccinations in Chano Chalba once a week.

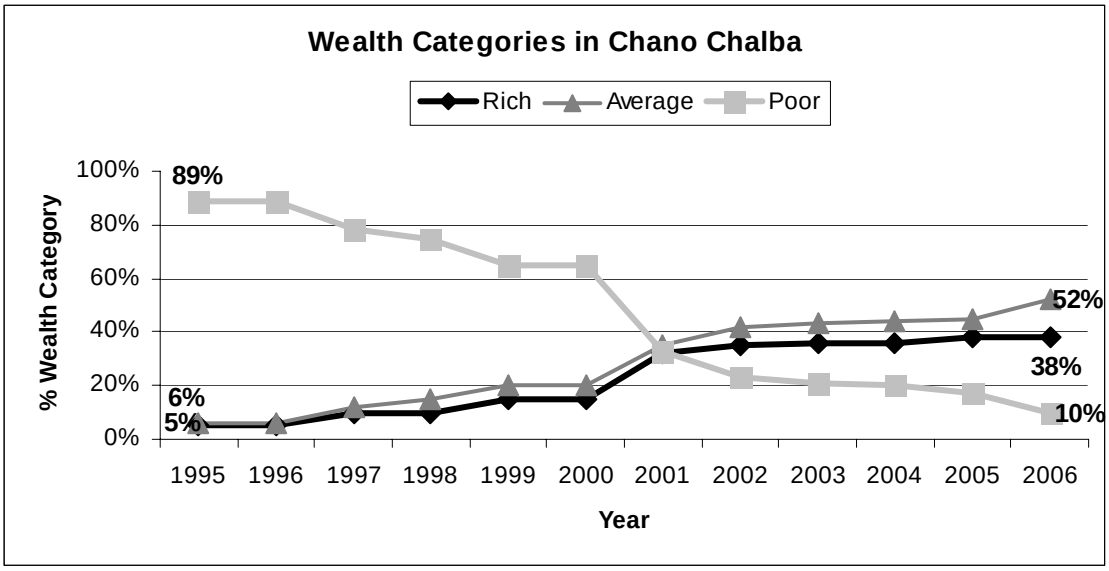
Thus people have less livestock, the availability of livestock products like butter, milk, cheese and meat has declined. Prices at the market are considered as too expensive so there is less diversity of animal products, especially in proteins, in their diet.

4.1.7. Income and expenditures

As can be seen from Figure 1, the wealth situation of the Kebele developed in a positive

way. There are more "richer" and "average" households today while the category "poor" decreased.

Figure 1: Development of wealth categories in Chano Chalba, 1995-2006



Source: Agricultural Office, February 2007.

- **Income**

Since ever, cash crops were seen as main source of income in Chano Chalba. Due to the shift to cash crops, people have a higher and more constant income today, although the number of different income sources decreased significantly from 3.17 to 2.24.

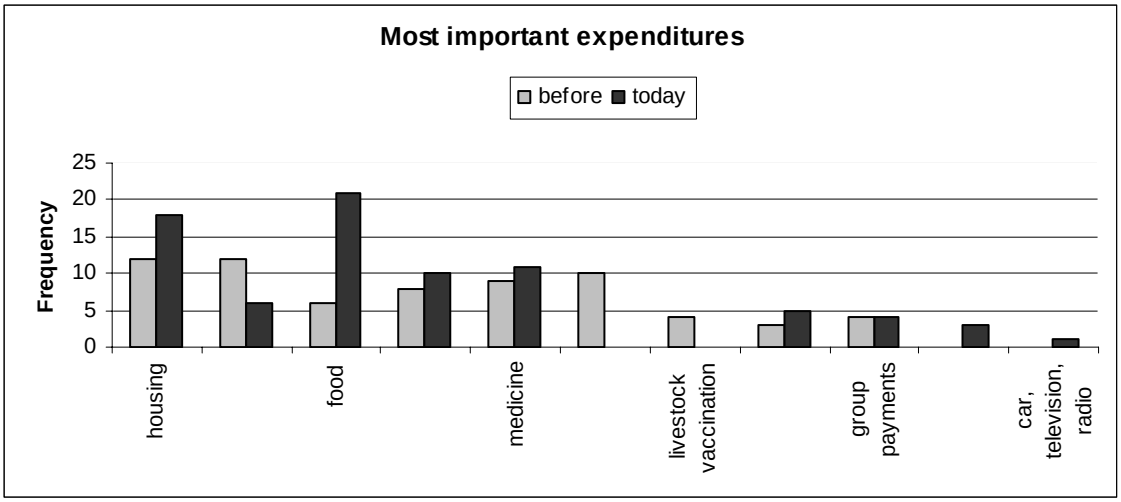
Selling of home made talla, arake or honey, income sources ten years ago, is considered as less important today. The production has decreased for both selling and own consumption. Reasons for the abandonment of beehives, was spraying of DDT several years ago to kill the mosquitoes that transmit malaria but also displaced the bees.

- **Expenditures**

Income from cash crops is generally managed by the male household head, mostly in accordance with his wife. In female headed households it is the women who decided how to spend the income.

Generally, people spend more money on food purchase, housing, education and medical expenses today than ten years ago while expenditures on clothes as well as governmental taxes play a minor role. Since electricity came recently, it was not of importance in the ranking ten years ago, neither expenses on mobiles, television and else.

Figure 2: Importance ranking of expenditures; (mentioned most often on rank 1 to 3)



Source: Household interviews/ranking, 2007.

The result that most of the people placed housing on first rank is connected with the fact that people were often moved to another place of the Kebele during the resettlement and that they could afford iron sheet roofs instead of grass roofs because of their higher income from the cash crops. Housing is seen as a big and important investment that is only made once. Some also put it on first place because it was an expenditure of a high amount of money that they had saved for a long time for exactly that purpose.
When asking whether the households spend more, less or the same amount of their income to purchase food today, the answers were as shown in Table 3: Money spent on food purchase, today compared to ten years ago

Table 3: Money spent on food purchase, today compared to ten years ago

Answer	Frequency	%
More	**24**	**82.8**
Less	4	13.8
Same	1	3.4

Source: Household interviews, 2007.

The reason for the bigger amount spent on food purchase is first because people have less food crops and livestock, thus they produce less themselves to eat, and second that food prices are higher today. That stands in relation with each other because if there are more people who need to buy food from the market but less who sell their food crops there, the competition is higher and following prices on the markets increase.

When people spent money on food purchase ten years ago, it was because they wanted a bigger variety. They bought food they did not produce themselves but that were considered as healthy, like peas and beans. Others, on the contrary, just bought salt and oil. Today people do not have enough food crops so they need to buy even part of their staple food.

4.2. Access to food

4.2.6. General changes in the Kebele's infrastructure

The infrastructure developed to a great extent since the modern irrigation system was constructed and brought a lot of benefits to the Kebele: the Agricultural Office, the Health Centre, a road, electricity, the school, a telephone station, potable water points, flour mills, etc. The money for these improvements was provided both by the Government and the inhabitants of Chano Chalba.

Farmers consider the road as most important innovation because it made the access to the markets easier, merchants came from Addis Ababa and people could sell their crops. That is underlined by the 15 people (53.6%) who abnegated that they would have got the same

income from cash crops ten years ago while 5 people (17.2%) answered in the affirmative and 8 (28.6%) could not give an answer. Explanations when abnegating never included the irrigation scheme but the lack of knowledge about the value of the bananas and the absence of the road, thus the missing merchants.

4.2.7. Markets and market prices

Chano Market takes place every Monday and is the most important market for the people of Chano Chalba. People are coming from the surrounding Kebeles (Chano Mile, Chano Dorga, Kola Shara), the highlands (Dorze, Chencha), Arba Minch and from Lante, to participate in this social event.

The next bigger market people tend to go is in Arba Minch, a 2 hours walk, while the preferred Chano Market is reached within half an hour by all the inhabitants.
The better transportation system to surrounding villages is connected to the new road because people could catch one of the minibuses that cruised between Lante and Arba Minch if they had the necessary money.

Although there is more food available on the markets today, both in quantity and quality, it is also a fact that people get less food for the same amount of money.
Data on retail prices at Arba Minch from 1996 until 2005 were looked up on the most important foodstuffs and show the steady increase.

4.3. Utilization of food

4.3.6. Local food

Ethiopia is famous for "enjera", a flat, pancake like bread made from teff. Enjera is eaten with different kind of sauces, that consist, depending if fasting day or not, in meat or vegetables.
The situation is different in Chano Chalba. There, maize is staple food and they usually make the local bread, or other dishes like porridge, from it. Because of the higher price, enjera made from teff is mostly eaten for holidays, when people afford "better" food.

"Halakko", moringa stenopetala, grows in nearly every garden and contributes a lot to the daily diet. Although it is not among the most preferred dishes of the people it is eaten up to 2 or 3 times a day. Moringa stenopetala is related to the moringa oleifera which has its origin in the North of the Himalaya and was already used as a nutritious supplement by old traditional healers in Asia and Africa to help sickly people. The fruits contain important minerals, vitamins, amino acids and enzymes. It has sufficient amounts of iron, zinc and copper as well as 17 to 18 amino acids that are the most important components for the construction of proteins and the immune system (Schulz, 2006).
Studies in Senegal, Malawi and Tanzania confirmed its positive effect on child growth when consumed regularly and it was diagnosed that it decreased the proneness to cold-infections, worms and certain skin allergies up to 70%.
Moreover, it is of special interest because it stimulates lactation and it was proved that it removes hazardous materials from water (Schulz, 2006).

Usually, people eat the same the whole day or two different kinds of meals, depending whether they are on the field or not. The typical daily meal consists of roasted maize or beans, tea made from the coffee leave, "halakko", served with the local bread or sweet potatoes. All around the day, people eat bananas, mangos and avocados, some fresh made bread and drink water with lemon.

People are used to eat maize, in best case differently prepared, three to four times a day. 12 of the interviewed farmers (41.4%) stated that they can afford to prepare their meals from different kind of ingredients and 3 households (10.3%) eat the same dish all over the day.

4.3.7. Number of meals

The number of meals depends whether people spend the whole day on the field and how far away the field is located. As mentioned before, the banana trees do not need so much treatment as the time-and work consuming cash crops.
That is why 7 (24.1%) of the 29 farmers eat more meals today, 4 (13.8%) less and for 18 interviewees (62.1%) there was no change in number of meals.
When it comes to the choice of food and according to the FAO definition of food security that "...food is acceptable within the

given culture", only 7 people (25%) said that they can eat whatever they want today while it was 21 (75%) ten years ago. The reasons are again connected with the decreased food crop production and the increase of market prices.

4.3.8. Healthiness of food and "food education"

Concerning the healthiness of food, it is difficult to make a clear statement. As already mentioned, people have a bigger variety both from fruits in their garden as well as on the market. Although some products became more expensive, they could be substituted by cheaper ones, and as it turned out during the interviews, people have quite a good knowledge about food preparation, also due to the lessons they got from the Health Centre. It depends on the people how important they consider a healthy diet and how they spend their income.

Although 9 (31%) of the 29 farmers stated to have more times of food shortages today compared to ten years ago, the author thinks differently because all the people seen in the study site did not show any observable signs of under nutrition and, furthermore, if people have enough money to renew their houses, they should have enough money to eat, too. Information of the Health Centre also showed that there are no noteworthy problems with malnutrition and data gathered from the Arba Minch Catholic Church Medical Section showed that the low incidence of malnourished children that existed in former times also decreased. If there are still cases of malnourished children, the UNICEF distributes food and supplements (Alimi) to the Health Centre of the Kebele where women can get it for free.

4.3.9. Health situation, sanitation and nutrition

Reasons that the health situation improved in Chano Chalba was induced by the construction of the potable water pumps as well as by the lessons from the Health Centre on food preparation and water storage, the distribution of mosquito-nets, a family planning model, antenatal examination, free vaccinations and education on topics like hygiene in kitchens, FAO breastfeeding recommendations, toilets, hand washing and cleaning practices.

5. Conclusion and recommendations

- **For the irrigation scheme and its stakeholders**

As can be seen from the results of Chano Chalba, irrigation requires not only governmental support. Management and rehabilitation should be done from a bottom-up viewpoint and pro-poor, so that farmers "own" the irrigation schemes and make it more efficient.

Although it is difficult for a non-irrigation-expert to say whether the dam, that is wished from the farmers of the study site, made sense and provided the necessary water that is needed during dry season or not, it is clear that people would make a bigger effort to sustain the irrigation system. Water losses might also be smaller if the field canals were made the modern way, from concrete.

- **For Chano Chalba and its inhabitants**

Chano Chalba developed step by step and is still moving on since they got the modern irrigation scheme. The road, the Agricultural Office, the Health Centre, electricity etc., all interventions improved the situation of the inhabitants to some extent. Only regarding their food situation, it seems that the positive change has not taken place yet. In contrary, people are somehow restricted in their choice of food. The explanation of this problem from the author's point of view is both the missing education of most of the people as well as the focus on other targeted values of the population.

Although the author would say that the food situation of the study site is not in a bad state, yet no one is starving or suffering from under nutrition and people look quite healthy, there is no doubt that it could be much better.

Regarding the people's values, they have to decide themselves what is most important to them.

Questions pop up when thinking about what would happen if the market for the cash crop banana changed and people lost their (only) source of income. Then there would be a lack of food crops grown, people would not have the necessary money to buy food from the market where prices might rise even more.

A shift to producing again more and maybe different kind of food crops could be helpful, although farmers would have to accept a

smaller income. But as the experiences of some of the interviewees showed, people who plant food crops and cash crops to the same extent are not worse off at all.
Moreover, as already recognized by the farmers and experts, mono cropping has negative impacts on the agricultural area by reducing soil fertility. But first, farmers have to be aware of the problem so that they give more effort and place bigger emphasis on strategies on keeping soil fertility.

The ongoing strategy of family planning to slow down the rapid population growth of the past years might show its success in the coming years and hopefully it will change the situation of landholdings in a positive way.
Also the lessons people got in sanitation and health care practices should show a positive impact in the livelihood of people.

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