Research-inspired Policy and Practice Learning in Ethiopia and the Nile region

Income diversification through improved irrigation in Ethiopia: impacts, constraints and prospects for poverty reduction

Evidence from East Harerghe Zone, Oromia Region, Ethiopia

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List of Acronyms

CISP	Comitato Internazionale per lo Sviluppo dei Popoli / International Committee for the Development of Peoples
DA	Development Agent
ETB	Ethiopian Birr (US$1 = ETB 13.25 in March 2010)
FGD	Focus group discussion
HCS	Hareghe Catholic Secretariat
HH	Household
KI	Key informant
MUS	Multiple-use water services
NGO	Non-governmental organisation
PSNP	Productive Safety Net Programme
TGM	Total gross margin
WUA	Water users' association

Executive Summary

Introduction and background

This Working Paper is based on research conducted in three sites in GoroGutu woreda, East Harerghe Zone, Oromia Regional State, Ethiopia, from January to May 2009. The research examined the potential for irrigation to increase household resilience and contribute to poverty reduction and pro-poor growth through enabling households to diversify incomes – both commercial crop production and new forms of non-farm income generation.

Previous studies have found strong links between irrigation, agricultural productivity and poverty levels, reflecting both direct and indirect effects. Irrigation leads to increases in yields and farm income which can buffer irrigators against risks in their livelihood. However, the feedback mechanisms and indirect effects that link irrigation and poverty reduction are less clear. These include the potential for reinvestment in farming or other income-generating activities, as well as effects on local food and labour markets which also affect surrounding communities and non-irrigating households. Second-order impacts occur if irrigation areas become 'nuclei of growth' which attract investments in other infrastructure and services. Irrigation may have positive or negative effects on inequality; drivers of inequality in the benefits gained from irrigation include distance from the irrigation source and disparities in landholding size and education.

Income diversification is the process by which households widen their income base by adopting new economic activities. For rural agricultural households, this includes: agricultural diversification (producing a wider variety of crops or livestock or their products); diversification from subsistence into commercial activities; and diversification from agriculture into nonfarm activities. Income diversification may be driven by the desire to increase income in order to become more food-secure, upgrade housing, educate children, accumulate assets or otherwise improve the household's standard of living (pull factors). In the most successful cases, income diversification creates an upward spiral of increased household incomes and reinvestment in higher value activities. Such a spiral would be growth-promoting and poverty-reducing. In contrast, income diversification may occur as a survival response to severe shocks and stresses – for example when members of poor farming households are forced to migrate in search of wage labour or sell assets because their crops fail or they face a sudden need for extra income (push factors).

Small-scale irrigation is a policy priority in Ethiopia for the alleviation of rural food insecurity and poverty. Income diversification is proposed as a climate adaptation strategy in Ethiopia's NAPA (National Adaptation Programme of Action).

Findings

In the three sites studied, farmers reported substantial benefits from irrigation. They reported increase income (mean reported gain of 20%, with some gaining up to 400%) which in turn enabled them to build up their assets, buy more food and non-food household items, educate their children, and reinvest in further increasing their production by buying farm inputs or livestock. Nutritional benefits were reported due to both increased expenditure on food and the availability of a greater variety of crops in the local area, particularly fruit and vegetables. Social benefits were also reported, mainly by poorer irrigators who felt that their standing in the community had gone up. They also said that the extra income had reduced conflict within the household.

The introduction of improved irrigation has reportedly increased the asset holding of households. Households also reported a significant increase in investment in livestock and said that they are better able to meet the costs of living since the introduction of irrigation. It therefore appears that irrigation can make a significant contribution to increasing household resilience and buffering livelihoods against shocks and stresses. Some households reported that they have also been able to build up savings, buy costly new equipment and achieve quite a transformation in their livelihood.

These findings suggest that irrigation could be highly beneficial in reducing poverty and promoting growth. However, the benefits are very unevenly distributed. Focus group discussions with different wealth groups indicated that the better-off had benefited more from irrigation, because they had more land and labour, compared with poor and female-headed households for whom these are significant constraints. Poor households in the study areas routinely hire out labour for vital income (according to the criteria for determining wealth groups set by the community) which probably contributes to their lack of available labour to work on the farm. In some cases the poor group reported that the cost of water was unaffordable. The poor also reportedly suffer more when water shortages occur, as they are less likely to be able to access alternative sources than the better-off who can mobilise their resources to do so, for example by buying a pump. This is consistent with findings in the literature from Asia which show that in a context of land inequality irrigation is likely to increase inequality (Hussein & Hanjra 2004). The findings also suggest that high inequalities in labour availability (including ability to hire labour) may have the same effect.

That said, there are also substantial differences within wealth groups in terms of the amount of income reportedly gained from irrigation. The explanations given were: different amounts of water received for irrigation; different levels of knowledge about improved agricultural practices; and different amounts of effort put in to farming. Inequities in water distribution, due to farm locations and mismanagement by irrigation committees, emerged as a serious problem in all sites, reportedly preventing many households from making the gains expected from irrigation.

Lack of enough knowledge of irrigation management and improved agronomic practices was mentioned as a constraint even though all farmers received training in these areas at the time of irrigation development. There is also evidence that people have learned by observing the practices of innovative farmers in their village, and some more risk-averse households waited to adopt new crops until they saw the benefits to their neighbours.

Even the better-off irrigators reported that they faced serious constraints and risks in earning a reliable income from their new crops. Climate and pests have serious impacts on production, and these problems are exacerbated by reported gaps in the availability of improved farming inputs (pesticide, fertiliser and improved seeds) in local markets. On the marketing side, it was reported that farmers face low and unpredictable prices for their new crops. A study of the potato market chain showed that this is rooted in the power imbalance between the producers – who produce in small quantities, lack good market information and cannot access large market centres because of the small scale of their production and lack of transport – and the assemblers who buy from them. Because there are so few assemblers operating at such a local level and buying directly from small farmers, they are able to fix prices. The problem is exacerbated by a lack of facilities for producers to store crops and assemble them for bulk sales. This situation significantly limits the benefits which farmers stand to gain from diversifying into marketable crops. Although this problem was identified in one particular market chain, it is likely to apply both to other crops and in other parts of the

country where producers face similar conditions. In fact these communities are relatively well connected in terms of roads (though they still lack affordable means of transport), so the problems may be more severe elsewhere.

There is also evidence that reinvestment is taking place into agriculture and livestock, which should increase prospects for further income generation. However, reliance on agricultural growth and agricultural strategies alone as the primary vehicle for rural poverty reduction may not be a long-term option. Factors such as very small land-holdings, resource degradation and the huge gaps in infrastructure and market access in rural areas, means that agriculture is already unable to support all of the rural population, leaving many reliant on the Productive Safety Net Programme (PSNP) or food aid. It is therefore critical to understand whether irrigation and agricultural growth will trigger growth in the rural nonfarm economy and enable people to move out of agriculture into new, high-earning and more sustainable livelihoods. This study cannot answer this question, but does provide some indications of the role which irrigation might play. Many households reported that they have spent the additional income from irrigation on educating their children, which in decades to come could enable them to move out of agriculture, but only if other jobs are available. Irrigation seems to have led to increased expenditure on fertilisers, pesticides and a variety of non-farm items. If this took place on a large scale it could drive growth in the production or retail of these goods in the area. However, for this to happen serious gaps in the connectivity between rural areas and urban centres will have to be addressed (by investing in transport, communications and market development) and services such as credit facilities will have to be supported to promote enterprise.

Recommendations

For irrigation to contribute effectively to poverty reduction and growth through supporting income diversification, the right enabling environment is needed. Creating an enabling environment requires clear understanding of the existing production and marketing system, and of the constraints and opportunities faced by both producers and other actors. The enabling environment includes management of the water resource, support and extension services for farmers, and marketing infrastructure and institutions that can enhance the profitability of irrigated agriculture for small farmers. In addition, water must be distributed according to transparent and equitable rules, to ensure that more farmers share the benefits of irrigation.

At the same time, parallel investments must be made to promote enterprise development in the non-farm economy. Not all farmers can transform their livelihood through irrigation, as this study has shown, and in some areas declining water availability and land holdings will mean that irrigation is not a viable long-term strategy. Efforts are needed to ensure that agricultural growth, which will be achieved in part through expansion of irrigation and measures to enhance the efficiency and profitability of irrigated agriculture, leads to growth in the rural nonfarm economy over the coming decades. Detailed recommendations are made in the full working paper relating to: equitable and sustainable management of irrigation water; increasing production; marketing infrastructure and institutions; addressing equity concerns; and achieving medium to long term impacts.

1 Introduction

This Working Paper is based on research conducted in GoroGutu woreda, East Harerghe Zone, Oromia Regional State, Ethiopia, from January to May 2009. The research examined whether and in what ways improved irrigation has affected household income profiles and brought livelihood benefits through supporting income diversification, and considered the prospects for this to contribute to poverty reduction and pro-poor growth. Motivations, benefits and constraints to diversifying incomes were explored for different groups (irrigation users of different wealth levels and from female-headed households, and non users). The aim was to assess the potential of investments in improved irrigation to reduce poverty and vulnerability through income diversification, and to identify complementary investments that would be needed. An improved irrigation scheme is defined here as one which includes storage at community-level, a distribution system with lined primary canals, and a set of rules for management and allocation of irrigation water.

Previous RiPPLE research in East Harerghe provided evidence of the strong livelihood outcomes of improved access to water (for domestic and productive uses) in terms of both income and food security (Hagos et al, 2008; Adank et al, 2008; Tolossa & Tafesse, 2008). Multiple use services providing for irrigation and livestock as well as domestic water have been shown to offer significant benefits which outweigh their additional costs. Yet water schemes are rarely planned, designed and implemented in ways which enable all the livelihood benefits of improved access to water to be realised. Important questions remain as to how investments in productive water supply can best help households to build resilience, increase incomes and improve their livelihoods.

Ethiopia has high levels of chronic poverty, vulnerability and food insecurity, and national policy prioritises investments in water to tackle these. Ethiopia's growth strategy centres on agriculture, yet this growth is highly constrained by risk and vulnerability and inadequate access to critical assets including land and water (Slaymaker et al, 2007). Given declining landholding sizes, extensive land degradation and the likelihood of increasing rainfall variability under climate change, a shift away from agriculture is likely to be needed in the medium term to support livelihoods and enable continued growth. However elsewhere in the world agricultural growth has preceded and fed the growth of non-agricultural sectors, and investments in intensifying agriculture may be needed to kick-start such a shift. The nature of these interactions and pathways, and therefore the policy choices that might be more appropriate to support rural growth and development, are highly context-specific.

Small-scale irrigation is a particular policy priority to alleviate rural food insecurity and poverty. Irrigation enables households primarily engaged in subsistence agriculture to diversify production to new types of marketable crops such as fruits and vegetables and increase production for market, which should increase their income and resilience. Income diversification is proposed as a climate adaptation strategy in Ethiopia's NAPA (National Adaptation Programme of Action). It is possible that increased income from irrigation could support subsequent diversification into new non-farm activities, for both irrigators and non-irrigators.

This research examines the potential for irrigation to increase household resilience and contribute to poverty reduction and pro-poor growth through enabling households to diversify incomes – both crop diversification and new forms of non-farm income generation.

The remainder of section 1 briefly review background literature on linkages between irrigation, income diversification and poverty and introduces the research questions and analytical framework of

this study. Section 2 describes the study sites and methodology adopted. Section 3 presents discusses the results, and conclusions and recommendations are set out in Section 4.

1.1 Literature on irrigation-poverty linkages

There are strong links between irrigation, agricultural productivity and poverty levels, reflecting both direct and indirect effects (Comprehensive Assessment of Water Management in Agriculture, 2007: chapter 4). The direct effects of irrigation on yields and farm income are well understood. However, the feedback mechanisms and indirect effects that link irrigation and poverty reduction, as well as the effects of irrigation on inequality, are less clear, even though these secondary benefits may be more important in terms of poverty reduction (Bhattarai et al, 2002).

1.1.1 Direct benefits of irrigation

Irrigation enables farmers to increase crop production and achieve higher yields, and reduces the risk of crop failure if rain fails (Hussein & Hanjra, 2004). Irrigation also multiplies the positive effect of other inputs such as fertilisers and pesticides on crop yields (Comprehensive Assessment of Water Management in Africa, 2007). In addition – and of particular relevance to subsistence producers in rural Ethiopia – it enables small farmers to diversify production from staples to include high value crops such as fruits, vegetables and cash crops which can be sold. Increased production of fruit and vegetables also improves the household's own nutrition.

There are also direct benefits for non-irrigators. Food availability and affordability typically increase when irrigated agriculture expands and more reliable production helps to stabilise food prices. New employment opportunities arise in farming, and also in the wider rural economy as increased farm income leads to greater demand for both agricultural inputs and nonfarm goods and services (Hussein & Hanjra, 2004; Bhattarai et al, 2002; Delgado et al, 1997).

Irrigation can thus buffer both irrigators and non-irrigators against risks in their livelihood, preventing or reducing the need for last-resort coping strategies such as sale of assets or high-cost borrowing (Lipton & Litchfield, 2003). Given the precariousness of rainfed agriculture and high frequency of drought, with disastrous impacts for millions of people, irrigation clearly has a role to play in securing rural livelihoods and improving food security in Ethiopia.

However, the poor, particularly the landless, do not necessarily benefit much from investments in irrigation in the short term (see Van Den Berg & Ruben, 2006, on Ethiopia; Hussain & Hanjra, 2004, on Asia). Where transport or storage costs are high, lower food prices in a market served by irrigated areas are not likely to spread beyond nearby areas to benefit the poor more widely (Lipton & Litchfield, 2003). Irrigation may also have adverse impacts for the rural poor. Net producers reliant on rainfed agriculture suffer from falling food prices and competition with higher-yielding irrigated farms, while households reliant on agricultural wage labour can lose out if labour is displaced by intensification and mechanisation (Van Den Berg & Ruben, 2006).

1.1.2 Second-order impacts

Irrigation areas have potential to become 'nuclei of growth' which are attractive for inward investments in other infrastructure and services such as banking to facilitate this growth. This upward growth spiral has taken place in Asia (Hussain & Hanjra, 2004), with a positive effect on poverty levels. However it is not evident that this is happening at a significant scale in Ethiopia. The extent of this multiplier effect varies between regions and economies depending on factors including the

connectedness of the rural economy, communications, transport, population density and levels of demand for different products and services. The meso-level multipliers from irrigation have been found to be low in Africa, however, for a number of reasons, namely: irrigation projects tend to be smaller-scale; population density is less which makes it harder for rural nonfarm producers to compete with larger urban rivals; and consumption of non-food products is relatively low (Lipton & Litchfield, 2003). The lack of communication and transport infrastructure connecting irrigation areas with the wider rural population and urban centres is also a big constraint in Ethiopia.

A study conducted in Tigray region, Ethiopia, found little evidence of spillover effects of irrigation onto rural labour markets, the nonfarm economy or employment in irrigation programmes (Ven Den Berg & Ruben, 2006). However the irrigated area in this study was small, and irrigation on a larger scale might be expected to have a greater impact on the local economy. Further work is needed to understand the meso-level effects of irrigation on rural poverty.

1.1.3 Equity issues in irrigation

Empirical studies show that irrigation is usually associated with higher levels of income equality among households than are found in areas of rainfed agriculture, suggesting that investments in irrigation are often progressive (Hussein & Hanjra, 2004; Bhattarai et al, 2002). Even where the poor are not able to take part in irrigation, the spillover benefits such as employment may even out the overall effects on income (Lipton & Litchfield, 2003). The evidence is mixed, however. Van Den Berg and Ruben's (2006) study in Tigray region, Ethiopia, found that small-scale irrigation supported growth with a neutral effect on inequality, while a range of studies in Asia found that in areas where land inequality is high, irrigation deepens inequality (Hussein & Hanjra, 2004), and that disparities in education were found to affect returns to irrigation in Vietnam (Van de Wallle, 2000). Measures to ensure inclusion of the poor in irrigation schemes (such as equitable access to land and water) and to enable them to succeed in using irrigation to shift to higher-value production (such as access to markets, training opportunities and improved agricultural technologies) can help to ensure that irrigation reduces rather than exacerbates wealth inequalities.

An important source of inequality associated with irrigation is head-tail inequity in access to irrigation water. Farms at the 'tail'-end (far from the water source) usually receive less water than those close by at the 'head'-end, and lose out at times of water scarcity. The disparities in water received may be high, with serious implications for the productivity of tail-end farms; in some systems, head-enders are able to irrigate three times more often than tail-enders (*ibid*). Resolving this problem is not easy, but Bhattarai et al (2002) suggest various measures that can be taken to improve equity of access and/or compensate tail-end farmers. These include: definition of clear water rights and entitlements, with enforcement; integrated use of rain, canal and groundwater; adjustment of irrigation operation and maintenance costs to reflect level of water use and/or benefits gained; targeted additional support for tail-end users e.g. credit for extra irrigation equipment; and improving water storage and delivery structures.

Finally, irrigation is associated with a number of negative externalities and it is important to ensure that these do not disproportionately affect the poor. The main negative impacts are on health (irrigation ponds and reservoirs have been shown to increase incidence of water-related diseases (Ersado, 2005)) and the environment (water losses, waterlogging and salinisation of soils (Lipton & Litchfield, 2003)). Many of these impacts affect entire communities, both irrigators and non-irrigators.

For all these reasons, it is critical that equity issues are tackled head-on from the start of irrigation development, to ensure that poor farmers, non-irrigators and tail-end water users are included in the possibilities for growth and poverty reduction which irrigation can offer. This requires management institutions and norms which prioritise equity, are able to resolve conflict between water users particularly at times of water shortage, and do not allow capture of the resource by powerful individuals or groups.

1.2 The significance of income diversification for rural livelihoods

1.2.1 Defining income diversification

Income diversification is the process by which households widen their income base by adopting new economic activities. For rural agricultural households, this includes: agricultural diversification (producing a wider variety of crops or livestock or their products); diversification from subsistence into commercial activities; diversification from agriculture into nonfarm activities.

In some of the literature the term income diversification is used to refer only to the last of these, but here we include them all. The feedback and spin-off effects between these three types of diversification are of particular interest, to identify interventions or sequences of interventions which are most likely to support sustainable poverty reduction and growth.

1.2.2 Why do households diversify income sources?

Income diversification can be driven by different motivations. The desire to increase income in order to become more food-secure, upgrade housing, educate children, accumulate assets or otherwise improve the household's standard of living are 'pull factors'. In the most successful cases, income diversification creates an upward spiral of increased household incomes and reinvestment in higher value activities. Such a spiral would be growth-promoting and poverty-reducing.

In contrast, income diversification may occur as a survival response to severe shocks and stresses – for example when members of poor farming households are forced to migrate in search of wage labour or sell assets because their crops fail or they face a sudden need for extra income (Barrett et al 2006; Ellis, 1998). These drivers are 'push factors'. When undertaken as a last resort, income diversification is more likely to undermine than build household resilience (Niehof et al, 2004). New activities adopted in these circumstances usually have low returns and high costs, and efforts should be made to avoid "push diversification" by building the resilience of poor households.

This study focuses on pull-driven income diversification. Understanding the positive incentives which encourage farmers to explore new sources of income when irrigation offers them an opportunity to do so, the benefits which they gain from doing so and the constraints they face in successful diversification, will help to draw out the potential role of irrigation in achieving beneficial income diversification and identify the kind of interventions needed to support this. However, there are grey areas between push and pull-driven circumstances (for example, income diversification as an ex ante risk reduction strategy by chronically poor households) and the drivers and outcomes of income diversification are likely to be dynamic and multi-faceted.

1.2.3 Understanding different incentives for diversification

The economic incentive for diversification to different new activities is a function of the prices that can be obtained for new crops/products/services relative to existing activities, the perceived stability

of these prices, the cost of the engaging in different activities and any risks associated with their production, transport, storage or marketing. Poorer households tend to be motivated by reducing risk and smoothing incomes, while better-off households are motivated by a desire to increase incomes and accumulate assets, and are willing to run higher risks in order to do so (e.g. Reardon et al, 2006; Niehof et al, 2004).

Reardon et al (*ibid*) also note that when poor households increase their income through diversification they are less likely to be able to accumulate assets and instead often stay in a cycle of 'short-run recovery strategies', in contrast with better-off households which are more likely to profit enough to reinvest and make lasting improvements to their livelihood. This implies that income diversification may help in meeting the basic livelihood needs of poor households and reducing their vulnerability, which is a great benefit in itself, but that something else is needed to enable them to transform their living conditions and escape poverty. It also raises important concerns about equity, as interventions to support income diversification will deepen inequality if they benefit the better-off more the poor (Block and Webb, 2001; Holden et al, 2001). This needs to be borne in mind by those promoting income diversification as a strategy for climate adaptation or poverty reduction.

1.2.4 Livelihood impacts and feedback effects

How additional income gained from diversification is used depends on household priorities. For those earning small amounts of income only, meeting basic household needs for food and other expenses such as healthcare is usually the priority. With a little more income, households often make improvements in their standard of living by upgrading their dwelling in quality or size (e.g. constructing a new roof or adding a second building), buying more and better quality food, or buying labour-saving equipment or livestock (e.g. donkeys to transport water or draft oxen). All of these investments are likely to improve the overall health and welfare of the household. Households may also invest in livestock as a key asset for further insurance and income-generation. Another priority is often children's education. Educated children are likely to obtain better-paid jobs, perhaps in urban areas, and may achieve a standard of living not possible for their parents. Investment in children's education can also be seen as a form of income diversification by parents as children, once employed, may be expected to send remittances (Reardon et al, 2006).

Income may also be reinvested in productive activities, such as purchase of land, equipment or other inputs such as fertilisers, particularly where credit markets are lacking (Reardon et al, 2006; Holden et al, 2001). Diversification can thus be a means to support a more productive, lucrative agricultural livelihood (Ellis, 1999). In some cases the reverse pattern is seen; agricultural intensification may be undertaken first to generate the capital necessary for households to diversify into nonfarm activities and move out of agriculture. However, when income diversification is undertaken out of the need to cope with agricultural risks, it can compromise agricultural intensification (*ibid*; Delgado, 1997).

Whether diversification, intensification or a combination of the two is the best strategy for a rural household depends on many factors. However, in areas where the natural resources that underpin agriculture are becoming scarce or degraded, intensification may not be a viable strategy in the long-term and it will be important to explore how income diversification can reduce dependence on agriculture.

1.2.5 Constraints to income diversification – why some win and some lose

Households will be unable to diversify if they lack the assets needed for new activities (or deem the opportunity costs too high), including the necessary skills or knowledge. Irrigation provides access to one key asset for farm diversification: water. However, successfully using irrigation to diversify and increase incomes requires access to other assets such as labour, finance to buy inputs and water itself, and access to the necessary technologies, as well as the right skills. Assets that may be needed at household level also include less tangible factors such as knowledge, skills, social standing and family support. Important meso-level assets include market infrastructure, roads, community irrigation schemes, insurance and credit schemes and social organisations. To successfully generate income from an activity, access to market information and infrastructure is essential.

More lucrative forms of diversification typically have higher costs and demand more skill than low-return activities, meaning that poor households are often barred from high-value options, a problem exacerbated by the absence of credit markets (Barrett et al, 2000; Reardon et al, 2006). It has been shown that asset poverty is a barrier to the adoption of nonfarm activities, including in Ethiopia (e.g. Holden et al, 2001). The nonfarm activities available to poor households are likely to offer low returns and may be risky and insecure, such as wage labour and petty trading. This is borne out by findings from various countries that intensification or commercialisation of agriculture and the resulting higher incomes enable diversification into nonfarm activities, but very poor households are likely to remain stuck in subsistence production (Orr 2001, cited in Niehof et al, 2004 (on Malawi); Delgado, 1997). The better-off also tend to have better access to market opportunities which enhances the income-generating potential of new activities. They have more livestock to transport goods, money to spend on transport and (usually) more labour to send to market or to collect market information. This suggests that poor households need other opportunities to build up their assets and skills, which requires investments in education, health, water and sanitation, roads, electricity, credit facilities, information availability and market institutions.

1.2.6 Support services

Support services can help poor people to successfully diversify incomes in three ways: (a) increase their capacity (assets or skills) to undertake the activity; (b) reduce the transaction cost of the activity; or (c) increase the profitability of the activity. Increasing the asset base of poor households means investing in social protection measures and expanding access to credit in rural areas, and possibly activity-specific subsidies, as well as supporting effective institutions to mediate access. Skills can be enhanced by training and extension support. Reducing the transaction costs of activities could mean directly subsidising inputs for poor households but is also about improving their access to market by investing in roads and market infrastructure, while increasing profitability means taking measures to enhance access to higher-paying markets (such as major towns and even export markets) and fair prices for producers. The latter could include supporting farmers' cooperatives, contract farming or other such approaches.

1.3 Research questions

The study's overarching research question was:

What potential do investments in irrigation have to increase resilience and promote pro-poor growth through enabling income diversification by rural households, in the three communities studied? What additional investments are needed?

Detailed research questions applied to the three study communities were:

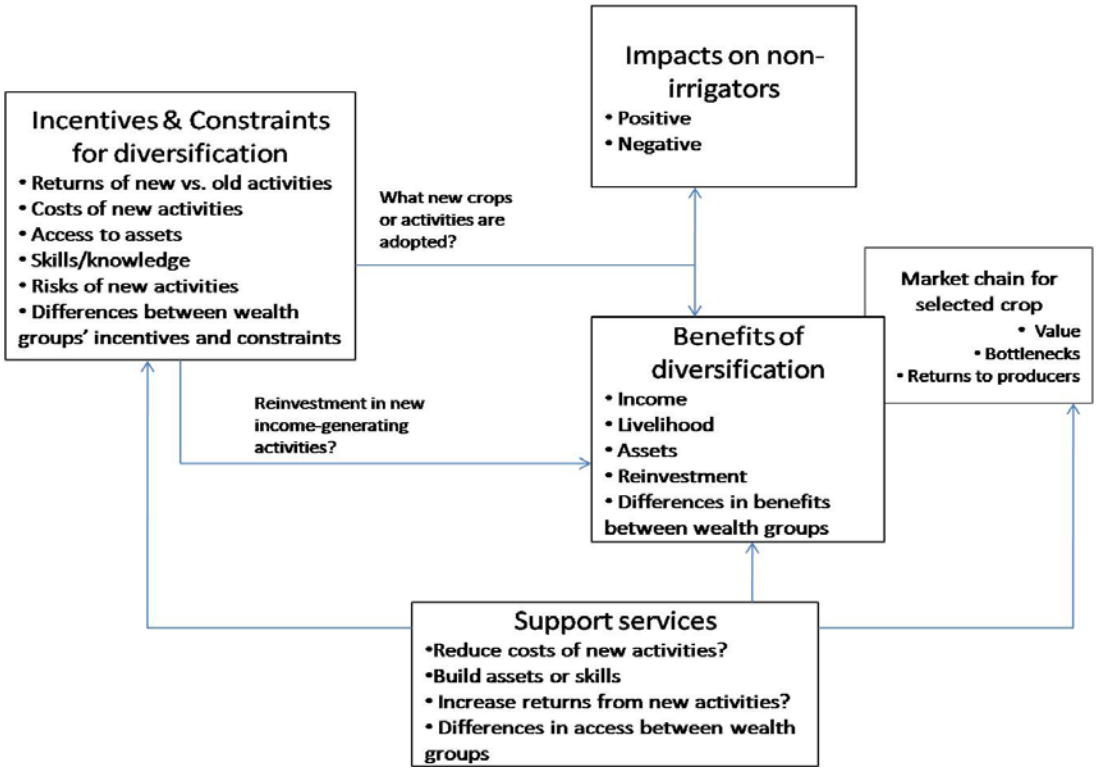
- Has irrigation enabled diversification into new economic activities (a) on-farm and (b) into nonfarm activities, for beneficiary and non-beneficiary households of different wealth levels, and through what pathways?
- Why have households sought to diversify their income sources?
- What constraints do households of different wealth groups face in successfully adopting new activities, and how far do available support services enable diversification?
- What income gains and other livelihood benefits have households of different wealth groups gained from diversifying income sources? Is there reinvestment in productive activities?
- What impact has the development of irrigation in the community had on households which do not irrigate?
- How could market chains for selected products be improved to enhance the profitability of new activities for small producers and promote pro-poor growth?

While research was conducted in the three selected sites only, many of the findings are expected to have broader relevance within Ethiopia and, perhaps, elsewhere in the region where households face similar constraints.

1.4 Analytical flow

Drawing on the theory outlined above, the analytical flow as shown in Figure 1.1 was adopted:

Figure 1.1: Analytical flow

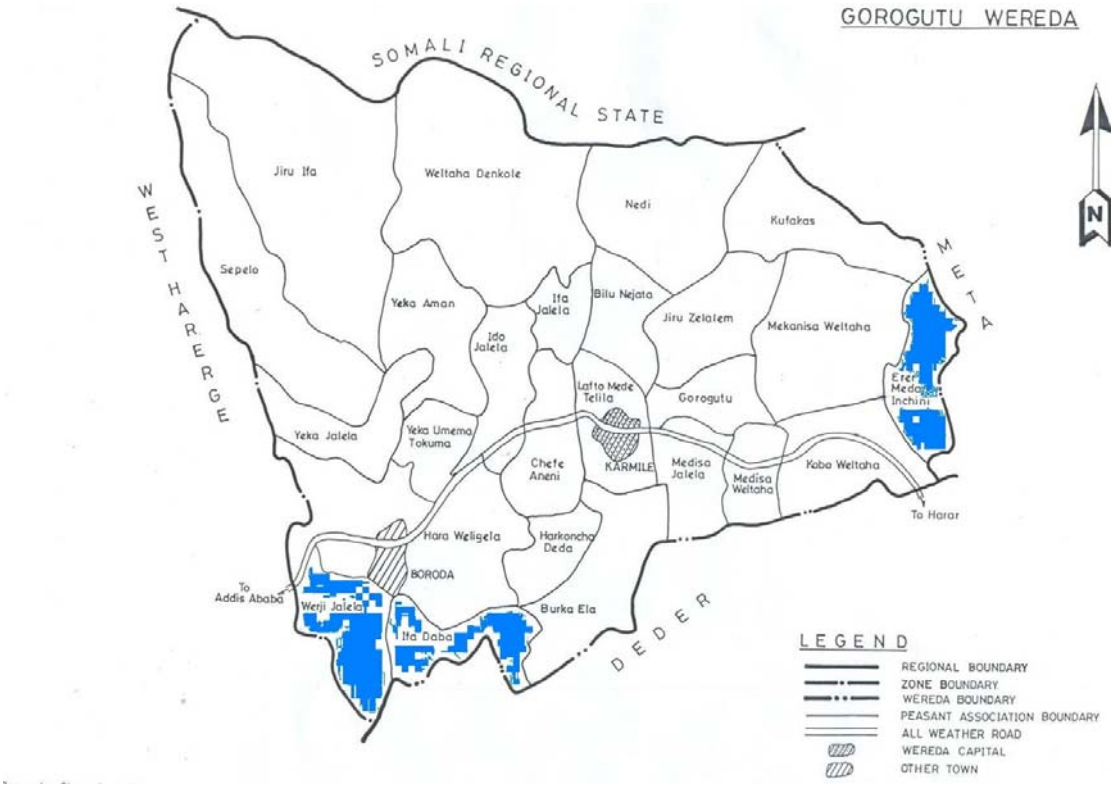


2 Research sites and methods

2.1 Study sites

This study was carried out in Gorogutu woreda (district), East Harerghe Zone, Oromia region. Gorogutu is a predominantly rural woreda lying about 115km west of Harar town, with a range of agro-ecologies: lowland (37% by area), mid-highland (51%) and highland (11%). Three improved irrigation sites were selected to represent these three agro-ecological zones. Only irrigation schemes which had been in continuous operation for at least the last three years (preferably longer) were considered. The selected sites were Werji Jalela (highland zone), Ifa Daba (mid-highland zone) and Erer Mede Enchini (lowland zone). These are shown in Figure 2.1.

Figure 2.1: Map of Gorogutu woreda showing study sites



2.1.1 Werji Jalela (highland)

Werji Jalela kebele lies 5km from the nearest town, Boreda. The improved irrigation scheme was constructed in 2003 by the non-governmental organisation (NGO) Harerghe Catholic Secretariat (HCS) as part of a food security programme for drought-affected communities. The water source is a spring with a discharge capacity of 8l/s. The scheme consists of a cemented high storage pond with a capacity of 230m^3, a 700m long primary canal, and distribution to farms by earthen canals. It cost 185,000 ETB (Ethiopian Birr) and supports irrigation of 24ha of land benefitting 170 households from two villages (Gende Yuye Roba and Gende Orea) out of ten in the kebele. HCS provided training in water management and financial management to the water user association (WUA) committee, and training in agronomic practices to the beneficiaries.

The community developed the criteria shown in Table 2.1 below to categorise the 170 beneficiary households (HHs) into better-off (17%), middle (33%) and poor (50%) income groups.

Table 2.1: Wealth ranking criteria - Werji Jalela

Ranking criteria	Well-off (29 HHs)	Middle (56 HHs)	Poor (85 HHs)
Livestock holding (number)	≥ 4 Oxen ≥ 3 milking cows ≥ 10 sheep > 5 goats > 5 Donkeys > 10 Chicken > 10 traditional beehives	2 – 3 Oxen 2 Cows 7 – 9 Sheep 1 – 5 Goats 1 – 5 Donkeys 5 – 10 Chicken 5 – 10 Traditional Beehives	No oxen (use others' oxen for ploughing) 1 Cow 0 - 1 Sheep 0 – 1 Goat No donkey 1 – 4 Chicken No beehive
Land Holding	> 6 Timad[1]	3 – 5 Timad	1 – 2 Timad
Food Security	Food secure all year Surplus income	Food secure all year No surplus income	Food secure for 3 months 9 months food gap
Housing	Mud house with corrugated iron roof Separate houses for family and livestock	Mud house with corrugated iron roof 1 house with part for family, part for livestock	Mud house with grass roof Small size, livestock and family live together
Labour	Hire labour occasionally	Don't hire labour	Earn from selling labour
Other income sources	Sale of trees	Sale of trees	None

Source: own survey, 2009

Figure 2.2: View of night storage tank, Werji Jalela

2.1.2 Ifa Daba (mid-highland)

Ifa- Daba kebele is also 5km from Boreda, the nearest town. The irrigation scheme here was also constructed by HCS, in 2004, with the objective of improving food security. The scheme source is a spring with a discharge of 1.44 l/s. The scheme consists of a cemented night storage pond to capture

[1] A Timad is a traditional land measurement unit equivalent to 0.125 ha.

night flow from the spring, with a capacity of 175m³, with 650m of primary canal and distribution by earthen canals. The total cost was 175,000 Birr. The scheme was intended to irrigate 5.75ha of land and benefit 46 households. However, it is now used by 121 households in two villages (out of 13 in the kebele). HCS provided training in water scheme management and financial management to WUA committee members, and training in agronomic practices to beneficiaries.

The community developed the criteria shown in Table 2.2 below to categorise the 121 beneficiary households into better-off (18%), middle (29%) and poor (53%) income groups.

Table 2.2: Wealth ranking criteria – Ifa Daba

Ranking criteria	Well-off (22 HHs)	Medium wealthy (35 HHs)	Poor (64 HHs)
Livestock (in Number)	≥ 2 Oxen ≥ 2 milking cows ≥ 5 sheep ≥ 5 goats > 2 Donkeys > 9 Chicken > 2 traditional beehives	1 Ox 1 Cows 3 - 4 Sheep 3 - 4 Goats 1 Donkey 5 – 9 Chicken 1 - 2 Traditional Beehives	No ox but use others' oxen for ploughing 1 Cow 0 - 2 Sheep 0 – 2 Goat No donkey 0 – 4 chicken No beehive
Land Holding	> 6 Timad	3 – 5 Timad	1 – 2 Timad
Food Security	Food secure all year Surplus income	Food secure for 9 months Borrow money and sell assets	Food insecure for > 6 months (food gap)
Housing	Mud house with corrugated iron roof Separate houses for family and livestock Separate latrine & kitchen	Mud house with corrugated iron roof 1 house with part for family, part for livestock	Mud house with grass food Small size, livestock and family live together
Labour	Hire labour occasionally	Don't hire labour	Earn from selling labour
Other income sources	Retail trade	Sale of trees	Sale of sand, stone

Source: own survey, 2009

Figure 2.3: View of night storage tank, Ifa Daba

2.1.3 Erer Mede Enchini (lowland)

Erer Mede Enchini is 21km from the capital town of Gorogutu woreda, Karamile. The improved irrigation scheme was first constructed by the Oromia Regional Water, Mines and Energy Bureau in 1996. The water source is a spring with a discharge capacity of 250l/s. The original plan indicates that the scheme would irrigate about 100ha of land by gravity and benefit 600 households in the area. The scheme has 3 primary canals leading to secondary and then 40 tertiary canals to distribute water to irrigation users. According to the operational design, the scheme was designed to irrigate 88 farm units per day using 6 tertiary canals. With this distribution rate, all beneficiaries could irrigate their farm within one irrigation interval of seven days.

The Bureau expanded the project in 2004 and increased its irrigation capacity from 100 ha to 130 ha, increasing the number of beneficiaries to 1066 households. Despite this, a significant number of farmers still remained unable to access irrigation water due to structural and topographical problems. As a result, in 2005 the international NGO the Committee for the Development of Peoples (CISP in its Italian acronym) expanded the scheme further for use by upstream households by installing power pumps and generating sets, and constructing a water storage facility with a holding capacity of 1200m^3. CISP also put in place water transport structures (pipelines and canals) by organising farmers into a WUA cooperative. CISP also provided training for the beneficiaries and WUA committee members in water scheme management, financial management and agronomic practices.

The new motorised irrigation scheme was designed to irrigate 33ha of land, and was handed over to the WUA with the aim of improving the livelihoods and food security of 100 to 200 households. The system is currently irrigating 166ha of land and is used by 1266 beneficiaries in eight villages upstream and downstream of the source (Ginge, Feres and Molle upstream, and Bishankello, Gultu, Abdi, Umour and Weliye downstream). Upstream users irrigate using the motorised system, while downstream users use furrow irrigation through a mix of gravity flow and motorised pumping.

The community developed the criteria shown in Table 2.3 below to categorise the 1266 beneficiary households into better-off (9%), middle (31%) and poor (60%) income groups.

Figure 2.4: Partial views of Erer Mede Enchini irrigation scheme

Table 2.3: Wealth ranking criteria – Erer Mede Enchini

Ranking criteria	Well-off (113 HHs)	Medium (398 HHs)	Poor (759 HHs)
Livestock (in Number)	≥ 2 oxen ≥ 2 milking cows 10 -20 goats ≥2 Donkeys ≥10 Chicken ≥ 6 traditional beehives	1 Ox 1 Cows 5 - 9 Goats 1 Donkey 5 – 10 Chicken 1 – 5 Traditional Beehives	No Ox but use others' oxen for ploughing 1 Cow 0 - 2 Sheep 0 – 2 Goat No donkey 0 – 4 chicken No beehive
Land Holding	> 5 Timad	1 – 4 Timad	0 – 1 Timad
Food Security	Food secure all year Surplus income	Food secure for more than 6 months (borrow money and sell assets to fill gap)	Food secure for 3-4 months Food insecure for 8-9 months
Housing	Mud house with corrugated iron roof Separate houses for family and livestock Separate latrine and kitchen	Mud house with corrugated iron roof 1 house with part for family, part for livestock	Mud house with grass roof Small size, family and livestock live together
Labour	Don't hire labour	Don't hire labour	Earn from selling labour
Other income sources	Cattle fattening Oxen trading	Fattening and sale of Oxen	Sale of fire wood Safety net programme
Assets	Motor pump House in nearby town Retail shop	2- 3 oxen bought for by credit for selling	

Source: own survey, 2009

2.2 Research methods

The study collected both quantitative and qualitative data related to: household demography and educational status; land tenure, livestock and crop production; household income, asset ownership and expenditure; access to extension and credit services; marketing; and food security situation before and after the improved irrigation schemes were introduced. Secondary data were collected from the Central Statistical Agency, woreda and zonal level government offices and implementing NGOs in the woreda as well as existing studies. Primary data were collected both at the household and community level using the following methods:

Wealth ranking was conducted to categorise the irrigation scheme beneficiaries to different wealth categories, using participatory wealth ranking methods where key informants from the community set the wealth criteria.

Focus Group Discussions (FGDs) were held with members of each wealth group of beneficiaries, female-headed household beneficiaries and non-beneficiaries in each study site. In addition a mixed group interview was conducted to triangulate findings. Five FGDs were conducted in each site, one with each of the above named groups, totalling 15. The FGDs were aimed at eliciting a range of information on: the sources of income for each wealth category and how these have changed since the water intervention; how and why households were able to benefit from the intervention; what

costs and difficulties they have faced in moving to new income sources; what kind of support services they have access to; how they market their products and what constraints they face in doing so. Moreover, the FGDs were planned to help identify options for diversification and possible interventions at all levels to support market penetration by poor households.

Key informant (KI) interviews were conducted with community leaders, implementers of water investments, providers of support services, and the chairmen/secretaries of irrigation management committees and farmer cooperatives. These interviews focused on how the services are designed and managed, the costs to implementers and users of the services, the decision-making process in terms of who was included/excluded from services, and the expected benefits to users of the services. These interviews were also an opportunity to triangulate information gathered in the focus group discussions and household interviews.

A small-scale *household survey* was conducted to collect qualitative and quantitative data at household level, in order to quantify changes in income and expenditure and triangulate the information obtained from FGD and KI interviews. A sample of 36 households (4 per each wealth category in each study site) was selected for the household survey.

Case study interviews were conducted with selected households to build up a detailed picture of household income and expenditure before and after the introduction of improved irrigation schemes. These were selected by asking the focus group discussants to identify typical households of that wealth group, and choosing a household which had a good recall of information and was willing to share it. The case studies gathered detailed quantitative data on changes in income, and qualitative data on how and why the change occurred, the costs and benefits associated with the water intervention, constraints and opportunities for income diversification and any future plans of the household to adopt new activities. In each village, one household was selected from each wealth category for an in-depth interview.

In addition to the village-level studies, a *market chain analysis* was conducted for one crop: potato. Potato was selected as the product for study through a participatory process with members of the three study communities, who identified potato as a priority crop with good potential for income generation. Further, the market chain for potato is thought to be reasonably representative of a variety of vegetable crops. Interviews were conducted with actors along the market chain (2 assemblers, 2 wholesalers, 26 retailers and 46 consumers – to complement the interviews with producers conducted in the three irrigation sites).

Market chain analysis is used to determine whether the market chain is functioning well with strong market demand and thus represents a good option for further market penetration by small producers meriting promotion activities, and whether there are bottlenecks or inefficiencies in the chain which could be addressed to increase the income-generating potential for small producers.

The market chain analysis included identifying the number and type of actors and value added at each stage of the chain, and mapping the market support system at all levels. The support system includes financing facilities for different actors, institutions which transmit market information, infrastructure which supports each stage of the chain, and the wider policy and regulatory environment. In the detailed analysis of the support system, the various support services, their availability and accessibility, the knowledge needed to use them, as well as their affordability, quality, and reliability, were assessed and gaps or prospects for improvement identified.

2.2.1 Data analysis

Interview and focus group data was analysed by coding and development of a set of matrices based on the analytical framework to organise and identify patterns in the data. The differences between wealth groups, and impacts on both irrigating and non-irrigating households, were analysed in detail.

Survey data was analysed using simple descriptive statistics, and a set of paired sample mean comparison tests used to compare the situation before and after the development of improved irrigation. The survey data was disaggregated by agro-ecology but the number of responses did not allow disaggregation by wealth group.

All price information collected for periods before and after the development of improved irrigation, was deflated using the appropriate price deflator index to enable comparisons.

3 Results and discussion

3.1 How and why have different households diversified their income?

All households surveyed across the three sites reported that improved irrigation has enabled them to diversify their income sources. The diversification that took place was principally agricultural: households are producing a greater variety of crops, particularly vegetables. Focus groups confirmed that in all three sites irrigation is used to produce a greater variety of vegetables than was previously produced. New crops include garlic, tomato, carrot, beetroot and peppers. In addition households were able to expand production of existing crops for income generation. According to survey respondents, the main criteria for selecting new crops or crops of which to expand production were high value at market (income-generating potential) and availability of early maturing varieties (meaning that multiple harvests could be grown each year). In addition crops which could be harvested at a time of high food demand were popular because these would command a good price at market. These include in particular potato, tomato and onion.

No significant change took place in land allocation between cereal and horticultural crops, however. This is probably because the average landholding in the study area is very small, and opportunities for diversification were taken through intensification of production rather than through area expansion.

Over 70% of households surveyed reported that their income from horticulture has increased since the introduction of irrigation. If the lowland site (Erer), where livestock is the main livelihood activity and irrigation is to a large extent used to irrigate fodder plants, is excluded, this rises to over 80%. There is considerable variation among households, however, with reported changes in horticultural income ranging from decreases of around 10% to increases of almost 300%. In Erer, the majority of households reported substantial increases in income from livestock, ranging from 50% to 650%.

A statistically significant 23% increase in mean reported income from horticultural crops took place overall, comparing the current situation with the time before irrigation. Income from cereal crops also increased by slightly less (19%), suggesting that many households still continued to prioritise the production of staples for own consumption or for sale locally in addition to new crops, although this change was not statistically significant. See Table 3.1.

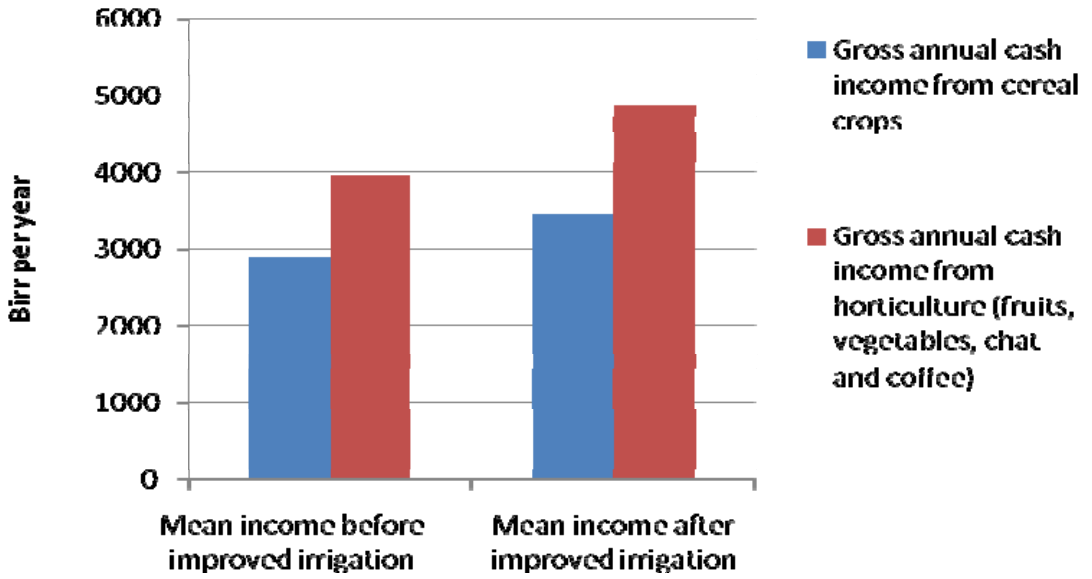
Table 3.1: Change in income from cereals and horticultural crops

Income Source	Mean before improved irrigation	Mean after improved irrigation	Mean difference	t-Value	Std. Dev
Gross annual cash income from cereal crops (birr)	2899.4	3459.8	560.4	1.429	2353
Gross annual cash income from horticulture (fruits, vegetables, chat and coffee) (birr)	3946.3	4863	916.8	2.389*	2302

Source: own survey result, 2009

* Significant at 10% **Significant at 5% ***Significant at 1%

Figure 3.1: Change in income from cereals and horticultural crops



3.1.1 Income diversification in different agro-ecologies

Households in the three different agro-ecologies have used irrigation to both diversify and intensify existing agricultural production in different ways (see Table 3.2). Survey respondents in Werji Jalela (highland site) reported a significantly increase their income from sale of chat and fruits and vegetables– the latter more than doubled from 1,495 to 3,037 birr per year. In Ifa Daba (midland), the significant reported increases were in income from grain and fruits and vegetables (each increased by around 50%). In Erer Mede Enchini (lowland), the only significant reported income increase was from livestock and their products, because irrigation was used to grow animal feed, enabling households to expand livestock production. Mean household income from livestock more than doubled from 459 birr to 1,151 birr per year.

Focus group discussions confirmed these findings on the relative importance of different products in different sites to some extent. Vegetables, alongside chat and oxen fattening, became the most important income sources in the highland site, the staples maize and sorghum and vegetables remained equally important sources of income in the midland, while in the lowland site the importance of irrigated animal feed (maize, elephant grass and sugarcane) to expand livestock production, particularly oxen fattening, was emphasised. Oxen fattening is an important source of income in the highland site as well, but does not depend on irrigation of animal feed.

Table 3.2: Change in income from all activities by site

Income Sources by Site	Mean gross annual income before improved irrigation (birr)	Mean gross annual income after improved irrigation (birr)	Mean difference	t-Values	Std. dev
Werji Jalela (highland)					
Livestock and products	1,638	1,742	103	0.18	1651
Sale of grain harvest	3,718	5,164	1445	1.6	3063
Trading / craft activities	876	912	36	0.24	259
Daily labour	-	-	-	-	-
Sale of chat	2,137	2,665	528	2.36*	774
Fruits and vegetables	1495	3037	1541	4.12*	1297
Ifa Daba (midland)					
Livestock and products	1401	1212	189	0.41	1304
Sale of grain harvest	1974	3020	1045	5.31**	681
Trading /craft activities	718	1073	354	0.47	1525
Daily labour	562	799	237	1.48	227
Sale of chat	1660	2149	489	1.8	909
Fruits and vegetables	1225	1846	620	2.41**	892
Erer Mede Enchini (lowland)					
Livestock and products	459	1151	692	2.64***	694
Sale of grain harvest	3005	2195	810	0.04	2145
Trading / craft activities	432	592	160	0.057	374
Daily labour	-	-	-	-	-
Sale of chat	2821	2377	443	1.04	1473
Fruits and vegetables	2498	2512	14	0.04	1317

Source: own survey result, 2009

* Significant at 10% **Significant at 5% ***Significant at 1%

Figure 3.2: Change in income from agricultural activities in Ifa Daba (midland)

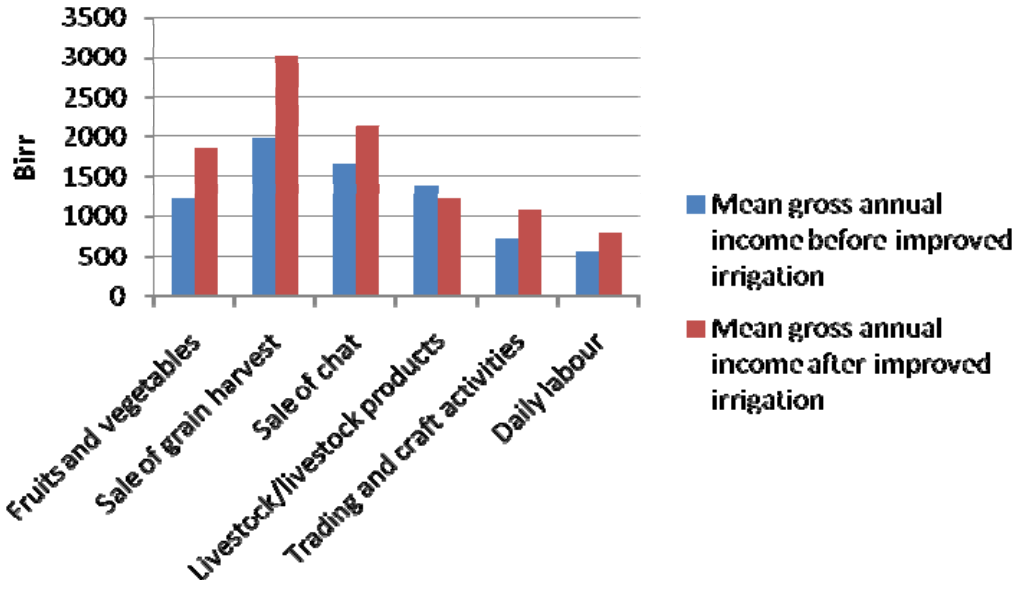
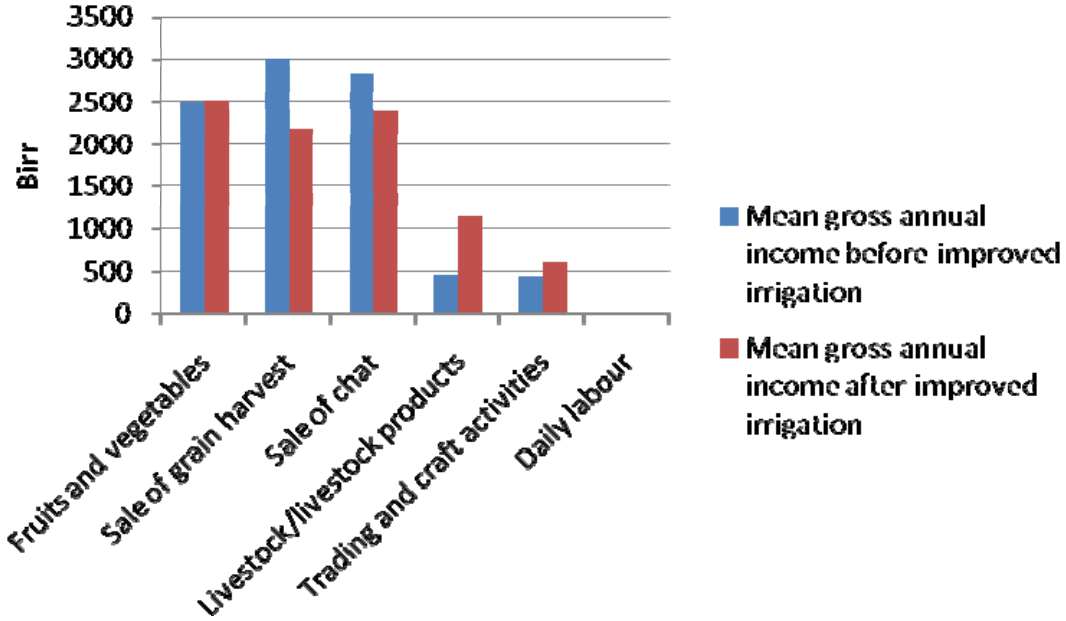


Figure 3.3: Change in income from agricultural activities in Erer Mede Enchini (lowland)



Within each site the different wealth groups tended to prioritise the same new crops and products, but FGDs reported that various constraints limited the ability of the less well-off groups to grow their preferred crops successfully (see section 3.3).

3.1.2 Motivations for diversification

Focus groups also showed that while motivations for diversification are similar across sites, they vary between wealth groups. The better-off were generally motivated by the desire to increase their income and accumulate both assets and capital. In contrast the poor groups were more concerned with increasing income to improve their livelihoods and cover basic household expenses and taxes, as well as smoothing income to reduce vulnerability to shocks. All groups said that increasing food security was a motivating factor, but this was a higher priority for the middle and poor groups. One priority expressed across all groups was the education of children. See section 3.2 for more discussion of how households have used the additional income gained from irrigation. Table 3.3 below summarises the motivations of households in the different focus groups, by site and wealth group.

Table 3.3: Motivations for income diversification, by wealth category and agro-ecology

Wealth group	Agro ecological zone/study sites		
	Werji Jalela (highland)	Ifa Daba (midland)	Erer Mede Enchini (lowland)
Better off	Increase income	Improve and sustain livelihood Accumulate capital & assets Ensure food security	Improve livelihood Accumulate capital and assets e.g. water pump Be more self-sufficient
Middle	Improve livelihood Smooth income Reduce vulnerability to shocks Achieve food security Accumulate capital	Escape food insecurity Generate income Build up assets	Increase income Be self sufficient in food production Decrease production and price risks
Poor	Increase household income Smooth income Become food secure Improve their assets	Become food secure Cover household expenses	Increase income Cover household expenses Become food secure Improve livelihood
Mixed Female headed	Achieve food self sufficiency Cover household expenses	Achieve food self sufficiency Cover household expenses	Achieve food security Cover household expenses Educate their children

Source: focus group discussions 2009

3.2 What income gains and other livelihood benefits have households of different wealth groups gained from diversifying income sources, and how are they using additional income?

3.2.1 Direct income gains

Households typically experienced a direct increase in income following adoption of irrigation. Almost 95% of households surveyed reported that their income had increased, and over 97% reported that their crop income had increased. This was due in part to diversification to new crops, principally new high-value vegetable varieties. Income gains also came from using irrigation in the dry season to produce existing crops (mainly chat or vegetables) two or three times per year instead of once.

The household survey of beneficiaries found that mean reported annual cash income from farm activities has increased quite substantially from 7,752 to 9,238 birr per year since the introduction of

irrigation. This is mainly accounted for by the increase in income from horticultural crops. Average reported annual gross cash income from farm and non-farm sources combined increased from 8,091 birr per year to 9,792 birr per year, an increase of 21% (see Table 3.4 below).

Reported annual incomes from all different sources, farm and non-farm, have increased to varying degrees since the introduction of irrigation (see Table 3.5 below). Some increases are small, but no sources of income for beneficiaries seem to have been negatively affected.

Table 3.4: Changes in on- and off-farm income (summary)

Income Sources	Mean income before improved irrigation	Mean income after improved irrigation	Mean difference	t-Values	Std. Dev
On-farm income (birr)	7752.9	9238	1485	2.8*	3122
Off-/non-farm Income (birr)	887	1110	223	0.66	1127
Total annual income (birr)	8091.7	9792	1700	3.09*	3298

Source: own survey result, 2009

* Significant at 10% **Significant at 5% ***Significant at 1%

Table 3.5: Changes in on-farm and off-farm income (detail)

Income Sources	Mean income before improved irrigation	Mean income after improved irrigation	Mean difference	t -Values	Std. Dev
On-farm					
Livestock/livestock products	1197	1378	181	0.67	1294
Sale of grain harvest	2899	3459	560	1.43	2353
Sale of chat	2206	2397	191	0.99	1156
Fruits and vegetables	1740	2465.4	3962	8.30*	2863
Non/off-Farm					
Trading and craft activities	886	932	45	0.12	1130
Daily labour	562	799	237	1.48	227

Source: own survey result, 2009

* Significant at 10% **Significant at 5% ***Significant at 1%

The reported value of assets owned has also increased significantly, from 10,679 birr to 17,370 birr – an increase of over 60%. Reported value of all categories of assets has increased apart from valuables (radio, watch, TV etc). Beneficiaries reported significant increases the value of their farm tools, household furniture and equipment, house and other physical assets (see Table 3.6).

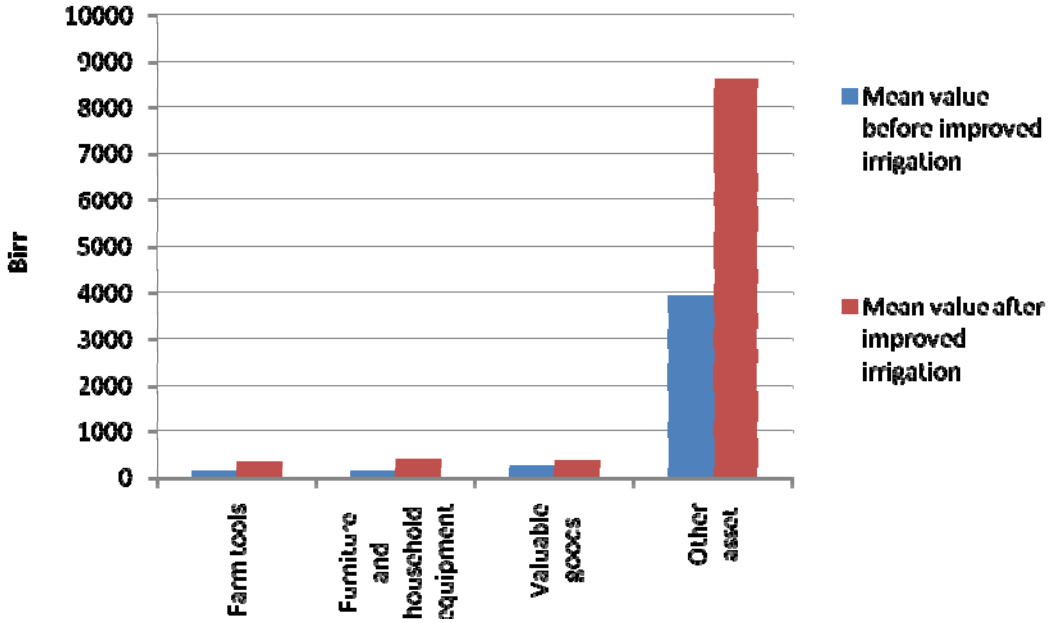
Table 3.6: Change in the values of assets owned by beneficiary households (in Birr)

Type of asset owned	Mean value before improved irrigation	Mean value after improved irrigation	Mean difference	t-Value	Std. Dev.
Farm tools	151	370	219	-5.786	220
Furniture and household equipment	128	409	280	-4.055*	397
Valuable goods	282	383	101	-0.934	406
Other (house, grain stock, cash savings, etc)	3929	8637	4707	-6.191*	4498

Source: own survey result, 2009

* Significant at 10% **Significant at 5% ***Significant at 1%

Figure 3.4: Change in value of household assets



Focus group discussions confirmed that the income gains from irrigation could be very substantial. In Erer Mede Enchini, for instance, participants reported that all of the "poor" wealth category irrigation beneficiaries now have a level of income and assets that would have been characterised as "better-off" before the introduction of irrigation. The gains seen by "middle" and "better-off" groups have created new levels of wealth in the village. One better-off farmer in Erer Mede Enchini site reported that his income had increased four-fold following the introduction of irrigation (Box 3.1).

However these positive overall figures mask some disparities among households in income gains made. While a member of the "better-off" wealth group in Erer saw his income rise four-fold, an

interviewee from the "poor" wealth group in the same village reported only a doubling of income. While both have benefited substantially this may indicate increasing inequalities between households at different initial levels of wealth, although further analysis would be needed to confirm this trend. In two of the sites, the "middle" and "better-off" respondents reported that they had gained more from irrigation than they had expected, while the "poor" said that they had gained less than they expected. A number of reasons were given for this. The poor often lack the capital needed to invest in expanding farming activities even after irrigation is made available, and typically have small landholdings. The cost of fuel was also prohibitive for some in Erer Mede Enchini (with a motorised irrigation scheme). See section 3.3 for a full discussion of the constraints limiting income diversification.

Box 3.1: Inspired and successful farmer – Mohamed Abrahim Abdulahi

Ato Mohamed Abrahim Abdulahi is 45 years old. He is ranked in the "better-off" wealth group in Erer Mede Enchini because of his income and assets. He has a house which he built himself, with separate rooms for his family and for livestock. He has 0.25 ha of land, an ox, a cow and a calf.

Mohamed also benefits from having three adult children who can work on the farm or bring income into the household. His other three children are still at school.

Ato Mohamed uses the motorised irrigation scheme constructed in Erer in 1985 to irrigate a wide variety of vegetables and fruits as well as chat and coffee. Access to irrigation water costs him 100 Birr per one irrigation of which 50 Birr is for fuel for the pump. Some of his land is also irrigated through gravity from the main source of irrigation scheme. In total half of his land is irrigated. Ato Mohamed grows sweet potato and maize for his family's consumption but the majority of other produce is sold at market.

He said: "my income has increased 4 times as compared to the situation before the irrigation scheme was put in". He has to pay for water and inputs such as seed and fertiliser (these inputs cost up to 100 Birr per year) but still makes a substantial income of 4500 Birr per year. Irrigation has also helped Ato Mohamed to cope with shocks such as drought which previously would have damaged his crops, and his family is food secure throughout the year.

Inspired by his success, Ato Mohamed would like to grow more high-value crops and also start more intensive livestock production. However, he is worried that these dreams might not be possible in the near future. His landholding is not big enough to extend crop production, and he does not currently have enough money to invest in buying more livestock. Even though he has earned a lot from irrigation, he has spent much of it on building a house for his family and supporting his daughter and brother.

However it is female-headed households which seem to gain the least, generally reporting that they made little extra income since adopting irrigation. The main reason seems to be lack of labour to cultivate crops, especially as many of the women are aged and/or have to spend their time looking after children. Some hire in labour, but this is costly. One female household head in Werji Jalela said that she can afford the costs of irrigation water and hired labour to grow staple crops for her family's consumption and chat for sale, but not the additional water and labour that growing vegetables would require (see Box 3.2).

Box 3.2: Striving woman farmer – Asha Abdo

Asha Abdo lives in Werji Jalela, and is ranked in the "poor" wealth group in her community. She is 38 years old and has 6 children. Asha lost her husband and only one of her children is of working age. Now she struggles to support her family with a small plot of land just 1/8 of a hectare in size. As well as this landholding, Asha has a grass-roofed house and some livestock: one ox, a milking cow, and a goat.

Asha uses her land to cultivate maize and sorghum for home consumption and chat for sale at market. Every year she makes about 900 Birr from selling chat. She has irrigation, but still only grows one harvest of chat per year. She thinks the cost of producing chat is high – she has to pay for the irrigation water and also to hire in labour, which adds up to about 250 Birr per year. Producing sorghum and maize in turn costs her 500 Birr per year in labour and input costs. Asha makes a small amount of additional income from petty trade and trading goats. In the past she has undertaken daily labour to meet her household's income needs. Asha does not produce vegetables in spite of their higher potential for income generation, although she has received some training from development agents on income diversification.

Asha would like to start a sheep and goat herding business to raise more income. However she needs support to do this, and few business support organisations are available locally. She could not obtain any credit which would enable her to boost her petty trading by purchasing more materials for trade, or to invest in start-up costs for a new activity.

Asha has gained some benefits from irrigation, but because of her low levels of assets, particularly labour, she has been unable to use irrigation as a springboard to transform her livelihood. The support services available locally have not been adequate to help her overcome these constraints.

Within wealth groups there are also variations in the income gains from irrigation. These differences were attributed to several factors: land-holding size and soil fertility; household labour availability; agronomic knowledge and skills; hard work and efficient management; and, in particular, the amount of water received for irrigation. In all three sites, farms further from the source reported receiving less water, mainly because of losses from unlined. The "poor" focus group in Ifa Daba said that while a few households close to the source were able to harvest three times per year using irrigation, others only received enough water to harvest twice, although they share the water equally in theory.

'Unfair' distribution practices by scheme managers were also reported in two of the three sites; it was said that friends and relatives of the managers or chairmen, or those prepared to pay bribes, are given priority. In the case of Ifa Daba participants said that the distributor favours chat growers over farmers producing vegetables, preventing even the "better-off" vegetable farmers benefiting as much from irrigation as they hoped (see Box 3.3). Together with increasing water shortages (which also favours chat production, as chat needs less water than vegetables) this seems to be limiting the income diversification benefits, which the scheme was supposed to provide, for many farmers. It was said during the focus group discussions that only around 30% of the scheme's beneficiaries have made a significant change to their livelihood.

Box 3.3: Disappointed family – Ato Lulu Tefere and W/ro Demera

Ato Lulu Tefera Desta is 60 years old and lives with his wife and four grown-up children in Jarso village, Ifa Daba. Ato Lulu is considered "better-off" by the community as he has 6 timad of land (0.75 hectare), a house with separate buildings for living, livestock, kitchen and toilet, and several livestock: one ox, two calves, a donkey, some chickens, a few sheep and a traditional beehive. He expected to benefit greatly from the irrigation scheme which was developed in his community in 1996, allowing him to irrigate 1/3 of his land and grow new crops such as vegetables. Indeed, in the first years after the scheme was introduced he produced potatoes and green peppers as well as increasing his chat production.

However, for the last two years Ato Lulu has been unable to irrigate his land as he is denied access to irrigation water. He said that the water distributors in the village were not distributing water fairly, but favoured chat-producers. Those who want to produce vegetables are being charged 50 Birr per day for water instead of the price originally set (10 Birr) which makes it unaffordable to many.

Ato Lulu's family do not worry about food insecurity as they earn additional income from other sources, such as petty trade, selling liquor, and hiring out labour (their four adult children) during the chat harvesting season. If times are hard, they can sell one or two livestock without damaging their livelihood dramatically.

However, he and his wife, Wezero Demera, are very disappointed that they are no longer to grow vegetables, which would sell for high prices on the market and make them a good income, due to unfair distribution of water. The irrigation scheme is not being used for its primary purpose, to support vegetable growing and enhance the income and food security of the community. Ato Lulu said: "I did not benefit much from the scheme. It did not have any effect on my income, but my family could have benefited a lot if the distribution of water was fair".

3.2.2 Smoothing income

As well as increased income, smoother income is an important outcome mentioned by the "poor" and "middle" groups in more than one site. Multiple harvests help to smooth incomes through the year and reduce risk, as does producing a greater variety of crops which are subject to different production and price risks. The "middle" group in Erer Mede Enchini reported that they deliberately use irrigation to grow a mixture of more profitable (but risky) and less profitable (but less risky) crops to guard against market risks.

3.2.3 Improved nutrition and health

All groups also reported that they benefited from improved nutrition, both from direct consumption of the additional crops they grow and from having more income to spend on food. The benefit to children in particular was emphasised. Various groups reported that this has brought health benefits, which in turn reduced household expenditure on healthcare.

3.2.4 Expenditure patterns

Surveyed households reported significantly increased expenditure on both food and non-food items. Expenditure on grain, fruit and vegetables, spices and meat were all said to have increased significantly, doubling in many cases, and significant increments were reported in expenditure on general household goods, clothing and school-related expenses. This suggests that households are increasingly able to meet their basic livelihood costs. See Tables 3.7 and 3.8 for details. Reported expenditure on children's education (school fees and uniforms) more than doubled following the adoption of irrigation. In focus group discussions, most households also pointed out the importance of sending their children to school. One member of the "better-off" wealth group in Werji Jalela spent a huge amount of the income he gained from irrigation to send his four children to a private college. Two of the children have now jobs in town, and send remittances to their parents. Many households agreed that investment in children's education can be a long-term livelihood strategy which creates a source of income transfers for parents in their old age, as well as improving future opportunities for their children.

Table 3.7: Change in household expenditure on food items

Items purchased	Mean expenditure before improved irrigation	Mean expenditure after improved irrigation	Mean difference	t-Value	Std. Dev
Grains, vegetables and fruit	1800	5568	3767	-8.137*	2739
Spices	647	1709	1061	-8.587*	731
Tobacco and chat	382	886	503	-4.777	606
Milk and milk product	308	488	180	-1.869	441
Meat	263	476	213	-2.281*	418
Food consumed outside of home	240	337	97	-0.881	615

Source: own survey result, 2009

* Significant at 10% **Significant at 5% ***Significant at 1%

Figure 3.5: Change in household expenditure on food items

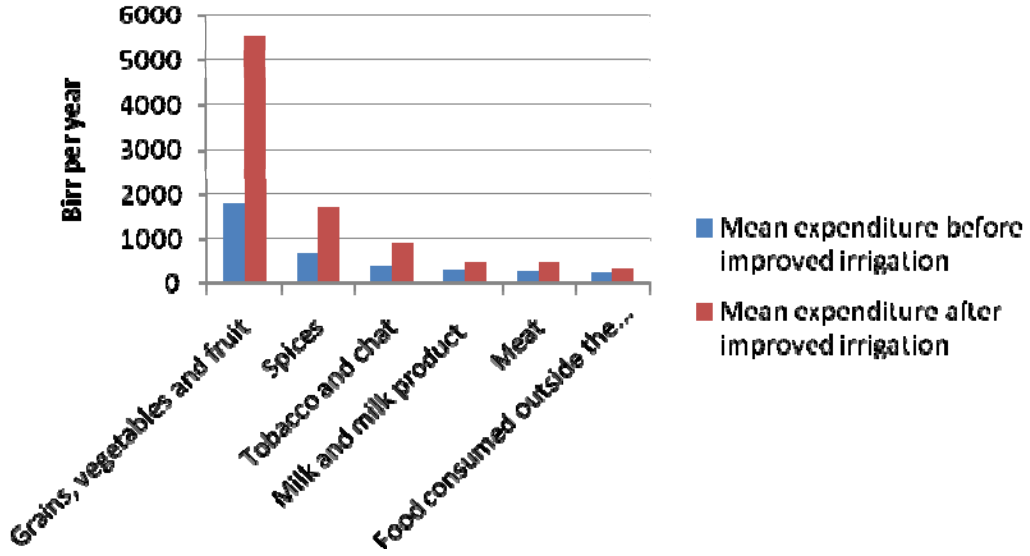


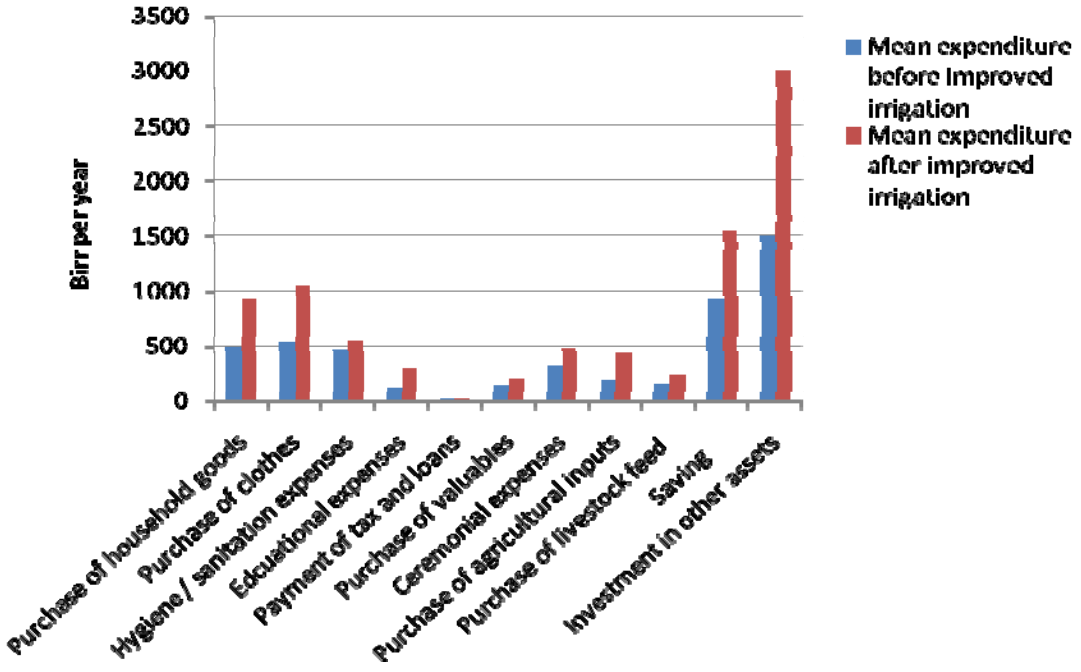
Table 3.8: Change in household expenditure on non-food items

Type of expenditure	Mean expenditure before improved irrigation (birr)	Mean expenditure after improved irrigation (birr)	Mean difference	t-Value	Std. Dev.
Purchase of general hh goods	476	918	442	-3.511*	745
Purchase of clothes	532	1049	516	-6.631*	461
Hygiene / sanitation related	454	551	96	-0.761	706
School fees & supplies	130	298	167	-2.983*	177
Payment of tax and loans	24	27	3	-1.304	12
Purchase of valuables	146	199	53	-0.731	217
Ceremonial e.g. weddings	326	472	146	0.928	872
Purchase of agricultural inputs	188	434	245	-4.638*	280
Purchase of livestock feed	162	234	71	-3.938*	95
Saving	928	1542	614	- 0.983	1652
Investment in other assets (e.g. livestock, house, petty trading, beverage production)	1500	3000	1500	-0.873	1320

Source: own survey result, 2009

*Significant at 10% **Significant at 5% ***Significant at 1%

Figure 3.6: Change in household expenditure on non-food items



3.2.5 Reinvestment in income generating activities

Households reported significant levels of reinvestment in agriculture and livestock. Average reported annual expenditure on agricultural inputs (improved seed, fertiliser and pesticide) has increased significantly – more than doubling from 188 to 434 birr per year. The average reported annual mean expenditure on inputs for livestock production (concentrated feed and salt) has also significantly increased from 163 to 234 birr (Table 3.8). To some extent agricultural inputs represent a cost as well as a benefit of diversification but the figures nonetheless indicate that spending on agriculture is a high priority as income increases.

Reported investments in other assets (livestock, house, petty trading, local beverages) have doubled and reported savings have increased by over half from 928 to 1,542. These are not statistically significant changes, but do suggest that capital accumulation and reinvestment in productive assets are taking place. However, only a very slight increase is reported in income from non-farm activities (excluding daily labour) suggesting that investment in developing new income-generating activities has not been prioritised (see Table 3.4). However, the survey households reported a more than 40% increase, on average, in income from off-farm daily labour. This could be a direct result of increased and diversified production elsewhere in the community.

According to focus groups, however, few of the poor have generated enough income from irrigation to build up productive assets, expand farm production or invest in new income-generating activities. In comparison, the better-off groups in all the three sites are able to make significant reinvestments in farming, which are expected to generate further income, thus multiplying the benefits from irrigation. In Ifa Daba, respondents commented that for the "better-off" group, livestock are the assets that have increased most since the introduction of improved irrigation scheme.

For any given household, the ability to invest in productive activities depends on competing demands for capital. The need to support family members or meet unexpected costs can affect households in all wealth groups, and may prevent even the better-off from reinvesting their income in productive assets. One respondent in Erer for example, had to use his additional income to support his brother and daughter, and was unable to start intensive livestock production or grow new crop varieties.

Female-headed households struggle the most to reinvest in productive activities, as they make little extra income from irrigation in the first place and spend most of it on meeting their families' basic needs. Many of the women in female-headed households gain additional income from trading chat and vegetables, and in Ifa Daba they reported that since the introduction of irrigation they had been able to expand trading slightly as other households in the village increased production. The benefit was small, however, and these households lacked the capital to expand trading substantially.

3.2.6 Social benefits

The poor group in one site (Werji Jalela) said that they had gained some incidental social benefits from the income increases gained through irrigation. They reported both an increased status within the community and a reduction in conflict between husbands and wives over household finances, which they saw as significant benefits.

Table 3.9 summarises the benefits of income diversification as a result of improved irrigation, as reported by focus group participants in different wealth groups in each site.

Table 3.9: Reported benefits from income diversification by site and wealth group

	Werji Jalela (highland)	Ifa Daba (midland)	Erer Mede Enchini (lowland)
Better off	Increased income due to increased frequency of cropping Built additional premises, house for livestock and latrine Sent their children to school and private college Became food secure throughout the year Bought additional livestock Purchased clothes for family Constructed house in town for better life and business Reduced conflict between husband and wife	Increased income due to Increased frequency of cropping Improved diet and health Constructed new house, Constructed shelter for livestock, Educated children, Purchased more food, household items and clothes	Increased income due to Increased frequency of cropping Bought new types of livestock due to availability of irrigated feed Built additional and/or better houses Educated children Improved diet & health, leading to reduced medical expenditure Increased savings
Middle	Increased income due to new crops and increased production Improved wealth status Educated their children Purchased oxen Constructed houses Purchased household items, furniture and clothing Improved diet	Increased income Bought ox, sheep and goats Educated children Added corrugated iron roof to house Constructed other houses for livestock & kitchen Constructed toilets Improved diet More efficient utilisation of land and labour	Bought new types of livestock due to availability of irrigated feed Purchased more food crops Educated their children Bought clothes for children Built better houses with corrugated iron roof Bought additional household assets Improved diet and better health
Poor	Avoid emergency livestock sales Increased income Purchased additional livestock including oxen Educated children Constructed their house Gained more respect in the community Improved their diet Purchased clothes	Increased income Avoid emergency sales of livestock and cereal stocks Improved diet and health Educated children	Bought new types of livestock due to availability of irrigated feed Increased income Increased livestock holding Bought household items and clothes
Female headed HH	Covered basic household expenses and consumption Bought clothes, livestock, and household utensils. Educated their children	Increased income land during dry season Cover basic household expenses and consumption	Increased income Covered household expenses Made improvements to house Educated their children Bought clothes, livestock, and household utensils.

3.3 What are the costs of new income-generating activities, and what constraints prevent households from adopting them?

3.3.1 Cost and Types of Purchased Inputs Used

Subsistence production in Ethiopia typically involves low or no input use. However, the surveyed households said that as households shifted to more diversified, commercially oriented production they significantly increased expenditure on improved seed, fertiliser and pesticide. Average reported annual expenditure on these inputs has more than doubled, from 189 to 434 birr (see Table 3.8 above). This is partly indicative of the costs of diversification – commercial production of horticultural crops requires more improved inputs than subsistence production of cereals – and may also reflect an increased ability to afford such inputs following successful diversification.

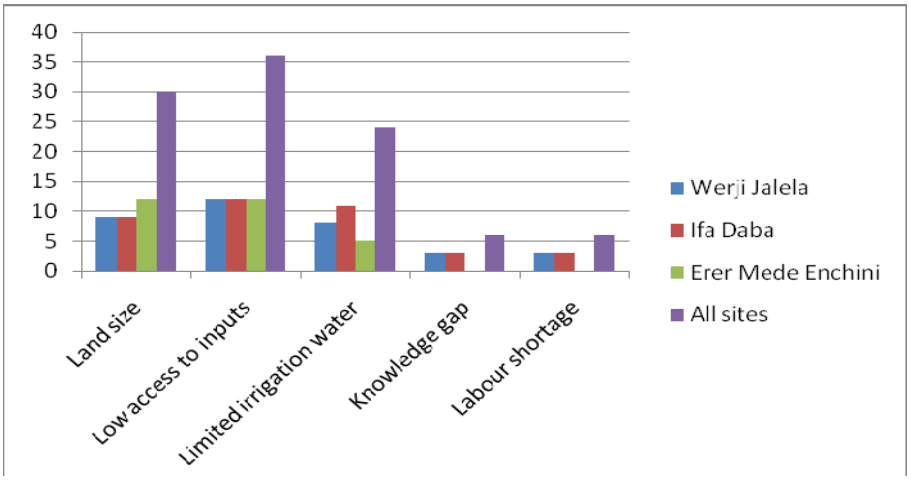
3.3.2 Constraints on Income Diversification

All surveyed households said that they had diversified the crops they produced under improved irrigation but diversification was constrained by various factors. Table 3.10 shows the major factors identified by households to be limiting diversification, which are represented graphically in Figure 3.7. The main constraint seems to be access to inputs, followed by land size or amount of irrigation water received. In Erer, where land size was mentioned by all 12 respondents, average landholding is very small at less than 0.2ha.

Table 3.10: Frequency table of reported constraints by site

Constraint to income diversification	Frequency (number of households reporting the constraint)			
	Werji Jalela (12 hhs)	Ifa Daba (12hhs)	Erer Mede Enchini (12hhs)	All sites (36 hhs)
Land size	9	9	12	30
Low access to inputs	12	12	12	36
Limited irrigation water	8	11	5	24
Knowledge shortage	3	3	0	6
Labour shortage	3	3	0	6

Figure 3.7: Frequency chart of major reported constraints to income diversification



3.3.3 Household assets

Finance

Several respondents in focus groups cited shortage of finance as an important constraint for agricultural production. In Ifa Daba, the poor and female-headed groups reported that they did not have the capital to significantly invest in irrigated farming. In Werji Jalela, the better off and middle income groups said the cost of initial investments in seeds and agricultural implements was a barrier to growing new crops, while for the poor the cost of water itself (irrigation fees) was prohibitive. In Erer, rising fuel costs in recent years have led some farmers who use motorised irrigation to reduce their use of water or stop irrigating altogether. The lack of local finance / credit institutions exacerbates the problem, as households cannot borrow money to buy initial inputs even if they would be able to repay the loan using the additional income from irrigation.

Land

In the focus groups, small land-holdings were identified as a constraint by poor groups in Ifa Daba and Erer Mede Enchini and by the middle group in Erer, but not by any of the better-off groups. However in the household survey two-thirds of respondents in Werji and Ifa, and all of them in Erer, cited land size as an important constraint. In Erer, it was also noted that the topography of some marginal land holdings prevents households from irrigation as canals cannot be constructed easily.

Water

Water shortages are also an important constraint in all three sites, and result from a mixture of management issues and physical shortages. Farms lying far from the water source tend to be most affected. In Ifa Daba, the irrigation scheme was designed for a limited number of users based on water availability, but other farmers have informally expanded the scheme leading to shortages.

Labour

Female-headed and some poor households identified lack of labour to cultivate land (along with lack of capital to hire in labour) as the main constraint explaining why they have benefited considerably less from irrigation than other groups (see Box 3.2).

3.3.4 Skills and knowledge

Various groups mentioned lack of skills as a constraint. Lack of knowledge of relevant agronomic practices and vegetable production was mentioned in Werji Jalela in particular, by all groups, while in Erer Mede Enchini a lack of skills in farm-level water management was said to be more important. These gaps have not stopped farmers engaging in irrigation, but were thought to have constrained production. It is interesting that farmers in all sites highlighted a lack of skills even though training was made available in all sites by the NGO which implemented the irrigation scheme. In Werji Jalela, budget constraints faced by implementers and overstretched government extension services were blamed for shortfalls. As well as lack of specific skills, it was suggested that a lack of awareness of the benefits of income diversification had prevented some households from using irrigation to grow new crops. In Erer Mede Enchini in particular, it was reported that there was some cultural resistance to adopting new farming practices. However, in at least one site farmers reported that seeing the success of others encouraged them to start irrigating – particularly the poor, who were initially reluctant to take a risk on new activities.

3.3.5 Access to key communal assets

Market(ing) infrastructure

All groups mentioned said that the lack of adequate storage, assembly and marketing facilities for produce is a major constraint. Farmers mostly forced sell produce in small volumes and therefore cannot sell to larger buyers. The perishability of vegetable products makes this storage problem particularly acute, and means that vegetables have to be sold in a short time period after harvest which further reduces the bargaining power of producers. Lack of transport to markets and inadequate market information were said to be important across more than one site. Even where markets are accessible by road, as in Erer, farmers do not have their own vehicles and reported that no commercial vehicles come to buy from them.

Input markets

Input markets are equally important and Table 3.10 above shows that access to inputs was felt to be a constraint in all sites. The survey found that all irrigating farmers are using improved seeds, around 75% use fertiliser and over 50% use pesticides, inputs which are mainly bought on the open market but also obtained as credit from government or NGOs. However farmers said that input use was constrained by cost and irregular or inadequate supply in local markets.

3.3.6 Risks of income diversification

Farmers reported that they face both production and market risks after diversifying incomes. These risks affect the income they gain from irrigation. Another set of risks relate to management of the water scheme, and affect the volume, reliability and cost of water available to irrigation users.

Production risks

Farmers in all sites said that, in spite of irrigation, crop production is subject to considerable climatic risk. Households in all groups in Erer Mede Enchini and Ifa Daba (lowland and midland) highlighted drought as a major production risk. The middle income group in Ifa Daba said that erratic rainfall is the main reason for income variability. Pests and disease are also important, particularly affecting potato and tomato. In Werji Jalela (highland) the main production risks were said to be flood, snow and frost; in 2004/5 and 2006/7 flood and frost caused serious damage to vegetable crops.

Market risks

Farmers in all sites face significant market risks. Prices for vegetables, chat and livestock fluctuate seasonally and interannually and all farmers stressed the unpredictability of prices and the lack of reliable market information or forecasts which would help them to plan production to suit market demand. Several examples were given of overproduction leading to falling prices in recent years, particularly for cabbage and potato. Households take different approaches to risk. Some stick to less profitable but less risky crops while others produce a mixture of more risky (but potentially more profitable) and less risky crops. Producing and selling crops more than once per year through irrigation also helps to smooth income and reduce risk.

Farmers also reported various "unfair" tactics by buyers which kept the selling prices low, including intimidation, deception about market prices, and agreeing to a price but reducing it later the same day when other opportunities to sell have passed. This was blamed on the excessive power of small groups of buyers in local markets who reportedly control prices through collusion. Farmers said that they have no option to sell to others because of the small scale of their production and lack of

transport to larger market centres, and these buyers reportedly tie them in by providing seeds on credit in return for guaranteed purchasing rights. See section 3.6.

Management risks

In all sites, problems were reported in the management of the irrigation scheme. As well as poor maintenance, leading to blockage or breakage of canals, "unfair" distribution practices were reported in all three sites. In Ifa Daba and Erer Mede Enchini rules or by-laws were established to govern water distribution but it is reported that these have been ignored and water is distributed to friends of the provide more, and cheaper, water to chat farmers than vegetable farmers. One respondent stated that the price of water for vegetables had been raised from 10 birr to 50 birr per day, which was too much for some of the better-off farmers. Farmers reported that this has seriously reduced the benefits gained from irrigation, as one quote illustrates: "I did not benefit much from the scheme; it did not have any effect on my income, but my family could have benefited a lot if the distribution was fair". Some inequities in distribution were also reported in Erer, due to failure to apply by-laws and refusal by some farmers to allow canal construction across their land (which has excluded some farms from irrigation). Households of all wealth levels have been excluded, however the poor suffer most because the better-off are more likely to be able to access water in other ways such as buying a pump.

3.4 What support services do households currently access and how do these support successful income diversification?

This study assessed the importance of institutional and support services in enabling households to overcome constraints and maximise the benefits from income diversification. Support services are categorised here into services which improved: (i) households' access to assets, (ii) households' skills or knowledge, and (iii) access to communal assets, including markets and water resources.

Both the survey results and the FGDs reveal that there is a growing consensus among the sample households that the institutional and infrastructural support that has been made available in the study sites created conditions conducive to improving the benefits of income diversification from productive use of water, although considerable gaps remain.

3.4.1 Enhancing access to assets

Most households engaging in irrigation have benefited from some form of credit, in kind or in cash. The agencies which set up the irrigation schemes provided vegetable seeds on a credit basis in all sites, and in one case fertiliser and farm implements were also provided.

There are a variety of credit services available for poorer households, from government, donors and NGOs, which make small loans of the order of a few hundred birr. These are intended to ensure the food security of poor households and enable them to purchase assets such as sheep and goats, although not all poor households have been able to access them because they could not afford to pay the credit back with interest added.

However, access to larger amounts of credit that would enable asset-secure households to expand or upgrade their agriculture, or invest in start-up for new income-generating activities, is a serious gap. None of the sites has a microfinance facility, and many middle and better-off households which

identify the lack of credit as a serious hurdle to reinvesting and engaging in new income-generating activities, even if they have increased their income through irrigation.

Another gap is provision for female-headed households. In two of the three sites focus groups reported that there were dedicated credit schemes for women (provided by the Woreda Women's Office or NGOs), but female-headed households said that they did not have access to these facilities. Female-headed households reported that the lack of credit facilities to enable them to start up activities such as trading or herding was a serious limitation to them.

3.4.2 Enhancing skills or knowledge

Beneficiaries in all sites received training in agronomic practices such as vegetable production and on-farm water management from the implementing agencies when the irrigation scheme was developed. Focus group respondents generally agreed that this training enabled them to start successful vegetable production. It was complemented by various forms of government provision, though the depth and quality of government support reportedly varied between sites. Farmers in Erer Mede Enchini said that the Woreda Cooperative Office gave training in marketing management (not found at the other sites) and development agents (DAs) offered frequent ongoing support and advice to farmers on agricultural practices. This was appreciated by one poor beneficiary who said that he had "good day to day communication with the DA". In contrast, in Ifa Daba it was felt that DAs gave good initial support but follow-up was limited. However, in both Ifa Daba and Werji Jalela some farmers took part in longer training programmes through Farmer Training Centres. In some sites the training from NGOs and government extended to other livelihood activities such as livestock fattening and bee-keeping. In Ifa Daba HCS gave training in saving.

Again however there seems to be a gap in provision for female-headed households. In both Ifa Daba and Werji Jalela, female-headed households reported that they were excluded from training programmes.

Table 3.11 shows that a great majority of the surveyed households have received training. About 89% of the sample respondents participated in training programmes on the use of improved agricultural inputs, irrigation agronomy practices and irrigation water management, although there were differences between sites. However, focus groups stated that training was not adequate and continued to identify lack of skills as a constraint to successful diversification.

3.4.3 Improving access to communal assets

The only intervention of this kind which was mentioned by any groups was the support given to the water management committees established in Ifa Daba and Werji Jalela, and to the irrigation cooperative in Erer Mede Enchini. The water committees in the former two sites were trained in water management, aiming to ensure that water would be available for all irrigation users on a sustainable basis. In Werji Jalela the committee was also trained to deal with conflicts over access to water in case of scarcity and ensure equitable distribution. In Erer Mede Enchini, the Woreda Cooperative Office has assigned a DA to provide ongoing expert support to the cooperative. Farmers explained that over recent years their communities have become better connected by roads, significantly improving their market access. However there is still a notable gap in support services to improve market access, information and bargaining power for producers.

In all sites, participants in the focus group discussions said that they would like to adopt new income-generating activities such as modern poultry production but were constrained by lack of support services.

3.4.4 Other services

Many poor irrigation users continue to rely on the Productive Safety Net Programme and small-scale credit services to maintain their livelihood. While irrigation has generally improved their income and food security, it has not been enough to lift all households out of dependence on these support services.

Table 3.11 summarises the participation level of households in extension services. These covered use of improved agricultural inputs, irrigation agronomic practices and irrigation water management.

Table 3.11: Participation of survey households in extension services

Percentage of Households participating			
Werji Jalela (12hh)	Ifa Daba (12hh)	Erer Mede Enchini (12hh)	Total (32 hh)
92	75	100	89

Source: own survey result, 2009

3.5 What impact has the development of irrigation in the community had on households which do not irrigate?

In all three sites, not all community members are beneficiaries of the improved irrigation schemes. Some households are too far from the source or the topography of their land makes canal construction impossible. Focus group discussions with non-beneficiaries reported a mixture of positive and negative livelihood impacts arising from the introduction of improved irrigation in their community. In all three communities, hiring and sharecropping arrangements are enabling non-beneficiary households to cultivate crops on irrigated land and gain extra income from doing so. In one site (Erer Mede Enchini) they also described how they make extra income from trading vegetables bought from irrigators at local markets.

Non-beneficiaries in two sites also mentioned benefits in terms of food security. They are able to buy more vegetables locally and in Erer (the lowland site) they also buy irrigated livestock fodder (elephant grass) and are able to borrow cereals from neighbours in times of scarcity. In Werji Jalela, where non-beneficiaries have good access to alternative water sources, they have constructed ponds and begun to irrigate after seeing the benefits of irrigation to their neighbours, with positive effects on their income and livelihood. In Ifa Daba, non-beneficiaries received the same training and supply of improved seed as beneficiaries, and are using these to improve their rainfed production. Participants in two sites (Werji Jalela and Ifa Daba) also reported that they are able to use water from the scheme for their livestock.

However, some negative impacts were also reported, particularly in Ifa Daba (the midland site). Irrigation was said to have reduced the discharge of the community's water source, reducing access by non-beneficiaries, and reduced crop prices (thought to be due to increased local production) were said to have hit rainfed producers. In other sites, reduced prices were seen as a benefit to non-irrigators, presumably because more were net food purchasers. Some of the negative impacts relate

to the implementation of irrigation schemes themselves. In Ifa Daba, it was reported that some individuals' land was used for construction without compensation, while in Erer some non-beneficiaries said that they contributed labour to scheme construction but the scheme never reached their land because of a budget shortage.

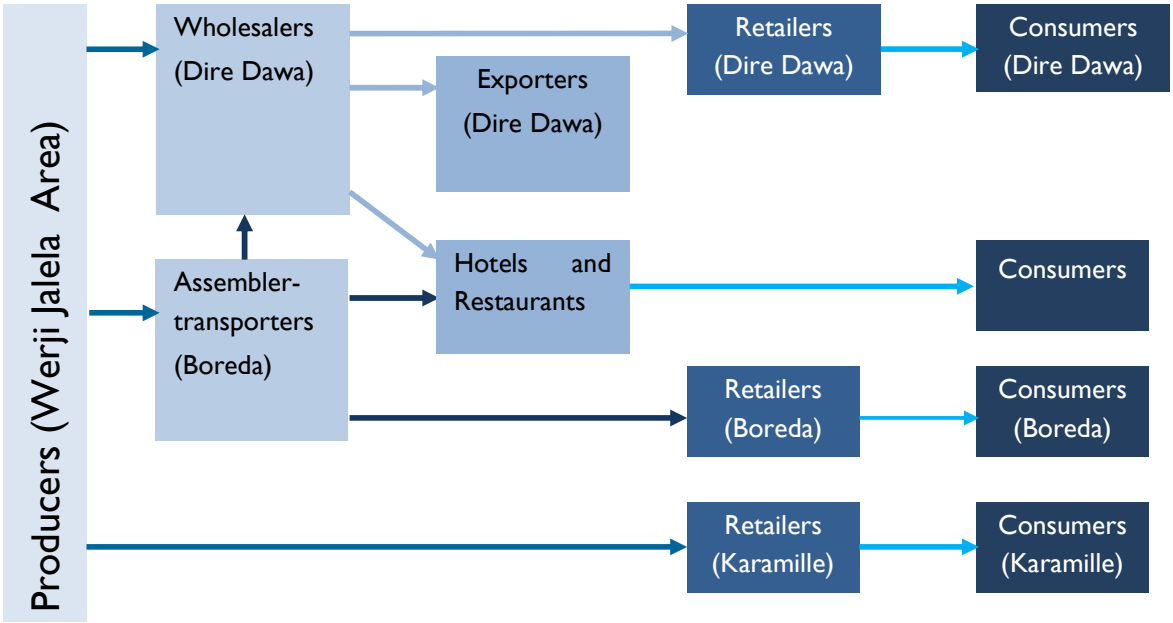
Overall, however, most participants said that the impact on non-beneficiaries had been quite small and their livelihoods were similar to before the introduction of improved irrigation. This suggests that while severe negative impacts have been avoided, non-irrigators are likely to be left behind as beneficiaries (particularly better off households) were able to significantly increase their income and standard of living. In spite of this, though, it was reported that there has been very little conflict between beneficiaries and non-beneficiaries – where tensions have arisen, they have been between beneficiaries over allocation and management of irrigation water.

3.6 How could market chains for selected products (potato) be improved to enhance the profitability of new activities for small producers and promote pro-poor growth?

3.6.1 Marketing channels, functions and margins

The potato marketing system selected for study was based in the highland site, Werji Jalela. The study area has three main stages: assembly, concentration, and retailing. Figure 3.8 shows the main actors in the chain. The major participants ("marketing agents") in the chain are: producers, assemblers, retailers, exporters and consumers.

Figure 3.8: Potato supply chain and marketing channels from Werji Jalela area



Source: Sketched from market survey (2009)

The Total Gross Margin[2] (TGM) was estimated to be 11.4% and 43.3% in Boreda and Dire Dawa markets, respectively. The producers' shares[3] were 88.6% and 56.7% in Boreda and Dire Dawa markets, respectively. The producers' share from Dire Dawa retail price seems to be unreasonably low because the marketing service added to the produce was only transportation; but the margin was beyond the transfer cost[4] required to move the produce from the point of its production in Werji Jalela to the point of its consumption in Dire Dawa. The price and margin information as given by respondents is indicated in Table 3.12.

Producers face considerable market risks and stressed the unpredictability of prices, lack of reliable market information or forecasts and their inability to plan production to suit market demand. Two years earlier, overproduction of potato led to a price crash with high losses. As discussed earlier, farmers also reported collusive price-setting, the provision of seeds in return for guaranteed sales and other 'unfair' tactics by the small group of local buyers which force producers to sell at low prices. The lack of producer organisations and the information imbalance make it hard for producers to counter their power. In addition the lack of assembly or storage facilities for perishable vegetables means that farmers have to sell in small volumes and in a short time period after harvest, which further reduces their bargaining power. Because of these factors many potato producers reported that they were reducing production and shifting to the production of other commodities with relatively low price risk (e.g. chat) and perishability (e.g. grains).

Table 3.12: Average producer and retail prices of potato and producers' share (2008).

Variable	Mean value
Producers selling price at Werji Jalela (birr per kilogram)	1.95
Consumer price in Boreda market (birr per kilogram)	2.2
Total gross marketing margin at Boreda market (%)	11.4
Producers' share at Boreda market (%)	88.6
Consumer price in Dire Dawa market (birr per kilogram)	3.4
Total gross marketing margin at Dire Dawa market (%)	43.3
Producers' share at Dire Dawa market (%)	56.7

Source: own survey result, 2009

High risks are seriously constraining farmers' willingness to diversify into higher return products. However, it was reported that there have been years when these assemblers were unable to fix prices collusively because of disagreements between them and attempts to control the market individually. At this time prices were good for producers.

[2] TGM is defined as the percentage of a final sales price which has been paid to all actors in the market chain for marketing activities and any processing to add value, i.e. the % difference between the producer's selling price and the final retail price.

[3] The producer's share is defined as the producer's selling price as a % of the final retail price.

[4] Transfer cost is the marketing cost incurred in moving a commodity from one market to the next, including loading cost, transport and unloading cost.

Assemblers

There are only two assemblers who collect potatoes from the nearby producing areas, store it and sell it on to retailers in Boreda and Karamille. The assemblers sometimes transport the potatoes to Dire Dawa for sale but only if a sale has been agreed in advance. Dire Dawa is considered a risky market with a high level of competition from other sellers. Retailers sometimes purchase the produce directly from the assemblers by paying some level of commission. Assemblers receive an 'agency fee' from their buyer. This includes the cost of transportation, storage and associated services as well as a margin which assemblers assume on the purchase price. This margin is not communicated to their buyers, who accept the overall price offered by the assemblers.

Assemblers do not add any type of form value. If there is any change of form due to quality deterioration, they would reject the produce and purchase from other producers who can offer the quality that is demanded by their buyers. Assemblers exercise much less power over their selling price than their purchasing price.

The assemblers' capacity and marketing margins are indicated in Table 3.13. The assemblers said that they mobilise about 50 quintals per year and gain a net marketing margin of birr 22.5 per quintal. However, computing the net marketing margin from the price and cost information reported by the assemblers gives a much lower figure of 5 birr. It appears that assemblers overestimated the marketing costs and underestimated the net marketing margins. They reported the average marketing cost of assembly to be birr 20 per quintal. However, if the marketing cost is computed from the gross marketing margin (birr 25.00 computed from the gross margin or price margin) and the net marketing margin reported by assemblers (birr 22.50), it would be only birr 2.50 per quintal. Generally assemblers generated a net profit of about 10% of their selling prices, though they underestimated it to be only 2.2%.

Table 3.13: Assemblers' capacity and marketing margins of potato in Boreda market (2008).

Variable[5]	Mean value
Annual capacity (quintals per year)	50
Purchasing price (birr per quintal)	200
Selling price in (birr per quintal)	225
Consumer price in Dire Dawa market (birr per quintal)	344
Gross marketing margin computed (birr per quintal)	25
Gross marketing margin computed (%)	7.3
Marketing cost reported (birr per quintal)	20
Marketing cost computed	2.5
Net marketing margin reported (birr per quintal)	22.5
Net marketing margin computed (birr per kilogram)	5

Source: own survey result, 2009

[5] 'Reported' refers to the response or estimate of the respondents. 'Computed' refers to the researchers' calculation based on other figures given by the respondents. These are used to triangulate reported costs and margins and to minimise misleading conclusions which may arise from respondents' reluctance to disclose the truth.

Wholesalers

Four wholesalers were identified who buy potato from assemblers in Boreda. However, only two were willing to participate in the study and they refused to provide certain details forcing the researchers to rely on secondary market information to fill gaps. Selling prices and marketing costs of the wholesalers – based on reports from the two which cooperated – are given in Table 3.14.

Table 3.14: Wholesalers' purchasing and selling prices and marketing costs of potato in Dire Dawa (2008).

Variable	Mean value
Annual capacity (quintals per year)	No data given
Daily capacity (kilograms per day)	850
Purchasing price (birr per quintal)	248
Selling price (birr per quintal)	281.5
Consumer price at Dire Dawa market	344
Gross marketing margin computed (birr per quintal)	33.5
Gross marketing margin computed (%)	9.74
Marketing cost replied (birr per quintal)	30
Marketing cost computed (birr per quintal)	19.2
Net marketing margin computed (birr per quintal)	3.50
Net marketing margin computed (%)	1.02
Net marketing margin replied (birr per quintal)	14.30

Source: own survey result, 2009

As with assemblers, the computed marketing costs were much lower than reported marketing costs. Wholesalers may have understated their marketing costs in order to report lower net marketing margins, because of a fear of taxes or cultural pressure to hide one's level of income.

Retailers

There are many retailers in the chain, compared with the assembly and wholesale stages where the market is concentrated. Retailers in Boreda, like the producers, have no option but to deal with only two assemblers who control selling prices without any bidding process.

The retailers' average gross marketing margin in the total marketing system was estimated to be 74.82 birr per quintal or 22.4% as indicated in Table 3.15. The estimated net marketing margin was 18.4% while the average net marketing margin reported by sample retailers was only 4.0%. The number of respondents was high compared with other groups and the estimated marketing margins were acceptable in this regard. Retailers were making very high marketing margins.

The efficiency of retailers may be indicated by their annual and daily capacity of retailing. On average, they mobilise about 35.1 kilograms per day and only 6.2 quintals per year. It is apparent that they are too small in size to benefit from economies of scale in marketing. Moreover, they do not operate with their full capacity throughout a year because of seasonality of potato supply especially in rural markets. This marketing cost inefficiency is transferred to consumers in the form of high prices.

Table 3.15: Retailers' purchasing and selling prices and marketing costs of potato (2008)

Variables	Mean value
Annual capacity of retailers (quintals per year)	6.2
Daily capacity of retailers (kilograms per day)	35.1
Purchasing price (birr per quintal)	259.1
Selling price (birr per quintal)	333.9
Gross marketing margin computed (birr per quintal)	74.8
Marketing cost replied (birr per quintal)	13.4
Marketing cost computed	53.8
Net marketing margin computed (birr per quintal)	61.5
Net marketing margin replied (birr per quintal)	21

Source: own survey result, 2009

3.6.2 Market structure

The key features of market structure which relate to the performance and efficiency of a marketing system are: the *number* of firms operating at each stage in a marketing system; the *size* of firms; and the number of *steps* involved in the chain of marketing events. These elements measure the extent of deviations from the perfectly competitive norm. The larger the deviation, the more imperfectly competitive is the market, the extreme case being monopoly (Pomeroy and Trinidad, 1995).

Market concentration

Market concentration means the number and size of sellers and buyers and the way in which they share the market. Concentration is believed to play a large part in the determination of market behaviour within an industry because it affects interdependence of action among firms. The greater the degree of concentration, the greater the possibility of non-competitive behaviour. There is usually a positive association between seller concentration and profitability.

The team obtained some estimates of the number and size of marketing agents participating in the system. However, it was impossible to estimate precisely the market share of each middleman operating in the marketing system, nor was secondary data available on this. Because of this, the extent of potato market concentration was measured only by the number and size of marketing middlemen participating in the markets. The relative number and power of marketing agents is indicated in Table 3.16.

Table 3.16: Number and size of marketing agents in the potato market chain.

Indicator of market	Markets	Producers	Assemblers	Wholesalers	Retailers	Consumers
Number of actors	Boreda	Many	2	_	7	Many
	Karamille	Many	_	_	4	Many
	Dire Dawa	_	_*	15	250*	Many
Size of actors	All markets	Small	Medium	Large	V small	V small

*The number of retailers in Dire Dawa market is a mean value of respondents' estimates and assemblers operating in other source markets were not considered.

Source: Market survey data.

Entry barriers

Entry barriers are advantages held by existing firms over firms that might enter the market. Potential entry barriers exist due to demand conditions including: product differentiation; price elasticities; control over input supplies; legal and institutional factors; scale economies; capital requirements; and technological factors (Pomeroy and Trinidad, 1995). For the purposes of this study capital costs were examined in particular, as this is often an important entry barrier in developing countries. Table 3.17 shows that middlemen felt the capital requirements of both initial investment and operational costs were medium for potato, while producers felt them to be high. Potato production is probably associated with higher initial costs than trading, and farmers are also on average poorer and face higher risks entering the market than middlemen, so their perception of costs is likely to be higher.

Table 3.17: Perception of potato marketing agents about capital requirements for potato operation.

Type of capital requirement	Respondents	Percentage of respondents		
		High	Medium	Low
Start up capital	Producers	20.6	47.1	32.3
	Middlemen	20.0	26.7	53.3
Operating capital	Producers	35.3	52.9	11.8
	Middlemen	11.8	29.4	58.9

Source: Computed from market survey data (2009)

Economies of scale may be empirically verified by the estimation of the regression of average marketing cost against quantity of commodity handled per day per middleman. As mentioned earlier, these data were missing in this case. However, it is feasible to mention whether or not scale matters for potato production and marketing, based on the information about capital requirement discussed above. Potato production can be operated with a medium capital requirement on a medium scale. This requires adoption of efficient methods of production techniques. This indicates that small scale potato production may not be feasible and may result in loss. This may be because of high risks associated with selling to small buyers only, and also because potato producers are too small to optimize their marketing operations as wholesalers did. The retailers were also too small in size and that they were not able to adopt new and effective methods of selling to satisfy their customers. So it appears that economies of scale have a significant impact on producers' profitability from potato production and marketing.

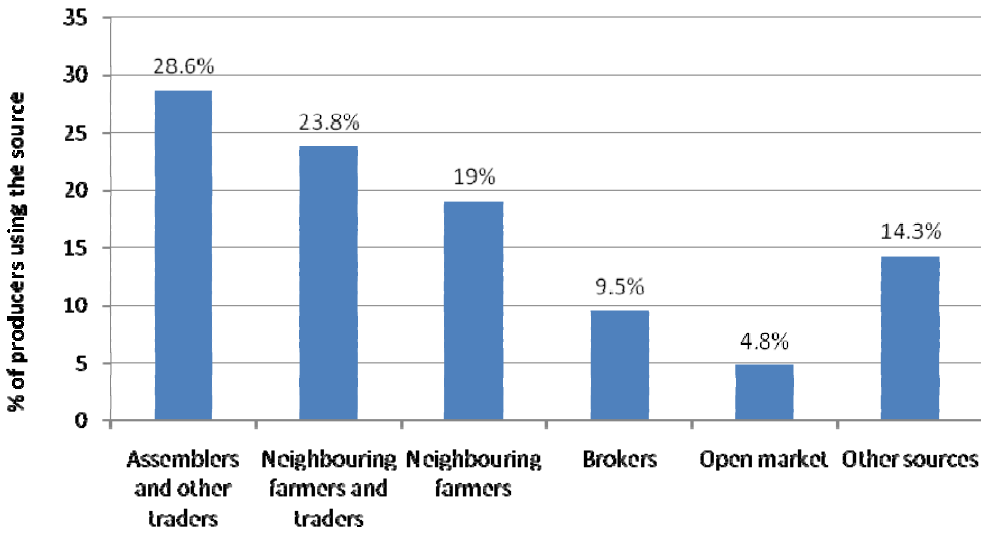
Market conduct

Market conduct defines the conditions which make possible competitive or exploitative relationships between sellers and buyers. Competitive relationships are dictated by marketing forces. Exploitative relationships are enforced via unfair price-setting practices including collusive, predatory, or exclusionary mechanisms. The producers pointed out that there were organised groups including brokers, illegal traders, and other agents that affect their selling prices, a problem compounded by the absence of alternative buyers or market outlets and the lack of good market information for

The potato producers have no dependable source of market information on important variables such as prices, supply and demand conditions. Table 3.18 shows that the main sources of information are

the assemblers and traders themselves, followed by neighbours who travel to urban centres and have better access to information. Less than 5% of traders travel to major market centres themselves and obtain the information there.

Figure 3.9: Producers' sources of market information for potato



Source: own survey result, 2009

Price determination

For better market performance, the structure of the marketing system should be such that the price sufficient to clear the market supply and demand will be arrived at quickly. Table 3.18 summarises perceptions at each stage of the chain of how selling and purchasing prices are determined. There are also other agents with an indirect influence on price setting behaviour, such as government bodies.

Selling prices for potato producers were determined by their buyers; about 38% of the producers believed that their selling prices were determined by assemblers and 33% that their selling prices were set by market forces. Only 14% reported that they were able to set their selling prices. This is related to the weak bargaining power of producers compared with their buyers. All the assemblers reported that they have complete control over their buying prices, and producers are largely price takers with no or little bargaining power. Assemblers in Boreda market had exclusive power to fix producers' prices affecting the overall benefits shared among producers. However, the selling prices of assemblers were reported to be determined by their buyers located in Dire Dawa. While 50% of the wholesalers believed that they had the power to fix selling prices, all of them underlined the importance of market forces in determining the purchase price.

All the retailers reported that they determined their selling prices, but only 7.7% felt that they had control over their purchasing price. A great majority (90%) of consumers believed that their buying prices were determined by retailers and considered themselves as price takers, confirming the reports of retailers. It is apparent that the most powerless marketing agents in the total potato marketing system are producers and consumers. Marketing middlemen have greater power to determine their selling prices.

Table 3.18: Perceptions of price making and price taking among marketing agents

	Marketing agent setting selling/purchasing prices				
	Buyers (% of respondents)	The market (% of respondents)	Sellers (% of respondents)	Myself (% of respondents)	Other (% of respondents)
Who sets your selling prices?					
Producers	38	33	14	0	14
Assemblers	100 (when selling in Dire Dawa)	0	0	100 (when selling in Boreda)	0
Wholesalers	0	50	0	50	0
Retailers	0	0	0	100	0
Who sets your purchasing prices?					
Assemblers	0	0	0	100	0
Wholesalers	0	100	0	0	0
Retailers	0	39	54	78	0
Consumers	0	10	900	0	0

Source: own survey result, 2009

Collusive price setting behaviour

For final triangulation, the collusive price-setting behaviour of marketing agents was assessed by analysing their responses to a set of questions.

All the assemblers (100%), a great majority of producers (81%), a slight majority of the retailers (53.8%) and half of the wholesalers reported that they did not collude to fix their selling prices. On the other hand, 50% of the assemblers and 50% of the wholesalers indicated that they colluded to fix their purchasing prices. Only 30.8% of the retailers and 16.6% of the consumers reported that they colluded to fix the purchasing prices.

These results are consistent with our earlier discussion on aspects of price determination where it was pointed out that there existed collusive purchasing price setting practices at assembly and wholesale levels and collusive selling price setting practices at wholesale level. The collusive selling price setting behaviour of the wholesalers is explained by their capacity to handle high volume of products and their access to financial resources that put them in a position of a price maker. However, assemblers are price makers perhaps because of the weak bargaining power of their sellers (or producers). Retailers were not able to fix prices in collusion because their number was relatively large for competition to prevail. The results conclusively show that producers and consumers were victims of collusive price-setting practices of wholesalers and assemblers.

4 Conclusions and recommendations

This study sought to assess the potential of investments in irrigation to increase resilience and promote pro-poor growth through enabling income diversification by rural households, and to investigate what complementary investments and services are required.

In the three site studied, farmers reported gaining substantial benefits from irrigation. They reported economic benefits (increased income) resulting from the ability to grow additional higher value horticultural crops (both new crop types and expanded production of higher-value crops) for sale at market, and to harvest more than once per year. The preferred crops were tomato, potato, cabbage, onion and beetroot. In turn this enabled them to build up their assets, buy more food and non-food household items, educate their children, and reinvest in further increasing their production by buying farm inputs or livestock. Nutritional benefits were reported due to both increased expenditure on food and the availability of a greater variety of crops in the local area, particularly fruit and vegetables. Social benefits were also reported, mainly by poorer irrigators who felt that their standing in the community had gone up. They also said that the extra income had reduced conflict within the household.

Household priorities were different in the different sites, probably reflecting the different existing livelihood strategies, market opportunities and external support services (e.g. extension) in each site. In the highland site significant increases were reported in income from fruits and vegetables and chat. In the midland, significant increases were reported in income from fruits and vegetables and cereals. In the lowland site, the only significant increase reported was in income from livestock and irrigation was used principally to irrigate fodder, and income gains from irrigation seem to be lowest in this site.

The introduction of improved irrigation has reportedly increased the asset holding of households. The value of all other categories of assets apart from valuables has increased since the introduction of irrigation, including farm tools, houses (grass roofs have typically been replaced with corrugated iron), furniture and other household equipment. Households also reported a significant increase in investment in livestock (a key asset) and reported that they are better able to meet the costs of living since the introduction of irrigation. It therefore appears that irrigation can make a significant contribution to increasing household resilience and buffering livelihoods against shocks and stresses. Some households reported that they have also been able to build up savings, buy costly new equipment and achieve quite a transformation in their livelihood.

These benefits suggest that irrigation could be highly beneficial in reducing poverty and promoting growth. However, the benefits are very unevenly distributed. Focus groups with different wealth groups reported that the better-off had benefited more from irrigation, because they had more land and labour, compared with poor and female-headed households for whom these are significant constraints. Poor households in the study areas routinely hire out labour for vital income (according to the criteria for determining wealth groups set by the community) which probably contributes to their lack of available labour to work on the farm. In some cases the poor group reported that the cost of water was unaffordable. The poor also reportedly suffer more when water shortages occur, as they are less likely to be able to access alternative sources than the better-off who can mobilise their resources to do so, for example by buying a pump. This is consistent with findings in the literature from Asia which show that in a context of land inequality irrigation is likely to increase

inequality (Hussein & Hanjra 2004). The findings also suggest that high inequalities in labour availability (including ability to hire labour) may have the same effect.

That said, there are also substantial differences within wealth groups in terms of the amount of income reportedly gained from irrigation. The explanations given were: different amounts of water received for irrigation; different levels of knowledge about improved agricultural practices; and different amounts of effort put in to farming. Inequities in water distribution emerged as a serious problem in all sites, reportedly preventing many households from making the gains expected from irrigation. To some extent these appear to be due to losses of water from irrigation canals, such that further away fields receive less water than those close to the source. But mismanagement and corruption in distribution were also widely reported and even where by-laws for equitable distribution have been established, enforcement seems to be weak.

Lack of enough knowledge of irrigation management and improved agronomic practices was mentioned as a constraint even though all farmers received training in these areas at the time of irrigation development, and respondents cited training in agronomy and agro-business as important factors in helping them to diversify. There is also evidence that people have learned by observing the practices of innovative farmers in their village, and some more risk-averse households waited to adopt new crops until they saw the benefits to their neighbours.

Even the better-off irrigators reported that they faced serious constraints and risks in earning a reliable income from their new crops. These relate to both production and marketing. While irrigation reduces climatic risk, households still reported that lack of rain affects their crop production and in the highland site frost and snow could cause a lot of damage. Crop pests, particularly affecting vegetables, were reported in all sites. These problems are exacerbated by reported gaps in the availability of improved farming inputs (pesticide, fertiliser and improved seeds) in local markets. On the marketing side, it was reported that farmers face low and unpredictable prices for their new crops. A study of the potato market chain showed that this is rooted in the power imbalance between the producers – who produce in small quantities, lack good market information and cannot access large market centres because of the small scale of their production and lack of transport – and the assemblers who buy from them. Because there are so few assemblers operating at such a local level and buying directly from small farmers, they are able to fix prices. The problem is exacerbated by a lack of facilities for producers to store crops and assemble them for bulk sales. This situation significantly limits the benefits which farmers stand to gain from diversifying into marketable crops. Although this problem was identified in one particular market chain, it is likely to apply both to other crops and in other parts of the country where producers face similar conditions. In fact these communities are relatively well connected in terms of roads (though they still lack affordable means of transport), so the problems may be more severe elsewhere.

In spite of these problems, the reported mean income of irrigating households has increased by over 20% and one farmer reported that his income has gone up by 400%. This increased income is improving people's standard of living and they are spending more on buying a wide range of goods. There is clear potential for irrigation to generate wealth and thus contribute to poverty reduction and growth in the local economy. However its poverty reducing potential will be maximised if more attention is paid to equity, particularly in institutional management of water distribution in irrigation systems. It must also be borne in mind that irrigation alone will not transform the livelihood of many of the poorest – in our study sites many poor households continue to rely on the PSNP and other

services to maintain their livelihood and food security – and other interventions will be needed to build up the assets of the poor.

There is also evidence that reinvestment is taking place into agriculture and livestock – key productive assets – which should increase prospects for further income generation. However, reliance on agricultural growth and agricultural strategies for poverty reduction will not be sustainable in Ethiopia; due to tiny land-holdings, resource degradation and the huge gaps in infrastructure and market access in rural areas, agriculture is already failing to support millions of the population and leaving them reliant on the PSNP or food aid. It is therefore critical to understand whether irrigation and agricultural growth will trigger growth in the rural nonfarm economy and enable people to move out of agriculture into new, high-earning and more sustainable livelihoods. This study cannot answer this question, but does provide some indications of the role which irrigation might play. Many households reported that they have spent the additional income from irrigation on educating their children, which in decades to come could enable them to move out of agriculture, but only if other jobs are available. Irrigation seems to have led to increased expenditure on fertilisers, pesticides and a variety of non-farm items. If this took place on a large scale it could drive growth in the production or retail of these goods in the area. However, for this to happen serious gaps in the connectivity between rural areas and urban centres will have to be addressed (by investing in transport, communications and market development) and services such as credit facilities will have to be supported in the area in order to promote enterprise.

4.1 Recommendations

For irrigation to contribute effectively to poverty reduction and growth through supporting income diversification, the right enabling environment is needed. Creating an enabling environment requires clear understanding of the existing production and marketing system, and of the constraints and opportunities faced by both producers and other actors. The enabling environment includes management of the water resource, support and extension services for farmers, and marketing infrastructure and institutions in order to enhance the profitability of irrigated agriculture for small farmers. In addition, water must be distributed according to transparent and equitable rules, to ensure that more farmers share the benefits of irrigation.

At the same time, parallel investments must be made to promote enterprise development in the non-farm economy. Not all farmers can transform their livelihood through irrigation, as this study showed, and in some areas declining water availability and land holdings will mean that irrigation is not a viable long-term strategy. Efforts are needed to ensure that agricultural growth, which will be achieved in part through expansion of irrigation and measures to enhance the efficiency and profitability of irrigated agriculture, leads to growth in the rural nonfarm economy over the coming decades. On the basis of the findings of this study, the following recommendations are proposed.

4.1.1 Equitable irrigation water distribution

Mechanisms should be established to ensure that by-laws regarding equitable distribution of water are enforced. This is likely to require ongoing periodic support from implementing NGOs, extension workers or woreda officials and could include:

- Regular awareness-raising with beneficiaries of the scheme about their rights and duties

- Transparent criteria for allocation of water
- Clear opportunities for farmers to report problems in allocation, first to the irrigation committee but also externally, e.g. to woreda officials
- Training for DAs, woreda officials and irrigation committee members in conflict resolution
- Reduced irrigation fees for those receiving less water

4.1.2 Sustainable management of irrigation water

Reducing water losses should be a priority, and can be achieved by:

- Upgrading infrastructure e.g. lining canals, adopting drip irrigation technologies
- Training irrigation committee members in the maintenance and repair of canals
- Establishing maintenance schedules

It is also critical that scheme management and estimates of water availability reflect the realities of water use, bearing in mind that in all three communities studied, households reported using water from the irrigation scheme for domestic use and livestock:

- Water services should be planned for the start to take account of different uses, taking a multiple use water services (MUS) approach

Irrigation water development projects should not be considered complete after the construction of irrigation water access facilities. If these projects are to bring about long lasting positive impacts on the beneficiaries' livelihoods, they must be accompanied by measures to enhance market access and the development of necessary infrastructure as detailed below.

4.1.3 Increasing production

Increased production could be achieved by:

- Staggered cropping of high yielding varieties of crops with short production cycle and use of improved inputs
- Increasing irrigation water use efficiency through, among others, the introduction of sprinkler and drip irrigation technologies so that beneficiaries could reap maximum benefits from irrigation schemes
- Expanding or developing additional irrigation schemes (must be based on an assessment of available water resources)
- Improving availability of inputs by supporting markets
- Providing credit for start-up costs / agricultural inputs

The following would improve farmers' knowledge and skills for more successful irrigated production:

- Strengthen Farmer Training Centres (FTCs) to train farmers on agronomic practices, marketing, irrigation management, and food preservation and preparation.
- Use these FTCs to train a small number of farmers intensively, who can then act as trainers or advisors to others in the community.

- Coordinate among networks of FTCs to enable successful experiences and innovations to be shared more widely.
- Create dedicated extension services on horticultural production and marketing.

4.1.4 Marketing infrastructure and institutions

There is an urgent need to improve market access and information for small producers. This would significantly reduce their marketing costs and the price risks they face, improve market efficiency and enhance the profitability of irrigated agriculture. This could include:

- Investment in transport links with market centres
- Establishment of producer-based organisations (such as cooperatives) and development of storage and assembly facilities at kebele level, allowing farmers to sell in larger volumes directly to wholesalers and to set up longer-term agreements with buyers.
- Establishment of storage or simple processing facilities for perishable crops to minimise post-harvest losses and reduce price risk for producers.
- Creation of market information service delivery centres at local level with reliable price information for different products.

In the case of the potato market chain, there are many redundant steps in the market chain which could be reduced or simplified to reduce costs, for example by:

- Establishing producer-controlled groups who carry out assembly, storage and transport
- Improved road infrastructure to producing areas
- Development of storage facilities accessible to producer organisations
- Supporting producer groups to transport produce and sell directly to secondary markets and exporters.

4.1.5 Addressing equity concerns

While irrigation allows some producers to greatly increase income and transform their livelihoods, for others it offers more limited benefits. Irrigation alone does not seem to enable poorer households to build up their assets and escape chronic poverty; other investments are needed, and this study points in particular to the following:

- Provide credit on appropriate terms to poorer households specifically for investment in income-generating activities such as purchase of farm inputs; start-up costs for new farm activities such as poultry keeping, or non-farm enterprises such as trading, construction, brewing or local handicrafts production. The amounts may need to be higher than the few hundred birr often offered to the poorest households. This credit could be provided through revolving credit schemes or local savings and credit institutions.
- Link the Productive Safety Net Programme to the development of key infrastructure (e.g. road building, construction of storage facilities, construction of irrigation schemes)
- Provide extension support for non-farm activities such as pottery, weaving and trading.

- Adopt measures to reduce head-tail inequalities in water access, such as

4.1.6 Medium to long term impacts

For the gains from irrigation to offer sustainable, long-term prospects for poverty alleviation, they will have to generate growth in the non-farm sector as well as in agriculture. As a first step, practices that promote the establishment of local level saving and credit associations should be promoted. The emergence of a network of local level saving and credit associations would help the development of saving culture and thereby create a potential for non-farm activities.

However, the meso-level multipliers between the farm and non-farm sectors are currently weak in Ethiopia, and building these requires investment in:

- Transport links between rural areas, market centres and major towns
- Communications networks
- Electrification
- Other measures to attract financial services, banks and businesses to rural market centres

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