



CZECH REPUBLIC
DEVELOPMENT COOPERATION

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*In its capacity of contractor within the official framework of
the Czech Republic Development Cooperation with Ethiopia*

EFFECTIVE IRRIGATION FOR SUSTAINABLE AGRICULTURAL PRODUCTION

Analysis of market potential of vegetable production

Kembata Tembaro Zone

SNNPR, Ethiopia

Mendel
University
in Brno





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1. Introduction and background of the study

1.1. Project description

Name: Effective Irrigation For Sustainable Agricultural Production, 2014 – 2017

Place: Kacha Birra and Angacha woredas in the zone of Kembata Tembaro

Funder: Czech Development Agency

Implementer: Mendel University

Partners: Bureau of Finance and Economic Development, Bureau of Agriculture: Nat. resources and small-scale irrigation process owner, Water and Irrigation development Bureau, Bureau of Agriculture and Natural Resources, Bureau of Administration, Cooperative office

Overall Objective: To help maintain the landscape's potential in light of the current emphasis on agricultural production.

Outcomes:

- 1) provide more effective utilization of water for intensive and sustainable agricultural production in the target area
- 2) reduce the landscape's vulnerability to erosion
- 3) increase of agricultural productivity, while simultaneously decreasing the size of actively cultivated land in the target areas.

1.2. Purpose of the study

One of the outcomes of the project is to increase an agricultural productivity of small scale farmers in the selected area. Thanks to the project the vegetable production in Angacha and Kacha Birra project sites has increased – quantitatively (farmers produce more tones of vegetables) as well as qualitatively (farmer have produced new types of vegetable thus their sources of income as well as variety of food for consumption diversify and made them more stable).

When producing more vegetable farmers need to be connected to a market to be able to sell their production for reasonable price. Output 3 of the project targets the ability of farmers to cooperate and be able to deliver quality and quantity of vegetable to the local market. In order to make a comprehensive production plan for farmers that will be based on irrigation options and market demand projects has conducted the survey of prices of vegetable and results are presented in this study.



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1.3. Context in selected area

Angacha district is one of the six woredas in Kambata Tambaro Zone, Southern Nations, Nationalities and Peoples' Region (SNNPR). It is located about 260 km south west of Addis Ababa. Agriculture, mainly composed of crop production and animal husbandry, is the main livelihood of the population in the woreda. The agricultural practice employed in the area is traditional oxen-plough and hoe-culture practices. The main food crops grown in the woreda are wheat, tef, barley, maize, field peas and broad beans. Root crops, enset, and potato are also grown in the woreda. Among the perennial crops enset (false banana) plays an important role in the life of the people through its multiple uses as a source of food, fiber, animal fodder, construction material and to make mats for sleeping. Livestock are an integral part of the agricultural production system and play an important role in the economy of the woreda in general.

Wheat is the major crop grown by the farmers. Enset (*Ensete ventricosum*) and broad bean are the second and third most important crops in the villages. Green enset is available throughout the year. Among vegetables, potatoes, cabbages, peppers and carrots are the main cash crops used to generate income for the family in the three sub-villages. Maize, teff, haricot bean are produced for family consumption and extra produce is sold in the market.

In Kacha Birra, the existence of diversity of crops and farming systems in smaller administrative unit is due to the extremely varied topography and agro-ecology. In all farm plots, site information such as crop types, the type and rate of fertilizers applied, the yield with and without fertilizer, geographical locations of the field, farming system, land use and fertility management practices were recorded on site description. The common crop types in the study area were found to be maize, teff, wheat, sorghum, barley, enset, haricot bean, potato, faba bean and vegetables in a decreasing order of magnitude. The distribution and average yield of crops varied from one landscape to other landscape even in the same altitude. The average yield of the crops at all landscape positions was below optimum level due to the lack of site specific soil fertility management, low soil fertility status, decline in soil fertility, unbalanced and little fertilizer use, cultivation of steep slope, lack of improved varieties, improper agronomic practices, lack of control of weeds and diseases, post-harvest loss and other biological and physical factors.

The only inorganic fertilizers that were used by farmers in the study area were DAP and urea with rate below blanket recommendation rate. Some farmers didn't use both of inorganic fertilizer at all. In the study areas many tree species such as eucalyptus and shrubs were observed. In order to improve the agricultural production in study area, site specific soil fertility management and the fertilizer rate which is based on soil test with proper agronomic practice and improved crop varieties are highly recommended.

The major trading constraints include high postharvest losses, poor marketing and value chain development, and weak linkages and integration among value chain actors. Postharvest losses of vegetables are high primarily because of poor postharvest handling, poor storage infrastructure and transportation facilities as well as poor market information and support systems in rural



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areas. Smallholders in rural areas are often poorly linked to markets and do not adequately access functional market information. Often middlemen do make much higher marketing margins than the producers, limiting the motivation of farmers to expand vegetable production, not forgetting the associated high input costs such as fertilizers and agrochemicals. Vegetable value chains are also generally poorly developed.

1.1. Situation on the local and zonal markets

Trading functions are mostly carried out by producers, retailers and whole sellers who are mixing vegetables with fruits or farmers who sell the products in open markets. On zonal as well as local markets there are typically only few bigger producers who supplement most of the vegetables and other products. Due to this strongly oligopolistic market structure of vegetable, small producers face difficulties to enter freely in the market. Producers have more chances to get a good position on the market if their supplies are in bigger quantity and very regular so the consumer can rely on such producer. Usually individuals can't enter the market due to missing logistics and capacities. At Angacha and Kacha Birra districts there are no retailers in the value chain performing standard trading functions. Wholesaler participation is only for limited commodities (onion, potato and garlic). In Lesho (KB) there are also retailers selling vegetables to urban consumers. Thus, the vegetable cooperatives could play a key role in succeeding on the market. Bigger group of producers could enter the market, share logistical expenses as well as costs of potential losses. The cooperatives should be capacitated in order to fully engage in serving all its members in delivering of their vegetable products (outputs) for markets.

Competitive environment is absent on local markets in the areas. Thus, the option for new producer to come to market also depends on local administration that will support trade of vegetable by creating more competitive environment for all. The Woreda Trade Office should be capacitated in a way that it could create/promote fair market for smallholder producers and all actors and encouraging of actors by giving incentives and awareness creation.

Processing of vegetables, in the sense of preserving and value addition, is not practiced as such in the study areas. Processing is undertaken mainly by hotels or restaurants in which case fresh and cooked vegetables are sold to consumers. In major towns of the study areas, very few individuals process potato into chips and sell by the roadside.

2. Reasoning and methodology of the study

Horticulture is the branch of agricultural science that uses technology and marketing strategies to increase vegetables, fruits, flowers and ornamental plants production for human welfare. In Ethiopia, more than 85% of the population depends on agriculture. However, agricultural



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production is less due to lack of advanced agricultural technologies and yield losses caused by damaging pests, diseases and environmental conditions. Many farmers in Kembata Tembaro also depend on agricultural production especially cash crops like fruits and vegetables.

The study was conducted in the 2 districts producing major horticultural crops and the data collection was done from January to December 2016 based on weekly price analysis (observation, interviews with sellers).

Main purpose of the study was to identify the price variation of several types of vegetable. Types of analyzed vegetable were identified together with woreda agricultural office and project interventions: vegetable, that is traditionally grown in particular area, vegetable that is not grown in the area, vegetable that is part of project demonstrations, vegetable that has high market potential, vegetable with added nutrition value.

At the basic level, price developments were observed at tomatoes, onion, cabbage, carrot. Cooperatives also showed interest in other types of vegetables, other potential species that farmers could cultivate were monitored: beetroot, garlic and peppers.

Data collection places were selected based on their importance and proximity to targeted cooperative and farmers. For both project sites 2 markets were selected – one in zonal town and one in woreda town: for Kacha Birra – Durame market and Shinshicho market, for Angacha – Hossana market and Angacha market.

3. Results of the survey

3.1. Prices variation (weekly) – evaluation of price environment on final markets,

The development of prices and their culmination and depression is shown for each vegetable in the attached charts. The graphical representation clearly shows the development of prices in individual months and weeks. The analysis presented clearly shows the time when the supply of vegetables to the markets is the most advantageous. The graphical development of prices shows the possibility of increasing farmers' financial income, observing appropriate agrotechnical deadlines and changing crop rotation so that the delivery time for vegetables coincides with the culmination of market prices.

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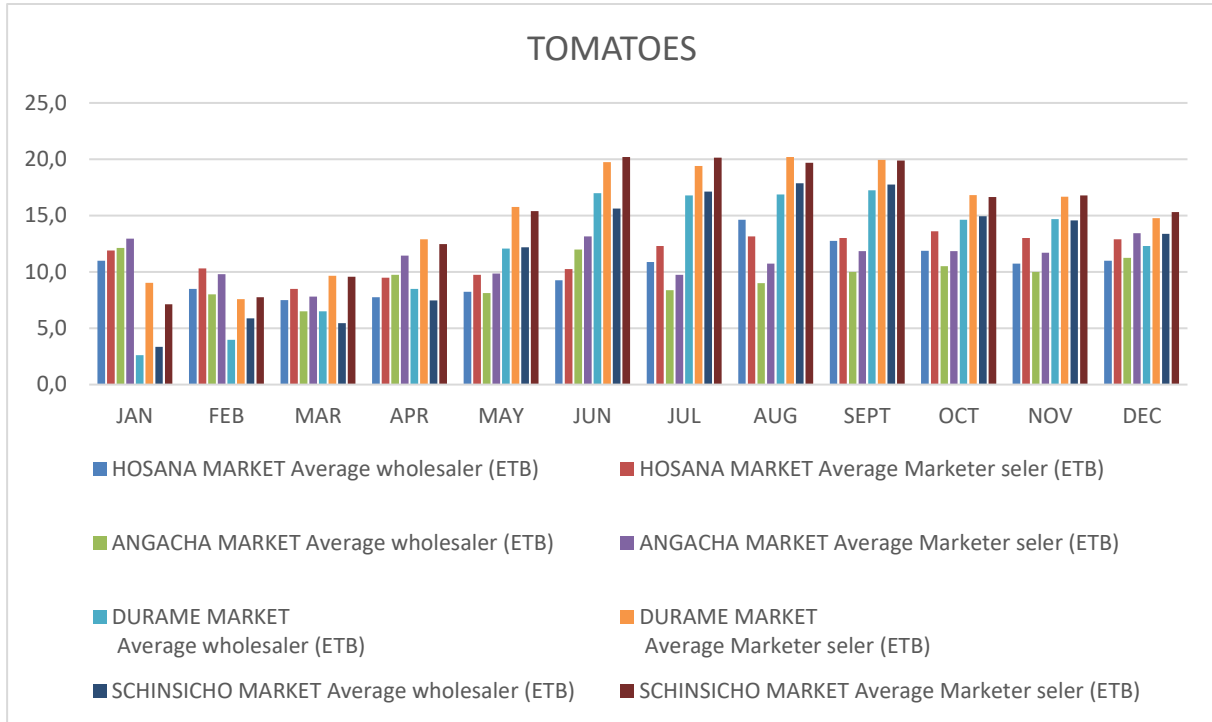
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TOMATOES

The development of tomato prices culminates from June to September in all selected markets. The substantially higher price of tomatoes shows a great potential for farmer who produce tomatoes before the rain season by using any type of irrigation. At the beginning of the year the price is lower as there is less demand due to enough individual production stored. The main selling season is the highest market price in Durame and Schinsicho which is more favorable for KB cooperative.

Regionally, tomato is one of the commodities with the most potential, especially as tomato concentrate is the most commonly-used ingredient in African cooking. Ethiopia's tomato processing sector represents untapped market potential for export to regional, European and Middle Eastern Markets.

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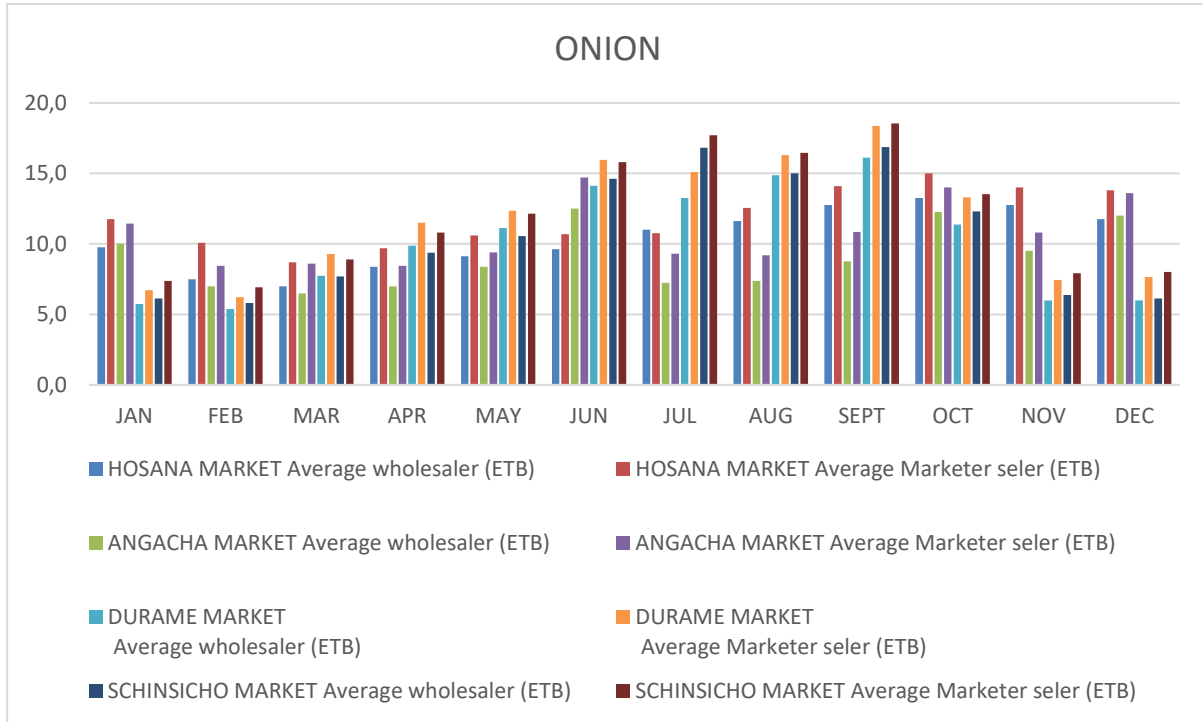
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ONION

The highest market price is in the second half of the year in the rain. As part of the round culmination, onions in Kembata have the highest market potential in September after the fall of the season.

The onion is produced both under rainfed and under irrigation in the off season. Despite the onion production is widely spread, the productivity of onion is much lower than other African countries. The low productivity could be attributed to the limited availability of quality seeds and associated production technologies used, among the others. The quality of seed supplied by the informal sector in most cases is not good enough. Most of the times there have been problems related to germination capacity of the seeds. The problem is further extended by the short shelf life of onion seed (one year under favorable condition).



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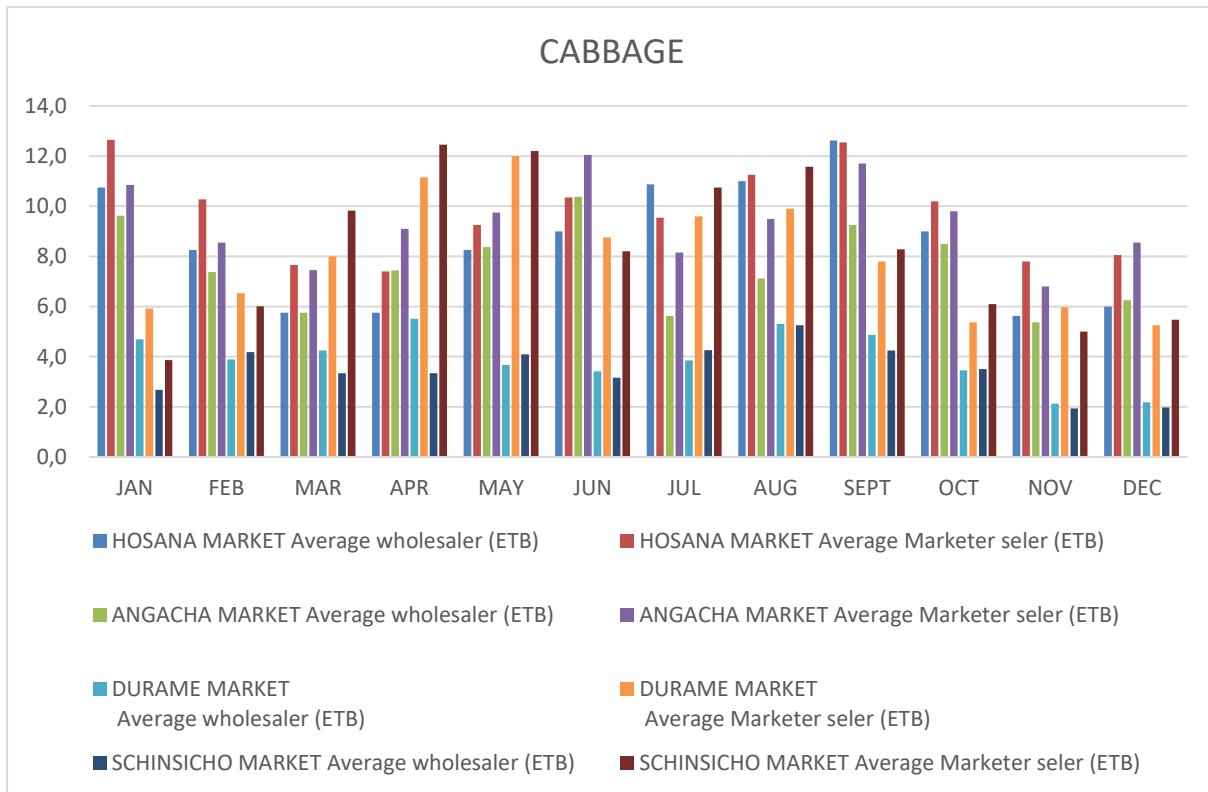
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CABBAGE

Cabbage is a cool-season crop generally requiring 60 to 100 days from sowing to reach market maturity, depending on the variety. Cabbage can be grown as a spring crop as well as a fall crop. Although it can be direct-seeded, most cabbage production relies on the use of transplants.

The market price of cabbages is bit more constant than with other crops throughout the year. For farmers, it can be a steady production path without major price fluctuations. On the other hand the price for cabbage is generally low and as such it might be treated as complementary vegetable to more value added vegetable types. Highest prices are attained in Hosana and from April to June.



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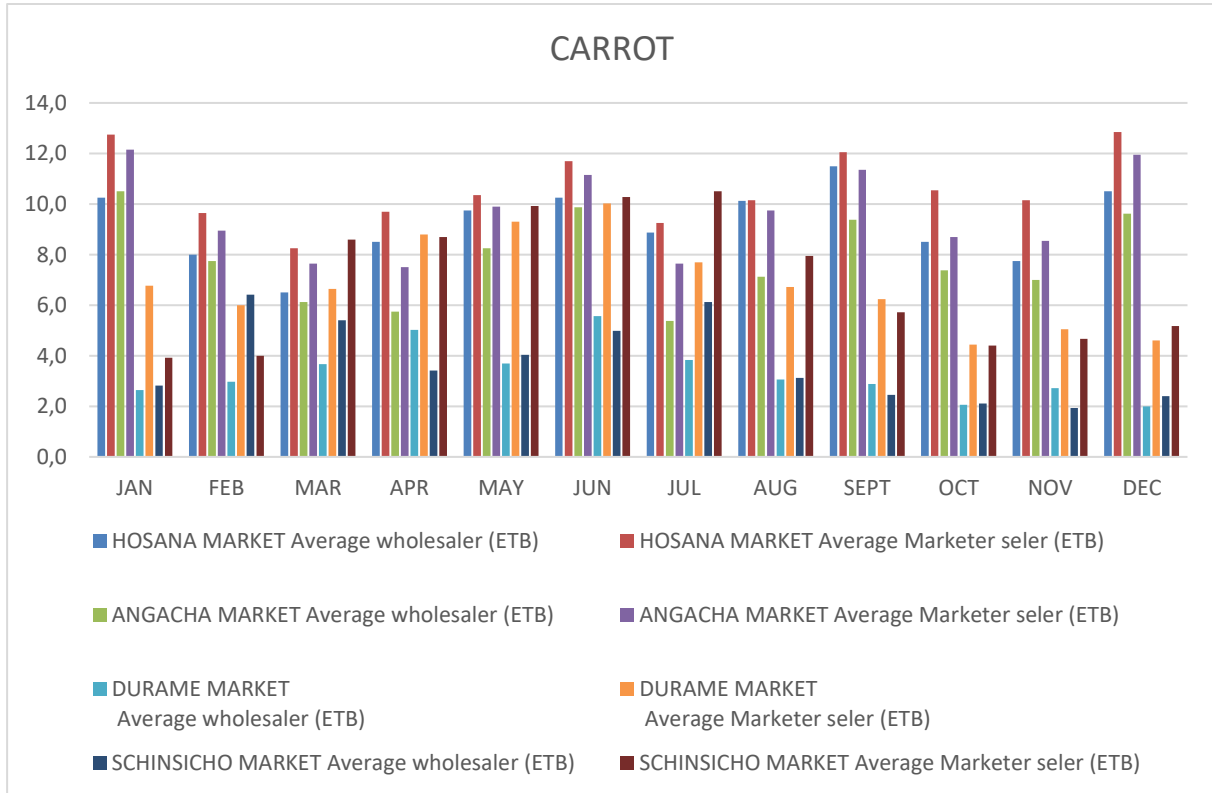
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CARROT

The area under carrot is increasing from time to time mainly due to its ease of production, and the increases in small scale rain fed and irrigation areas. In general there is lower productivity of carrot production compare to other african standards. The low productivity could be attributed to poor cultural practices including plant to plant spacing.

The average price of carrots has 3 main peaks – in Dec/Jan, June and September and as such carrot could be grown throughout the year focuses on these three peaks. Significant price increases occur in December when the highest market prices in Hosana and Angatcha.



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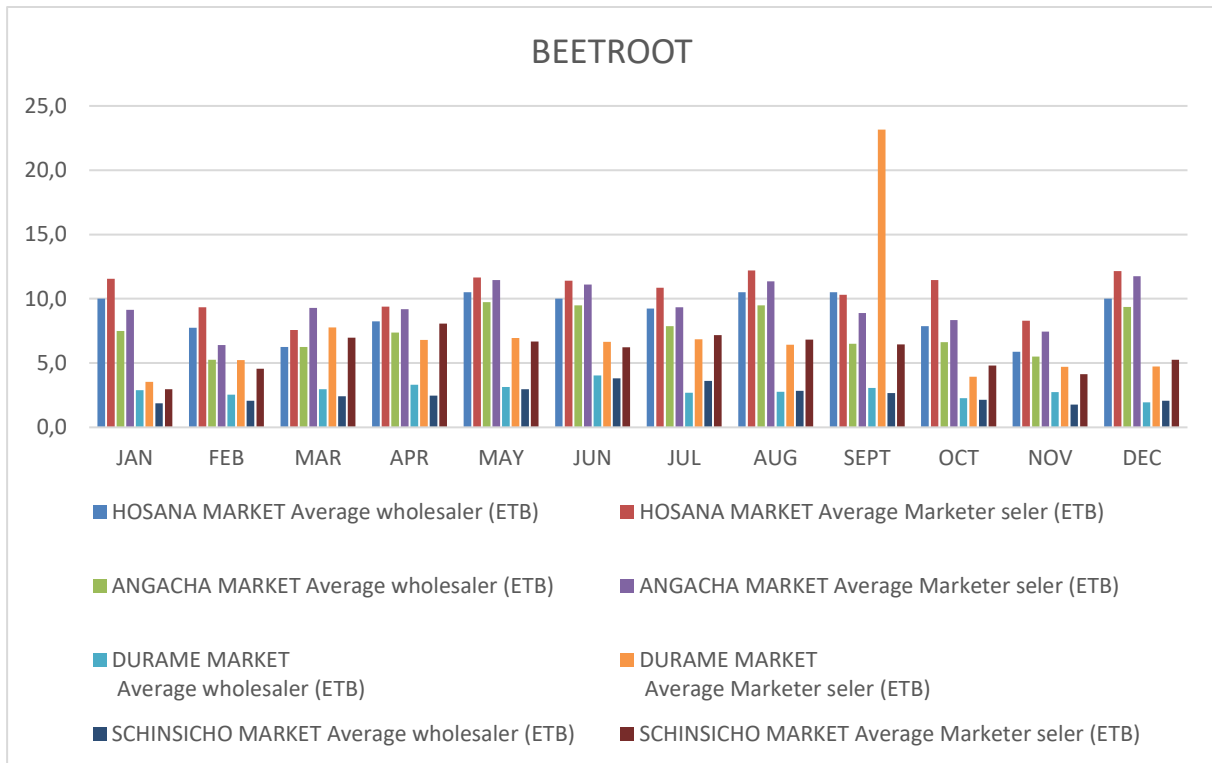
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BEETROOT

Ethiopian beetroot, also common as table beet, is highly nutritious vegetable crop. When not serving as food, the underground vegetables and their leaves also go into processing for production of food colors. Their medicinal qualities have made the plants feature in traditional treatment of fever and constipation, among other typical ailments.

The market price is in the course of no significant fluctuations. We can say that for a farmer it is a safe commodity that fired to invest in energy, without increased risk. During September, there is only a significant increase in the Durame market which might be an anomaly.



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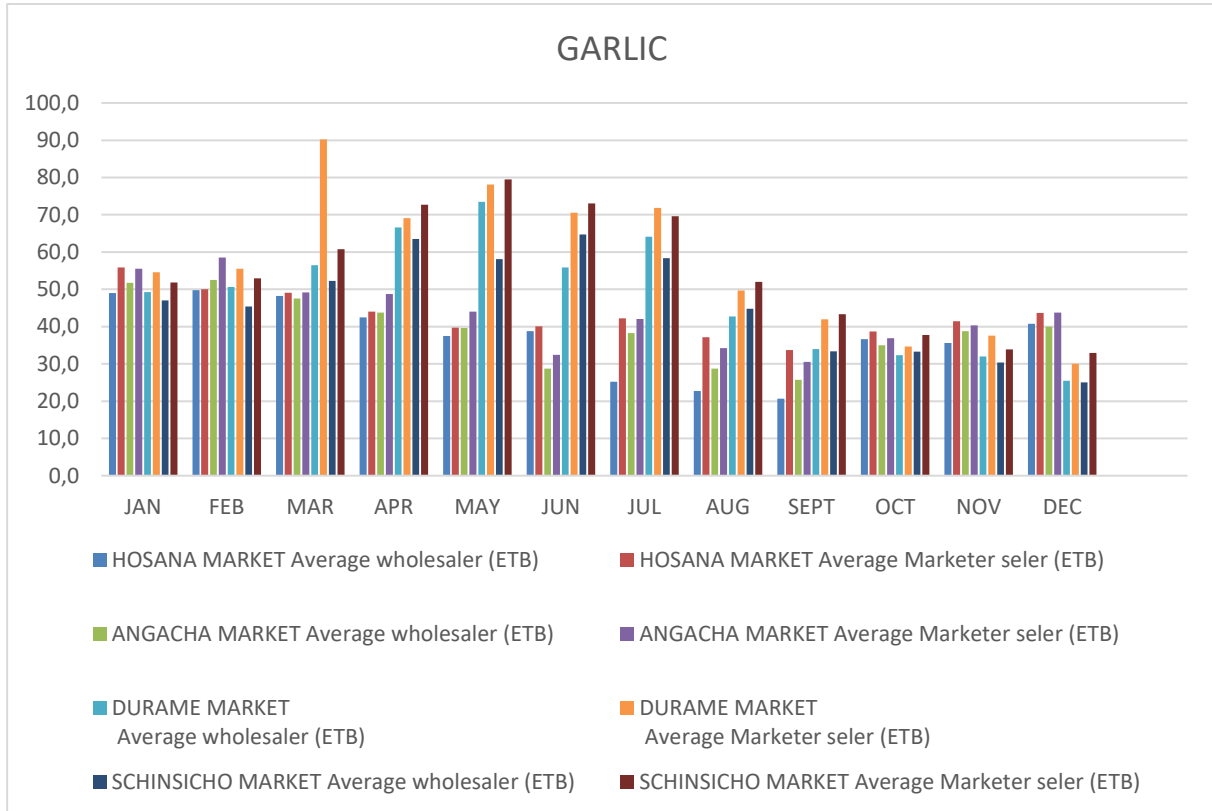
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GARLIC

Garlic is one of the most important vegetable crops produced mainly in Tigray region; however, farmers are producing the crop from the available cultivars without or with very low rates of nitrogen fertilizer. The cultivars produced in the region were not evaluated in comparison to improved varieties to the response of nitrogen fertilizer.

The price of garlic is the most favorable in the first half of year. Garlic does not need much water so it is ideal to be produced out of main rainy season (just before, or after). A very significant price increase is taking place in March on the Durame market.



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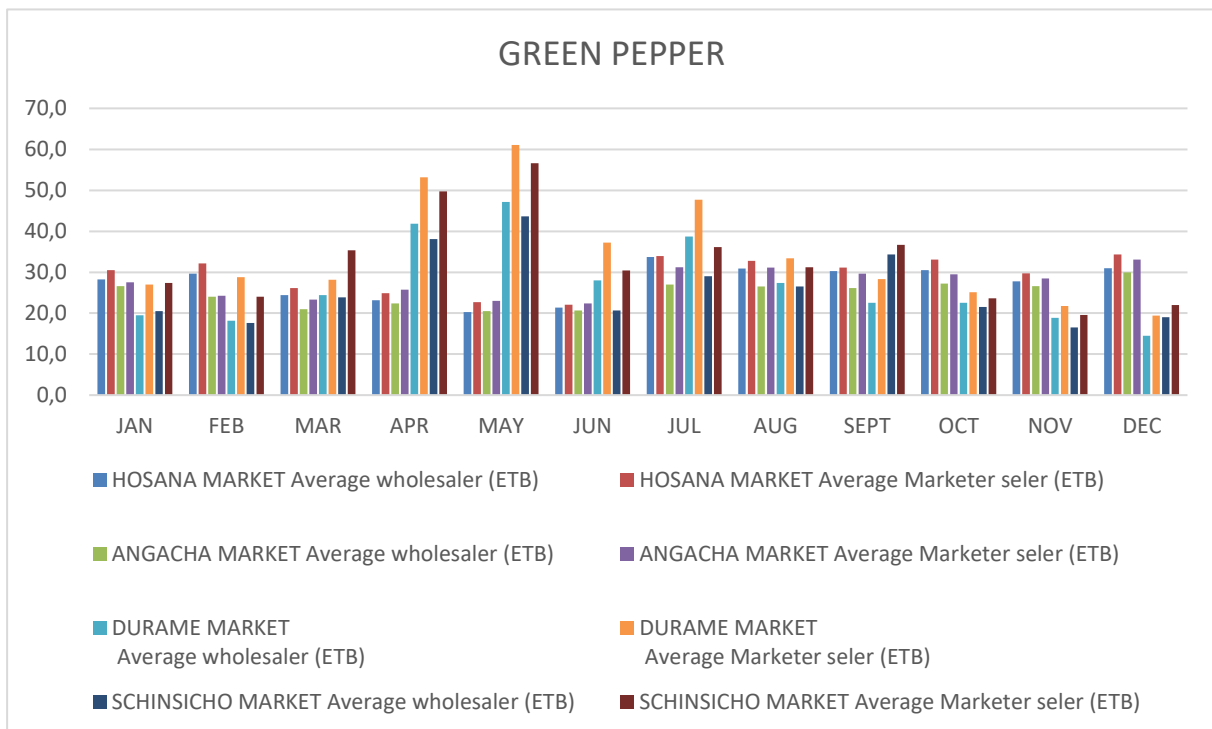
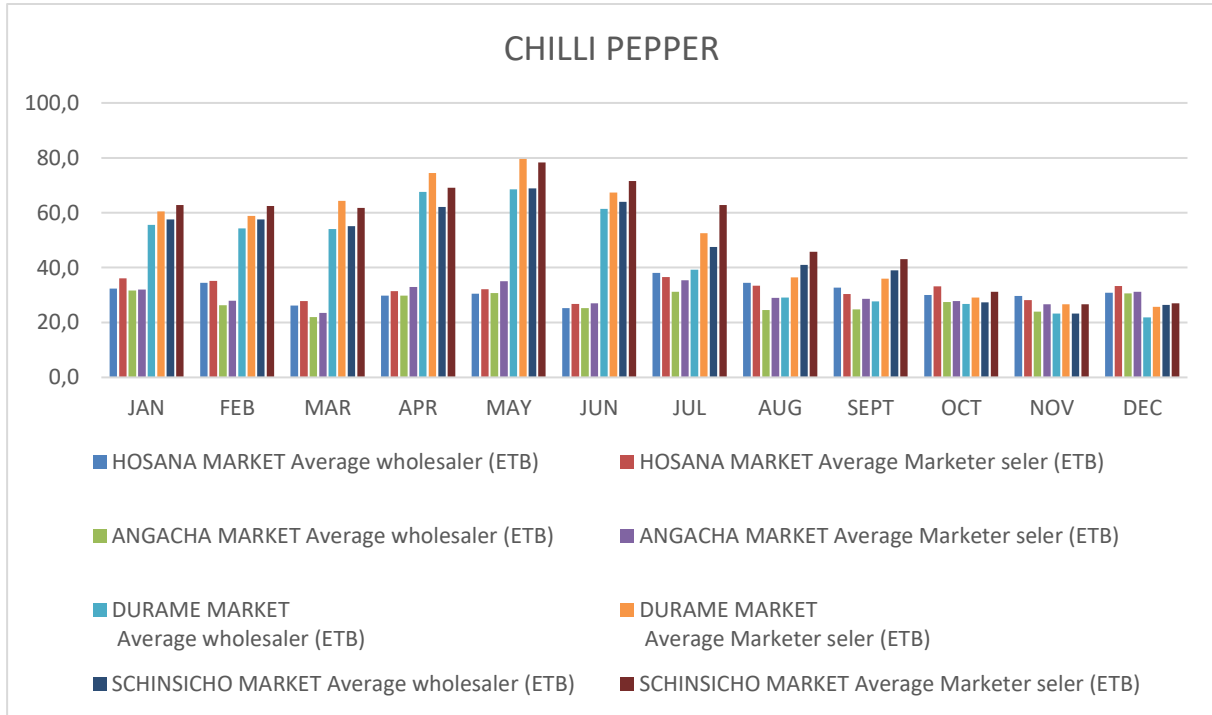
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CHILI/GREEN PEPPER

Ethiopians have strong attachment to dark red pepper which has high value principally for its high pungency. The fine powdered pungent product is an indispensable flavoring and coloring ingredient in the common traditional sauce whereas the green pepper is consumed as a vegetable with other food items. There is a general belief among Ethiopians that a person who frequently consumes hot pepper has resistance to various diseases. It is in the daily diet of most Ethiopians. In addition to having major role in Ethiopians daily dish it also plays an important role in the national economy. It is an important cash crop today pepper production is for market in SNNPRS. It is a crop of high value in both domestic and export markets. Since it is a commercial and industrial crop, it generates employment to urban and rural workers.

In recent years, the area of production of hot pepper in southwest Ethiopia is increasing due to its high price in the market as compared to other major food crops such as maize that are known to be widely cultivated in the region. Therefore, it is rational to design strategies that can support and facilitate such a vibrant agricultural transformation which could have an immense impact on the socioeconomic life of the people in this part of the country.

Main price for chili peppers rises in the first half of the year, for green peppers the peak is in April - May mainly on the market in Durame and Schinsico. In the second half of the year, the market price generally declines for chilli peppers, price of green peppers is generally more stable throughout the year (with exception of April/May).



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3.2. Production planning

On the basis of intensive monitoring of price developments on nearby markets a table was compiled. The table shows the optimum month for vegetable sowing in view of observed price developments in the monitored markets. By using the recommended data, crop harvesting can be planned to be based on the optimal price level of the vegetable to be able to sell it on the markets for better price.

RECOMMENDATIONS FOR SOWING SYNCHRONIZATION WITH CULMINATION OF THE MARKET PRICE OF VEGETABLES

VEGETABLE	DATE OF SOWING WHEN ADDED IRRIGATION IS USED	SOWING DATE WITHOUT IRRIGATION
TOMATOES	February	March/April/May
ONION	December	March/April/May
CABBAGE	November	March/April/May
CARROT	February	August
GARLIC	January	September
CHILLI PEPPER	December	February
GREEN PEPPER	December	February

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4. Analysis of cooperative and project benefits for farmers

4.1. Farmer's production

Angacha

<i>Cultivated crops (kg)</i>									
Year of Evaluation	Maize	Wheat	Teff	Cabbage	Sorgum	Endive	Tomato	Onion	
2014	810	563	492	364	167				
2017	1210	752	530	399	181	110	118	213	

Kacha Birra

<i>Cultivated crops (kg)</i>									
Year of Evaluation	Maize	Wheat	Teff	Sorgum	Haricot bean	Tomato	Onion	Carrot	Endive
2014	692	565	456	167	153	580			
2017	850	689	548	181	220	732	213	437	110

A closer estimate of the average vegetable production is apparent. At the last periods of the project, farmers began to devote themselves to growing new crops with which they learned about field training. Newly established crops include Endive, Tomato, Onion, Beetroot. Farmers now have to travel 18 km to get the vegetables produced on the market. After the workshops were completed, the production of the 250kg compost was increased to one farmer.

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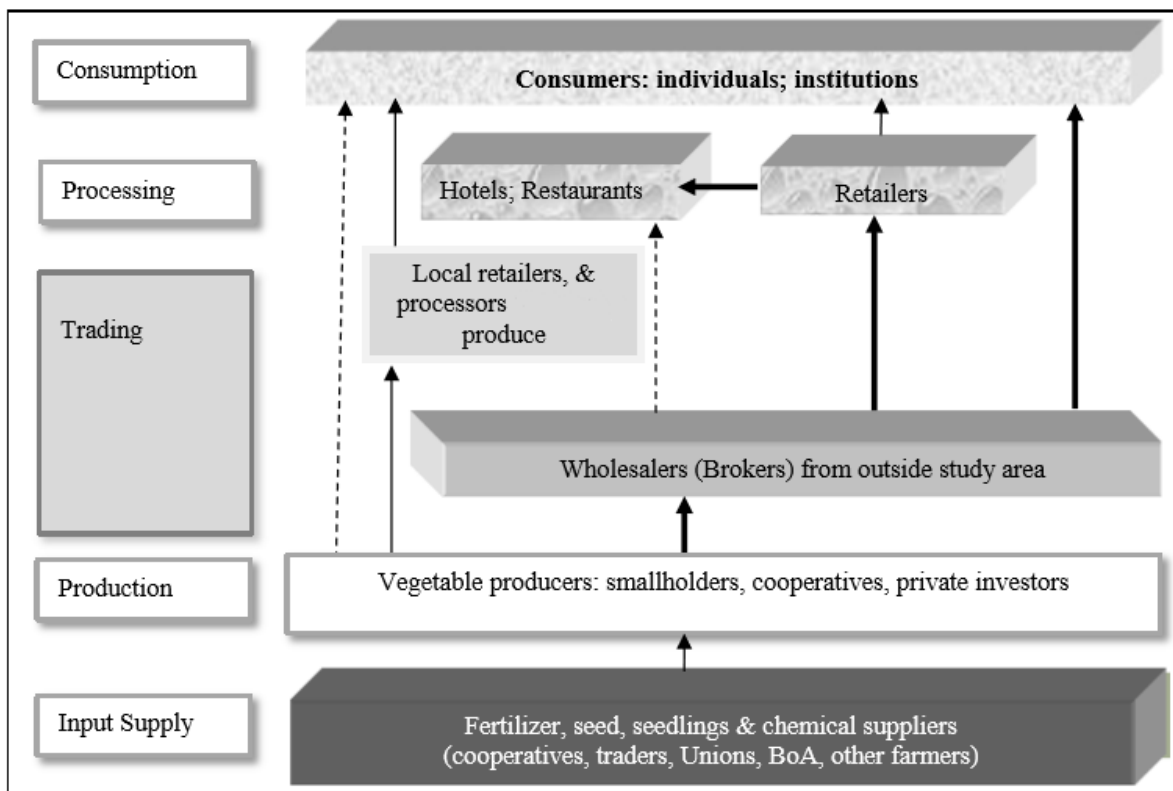
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In the course of the project, the potential production of cultivated crops increased. Very interesting from a production point of view are beans. From freshly grown celery, carrots begin to appear.

4.2. Cooperatives role

Figure 1. Mapping of vegetable value chain functions and actors



Vegetable value chains and marketing functions

The functions involved along the value chains of various vegetables in the districts are more or less similar. Differences appear mainly in the channels produce pass through in the trading



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functions and actors assuming different roles. Thus, mapping of value chain functions mainly shows the relationships and integration of the processes and activities performed along the value chain. Major value chain functions include: input supply, production, trading, processing and consumption. Figure 1 displays the functions or processes in vegetables value chain, the activities performed under each of the functions and the actors among the different value chains.

Regarding inputs, seeds, fertilizer, and pesticides are usually supplied to farmers by farmers' cooperatives/unions, traders and other individual farmers. Most farmers also recycle seeds of specific varieties by saving each season and do occasionally exchange with other farmers. Seeds of improved varieties are also supplied by private traders and cooperatives or unions. District level agriculture offices engage in input supply activities. Very few private investors are engaged in vegetable farming around urban areas as is the case of Hosana and Durame districts.

Establishing the cooperatives in the selected areas has been a long and difficult process. Project has faced many obstacles (low interest of farmers who would not directly benefit financially, limited tradition of cooperatives in the surrounding area, varying level of involvement of cooperative offices over time). But since 2017 when they got temporary certificates they have served as connecting point for farmers as well as local and zonal offices. Through them ministry of agriculture distributed seeds of sunflower, garlic, ginger etc. Cooperatives were able to organize farmers and plant crops on cooperative field together and also jointly to sell the production. Although the cooperation is on small issues the cooperatives are getting more independent with every action they take and they learn how to proceed in these situations. The implementer will finalize with them the production plan based on which they should be able to plan, act and sell together.

There are areas where cooperatives need to improve their performance especially in trading activities: individual farmers have enough production to be able to sell but they might not have means of transport or can't spare a person to go and sell vegetables. That is why cooperatives need to step in more and support farmers to be able to sell regularly and for fair price.

4.3. Means of transportation of products to target customers/markets

Transport is a critical service that, if promoted, planned and accompanied by appropriate training, can turn out to be a profitable enterprise for small holder farmers. Production, trade and daily life require movement of goods and people. At its most basic level, smallholder farmers can offer transport services to market for farm produce 'on foot' or 'on hoof'.

Most small-scale farmers in project sites have no means of transport to carry their produce to markets. Transportation problems result in loss of quality and late delivery, which in turn lead to lower prices and income liability. Lack of transport is in fact one of the many barriers that impede access to markets and hence to revenues which are much needed by smallholder farmers.

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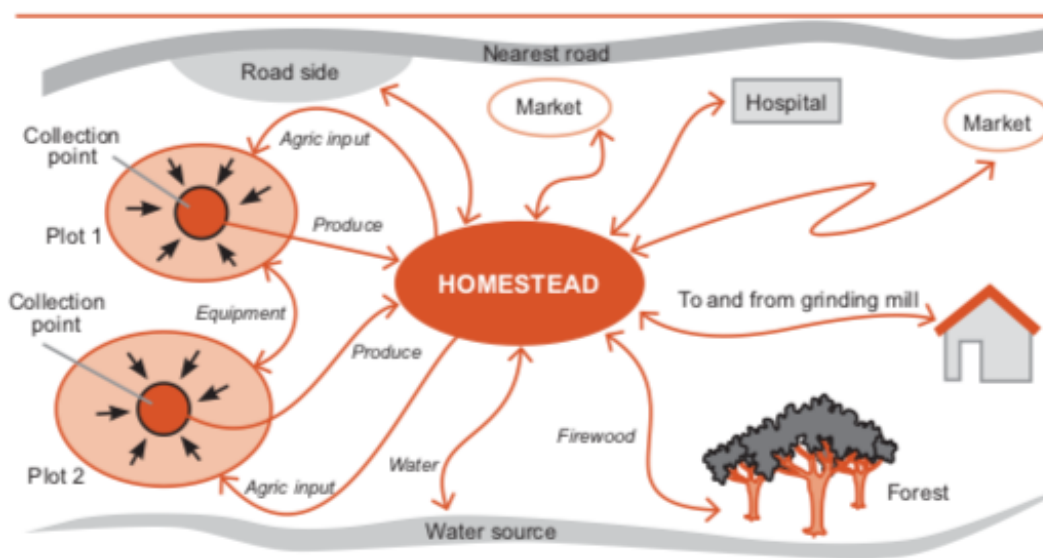
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However, there is little point in promoting development and diversification to smallholder farmers in rural and remote areas, without giving them an opportunity to access markets.

Different transport technologies exist which employ human energy, animal power or the use of motor vehicles. They range from basic walking and carrying to large-scale motorized transport, including motorcars, large trucks and buses. The many transport options available have different ranges, capacities and operating costs. These overlap and provide a continuum of complementary options, each with advantages and disadvantages. They vary in purchase price, payload, complexity and their requirement for work animals, mechanics, foreign exchange and road quality.



Source: O'Neill, D. H. 2005. Ergonomics in the improvement of rural transport in sub-Saharan Africa, International Ergonomics Association Press. (Adaptation by Fabio Ricci.)

Figure 1 - Common transport routes of a small farm, zdroj: <http://www.fao.org/3/a-i0525e.pdf>

Types and modes of transport for cooperatives

Transportation considered in the project were Human based and Animal based.

1 Human based

Human power is normally widely available, Kembata Tembaro is no exception. However, human power means human labour. The tasks of transport and traction are often very time and energy consuming.

Nevertheless, human power is widely available and often cheap, as well as fairly adaptable to many terrain types and weather conditions, and in certain situations it can be the only available transport and traction solution.



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For transport purposes, human power is based on head, back and pole loading. Head loading has a defined load which can be carried, normally around 20 to 25 kilograms, but there are exceptions. Distances that can be covered are not excessive as fatigue sets in after hours of walking with loads and rest is required. Speed is very low compared to other vehicles, for example, it can be around 5 kilometres per hour.

To assess the profitability of human based enterprises requires calculating the operating costs involved, the money that can be received, and the input-output relationship for the enterprise.

2 Animal based

Domestic work animals exist in all regions of the world. Animal power is often readily available, is more expensive than human power, is fairly adaptable to many terrain types and weather conditions, and in certain situations it can be the most viable transport and traction solution available. Animals can contribute directly to agricultural production, harvesting, post-harvest operations and rural trade. Animal power can provide for carrying inputs, an expansion in the cultivation area, better soil preparation and improved yields. Animals can also save farm household time, effort and drudgery. Animal power is a renewable energy source (it can be sustained in rural areas with little external input), is accessible to small farmers (even though for many small farmers animals are expensive).

In Ethiopia, donkeys are most common animal-based form of transport of goods. They are not as strong as oxen or horses and for traction can be used only for light work, but somewhat faster in compared to oxen. In transport the donkey is appreciated for its steady speed, 5 to 6 km per hour, much like human power transport, and can sometimes trot at greater speeds, keep a good pace, even on difficult terrain and narrow paths, travel long distances and can produce surges of power that may be critical in certain situations, for example, muddy roads and steep hills. A donkey's intelligence is underestimated: it can be trained, responds well to commands and whereas donkeys are sometimes branded as stubborn this is usually because they realize that the task at hand is too difficult or too burdensome.

For example, a simple calculation of a donkey that works for 4 hours per day, 3 days per week, in a year can contribute 624 hours of work. If this is considered over a 14 year working life it equates to nearly 9 000 hours of work output. This gives donkeys great value, not always reflected in their price, as in many countries they are cheap compared to other work animals.

Conclusion on transport methods

There are two types of transport suitable for both project sites. To get their products to local market in Angacha and Shinshicho, farmers can transport goods on foot, or on hoof. Carrying loads might be time consuming and demand on manpower is quite high in such case.

Donkey transport has a long history in Ethiopia. Farmers in the poorest regions have good experience with donkeys breeding and donkey carriages. Donkey trailers appear to be the most



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efficient and most sustainable for transporting of the farm products from farmers to matching markets, which are within 20 km of cooperatives warehouses.

For markets in zonal towns, Durame and Hossana, the only option is to use animal-based transportation. For Hossana, even the animal-based transport might be time consuming and demanding. Motor-based vehicle might be more suitable for the distance but it is not present in the targeted area and might create additional costs that local cooperatives can't afford.

5. Identification of market gaps and potential

5.1. Typologisation of potential buyers and their localization

The consumer base includes urban, per-urban and rural dwellers, who buy and consume a wide range of vegetables. Village market consumers and farmers themselves absorb a substantial volume of the produces. In terms of consumers groups, in Angatcha district were of the opinion that vegetables are mainly produced for urban consumers with little for their communities.

Producers sell vegetables through different channels. The shortest channel is direct sales to consumers. Producers also sell to local collectors or wholesalers or retailers. At Angatcha and Kacha Birra, the marketing channels were found to be much shorter with produce sold mainly at village markets or district markets. Producers sell the produce to consumers and retailers as well as to wholesalers based in markets outside the district. There are several vegetable traders. These traders transport the product to other markets including Addis Ababa at peak supply periods. At Katcha Birra some of wholesalers take part in vegetable marketing serving as major providers to retail shops and hotels in the town.

For local towns, Angacha and Shinchicho, the open market seems to be preferable target. Every week on specific market day (Tuesday/Thursday) farmers could use cooperative donkeys and coordinate their transport to town. Local restaurants are not focused on vegetable and regular and quality supply is not a priority. That changes a bit with zonal towns, Durame and Hossana, where are many hotels with restaurants which would benefits from regular supply. Also hospitals and schools in those two zonal towns are targeted.



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6. Conclusions and Recommendations

Vegetables are an integral part of the farming system, which plays a crucial role in the economy of Ethiopia. Vegetable production is increasing as a result of increased area allocation, increased yield per unit area as well as size and number of areas where farmers are producing. Much of the increase in production comes from area expansion and increase in small scale irrigation activities, enabling two or more production cycles per year. However, productivity at smallholders' level is low. Production is constrained by diverse abiotic and biotic factors. Lack or limited access to improved seeds, diseases and insect pests, high postharvest losses and poor marketing system are the major challenges. Vegetable marketing is also constrained by lack of market information systems, poor market linkages, low institutional support, lack of value chain development to ensure participation and benefit to the smallholders. This necessitates looking into the whole vegetable system development via a value chain upgrading/development approach.

Based on the findings of the study, the following recommendation is to further build the capacity of farmer's cooperatives/unions so as to provide cooperatives with much better opportunities for integrating smallholders into vegetable value chains so that the profit margins of the farmers could be improve. And also to engage government and policy makers in frequent dialogues to increase their awareness so as to enhance vegetable value chain development so that farmers get sustainable incentive to increase production.