University of Applied Sciences
VAN HALL LARENSTEIN
PART OF WAGENINGEN UR

Assessment of performance and adoption of improved enset processing technologies

Asfaw

9/14/2012

A case study in Enemorena Ener district, Guragie zone, Southern Nations, Nationalities and Peoples Regional State, Ethiopia

A research project submitted to van Hall Larenstein University of applied sciences in partial fulfilments the requirements for the degree of master of development, specialization in Rural Development and Gender

By

Asfaw Zewdie

Wageningen

The Netherlands

Table of contents

Acknowledgements

First of all I would like to thanks God for giving me courage and grace throughout my study in the Netherlands.

I would like to express my deepest thanks to all those helped and encouraged me to pursue this academic course. It will be have a very long name lists to mention all contributors' name since many have provided their valuable support to accomplish my study.

My gratitude thanks goes to Mr. Gumataw Kifle who helps me all his best efforts made from the beginnings of the scholarship findings until I finished my entire courses, and my gratitude go to my wife Mrs.Terefech Getachew and my brothers Mr Solomon Zewdie, Dr. Yebeltal Zewdie, Tadiwos Zewdie and Melakue zewdie who gives me as a family hood affection and supporting my families during my absence of leaving.

I would like to Thanks to Mr. Waga Mazengia in Wageningen who made my study time to be a family environment and for his entire contributions to my completions of study. My thanks goes to Ms Alemitu Golda to her providing of important information by email and telephone with related to home country policy and other related data to my field of study.

I would like to express my gratitude to my supervisor and course coordinator Annemarie, Westendorp for her overall guidance in my research and her entire encouragement, sharing knowledge and coordinating my course of specialization class.

My special thanks must goes to Nina de Roo, the CASCAPE staff member who support me initially to my thesis work and creating a contact with CASCAPE, facilitating and support my field work and who permits me to link my study with the project for the success of my study today; and my thanks also goes to Koomen, Irene for financial assistance and allowing me to do my research work in the CASCAPE project in Ethiopia.

It is an honor for me to thank the Van Hall Larenstein University of applied Sciences, for selecting me to study in this professional university and the Netherland Government for sponsoring my whole educational expenses.

I would like to give special thanks to Hawassa CASCAPE Innovation team Dr. Tesfaye Abebe (Project Coordinator) and Dr. Tewodrose Tefera (Assistance project coordinator) and others innovation team members who support me for my field work of study and many thanks goes to Dr. Mulugeta Diro the CASCAPE National office Assistance coordinator, Ethiopia who support and guide me during the time of my data collection.

My gratitude thanks must go to Mr. Degif Temesgen Enemorena Ener district agriculture office staff members who support me during my data collection process at field level.

I also extend my heartfelt thanks to my parents, my father Mr. Zewdie Tiruneh and my mother Mrs. Tsehaynesh Anley, for praying, nourishing in the word of God and Trinity, and encouraged me to complete this task.

DEDICATION

I dedicate this research paper to my father Mr. Zewdie Tiruneh and my mother Mrs. Tsehaynesh Anley and Mr. Gumatw Kifle who supported me in my life to reach today's success.

List of tables

List of figures

List of Abbreviations

SRTPC-Sodo Rural Technology promotion centre

MARI- Melkassa Agriculture research Institutes

SNNPRS-Southern nations Nationalities peoples regional States
BOFED- Bureau of Finance and Economic Development

BORAD-Bureau of Rural and Agriculture Development

BoTA-Bureau of transport Authority

NGOs- Non- Government Organization

CASCAPE- Capacity building for scaling up of evidence-based practices in agricultural production in Ethiopia

HIV/AIDS-Human Immune Virus and Acquired Immune Deficiency Syndrome

IFAD- International Fund of Agricultural Development

DEFINITION OF LOCAL TERMS

Kale – a type of local cabbage

Shiro-a local food made from beans and beans or peas cereal crops

Injera – local staple food made from teff crop

Teff- local crops used as staple foods of most parts of the country

Kocho – a staple food processing from false banana pseudo steam

Bula – a staple food processing from leaf sheaths

Chat- it is a stimulant crops used as a cash crops for farmers

Edir- It is a social association that people saved money weekly or monthly for establishing initial capital, for funeral ceremony when people death, wedding and others social activities

Eqube-saving and loan type groups

Birr-Ethiopian Currency

Woynadega-Moderate temperature in between lowland and and high land temperature

Kolla-The hottest temperature

Dega- The cold temperature of highland area

Abstract

This study aim to gain knowledge and assess the impact of introduced enset processing technologies in terms of time saving, income change and role distribution. Enset (Enset ventricosum) is one of the most important food crops in Southern, South- western and Western parts of Ethiopia. It supports about 12 million people in the Southern region of Ethiopia. It is a multipurpose crop used for various functions, such as human food, animal feed, shading other crops like coffee and decoration. It is a drought resistant crop which makes it a risk coping crop. Traditionally, enset production, which involves harvesting and processing, is one of the most cumbersome household responsibilities of women in the region. The traditional processing methods are inconvenient and unhealthy to women. Accordingly, technologies of various types have been introduced by different institutions to help solve these problems of the household. The introduced technologies include mainly enset scraping and squeezing devices. The results show that farmers' adoption rate of these technologies is very low. There is a paramount workload difference (labour hour) between the traditional methods and the introduced technologies. The new technologies are efficient in the sense that they saved women's time. The change in role distribution among households due to the introduced technologies is in a way that more boys, girls, and men are involved in the scraping and squeezing activities when a household used the introduced technologies. Income generated from the sale of enset products is controlled by the women in more than 90% of the time irrespective of the two enset processing methods. The majority of respondents reported that the introduction of the new technologies has also improved gender relations among the households since women started participating in productive roles. Given such effects of the technologies, designing new strategies, establishing networks and collaboration between partners would help to increase adoption rates of the technologies and to empower women in the household.

1. INTRODUCTION

Enset (*Enset ventricosum*) is commonly known as "false banana" and it is a traditional staple crop or co-staple food in the densely populated South and South-Western parts of Ethiopia. It serves as food security for about twelve million people in Southern region of Ethiopia (Brandt et al. 1997). It is a multipurpose crop used as human food, animal feed, to shade other crops like coffee, decoration, is a drought resistant crop which makes it risk avoidance crop. It resembles the banana plant and is produced primarily for the large quantity of carbohydrate – rich food found in the false stem (pseudo stem) and an underground bulb (corm). Enset is grown at an altitude that ranges from 1,100 to more than 3,000 meters above sea level (Brandt et al. 1997).

However, little effort or research is made to improve the processing aspect of the crop and thus traditional processes are predominantly used by farmers. Both men and women are involved in growing and managing enset at field level in most cases, however, there are places where it is most commonly associated with women. Women are mainly responsible for harvesting and processing enset. Enset processing requires more labour and thus it is additional burden for women beside to handling daily house routines. The burden remains as a challenge of women for a long time and this has influence on gender relations at household level. Some enset processing technologies (e.g. scraping and squeezing tools) have been developed by Sodo Rural Technology promotion Research Centre and Melkassa Agriculture Research Institution.

The different technologies that farmers used in the area were traditional and introduced technologies. The introduced technologies mainly differ from traditional methods in terms of time and labour taking, and their provided yield of quantities and qualities. Traditional methods are processing the whole plant is uprooted with the help of a special knife and brought to the processing site-an open place within the plantation. The traditional harvesting and post harvesting procedures are cumbersome; labour intensive, unhygienic, impose a lot of inconvenience to the working women, and associated with great yield lose. On the other hand the introduced technologies improve the process of the enset products, some devices such as enset scraper and squeezer.

During the interview the researcher was asked farmers interests about their need of money to buying these introduced technologies. Based on the interview farmers (n=32) responded most of the people need money for purchasing the introduced technologies such as enset scraping and squeezing. The discussion was undertaken between office of agriculture experts (N=3) about the procedures to delivering the technologies for farmers. Based on the discussion the procedures were stated as follow: (1) extension information was given about the technologies overall utilization and how to access the farmers; (2) women registration were undertaken by extension agents. This was applying depends on the interests of each individuals; (3) The list of registered women was announced to district office of agriculture; (4) The office of Agriculture was ordered to one of the technologies manufactured institutions that mentioned in the above; (5) Finally, after manufactured the technologies were delivered to farmers by offices of agriculture and demonstration was undertaken for a group of farmers in their local village by professional experts. Field demonstration is also used as a feedback mechanism for the next generation of the technologies.

These technologies have been disseminated at different times to farmers through government organizations (GOs) and non-government organizations (NGO) to alleviate the burden of women related to enset processing. However, the performance, adoption and contributions of these technologies in reducing women burden and improving gender relations have not been systematically assessed.

Gender relations are the way in which a culture or society defines rights, responsibilities, and the identities of men and women in relation to one another (Bravo-Baumann, 2000). Unlike biological characteristics of women and men, gender relations are context specific. They vary between and within countries (e.g. rural/urban regions), but also between households. Often, household presents different patterns of male-female relations depending on their structure e.g. if they are women-headed, nuclear or extended. Because women and men interact in all aspects of life, gender relations are omnipresent in the private sphere (i.e. household level) as well as the public sphere where women and men interact as community members or colleagues. Gender relations are intrinsic to all aspect of life. Whatever our age, religion, ethnicity, class etc. we are always either a woman or a man, with the limitations and opportunities that are associated with it a particular context (OECD).

1.1 Problem statement

Women in rural community of Ethiopia have more workload in general as compared to men. The workload is expressed in household, farm and social activities. Almost all the household activities (including child care) are performed by women alone. Therefore, women are busy all the day from very early in the morning to late in the evening. Men do not involve in household activities and in some places, like in Guragie women are not allowed even to share bread with their husbands in some cases, i.e., women eat what is left from their husbands. Women are also involved in farm operations mainly at planting, weeding and harvesting of different crops. Some crops are more managed by women than men. Such crops include enset, vegetables and spices. Moreover, milking and managing calves is among the daily routines of women. Processing of the staple food source enset is entirely done by women because traditionally men are not allowed to involve on such activities.

Enset processing is labour demanding and time consuming activity which calls for technology to make it efficient and lighten the burden on women. It is unimaginable to perform social activities such as wedding, funeral and circumcisions ceremony without active involvement of women. Due to all these workload, women may not have enough time to have adequate care for their child and may not perform the house needs to the satisfaction of men. This at times creates conflict among spouses. In general the existing enset processing coupled with other farm and household activities has negatively affected the relationship between men and women biasing the work load to women and affecting maternity health (Sodo Rural Technology Promotion Center report document, 2010). Thus, different development programs have introduced enset processing technologies as a solution to lessen the burden on women. The introduction these technologies are assumed to increase efficiency of enset processing, and change role distribution and decision making power. However, there is information gap as to how the introduction of technologies has been adopted and improved efficiency and change role distribution.

1.2. Research objective

The objective of this research was to gain knowledge and assessed the impact of introduced enset processing technologies in terms of time saving, income change and role distribution in Guragie zone, Enemorena Ener district.

1.3. Research questions

What are the performances and adoption of introduced technologies and their effect on time saving, income change and role distribution?

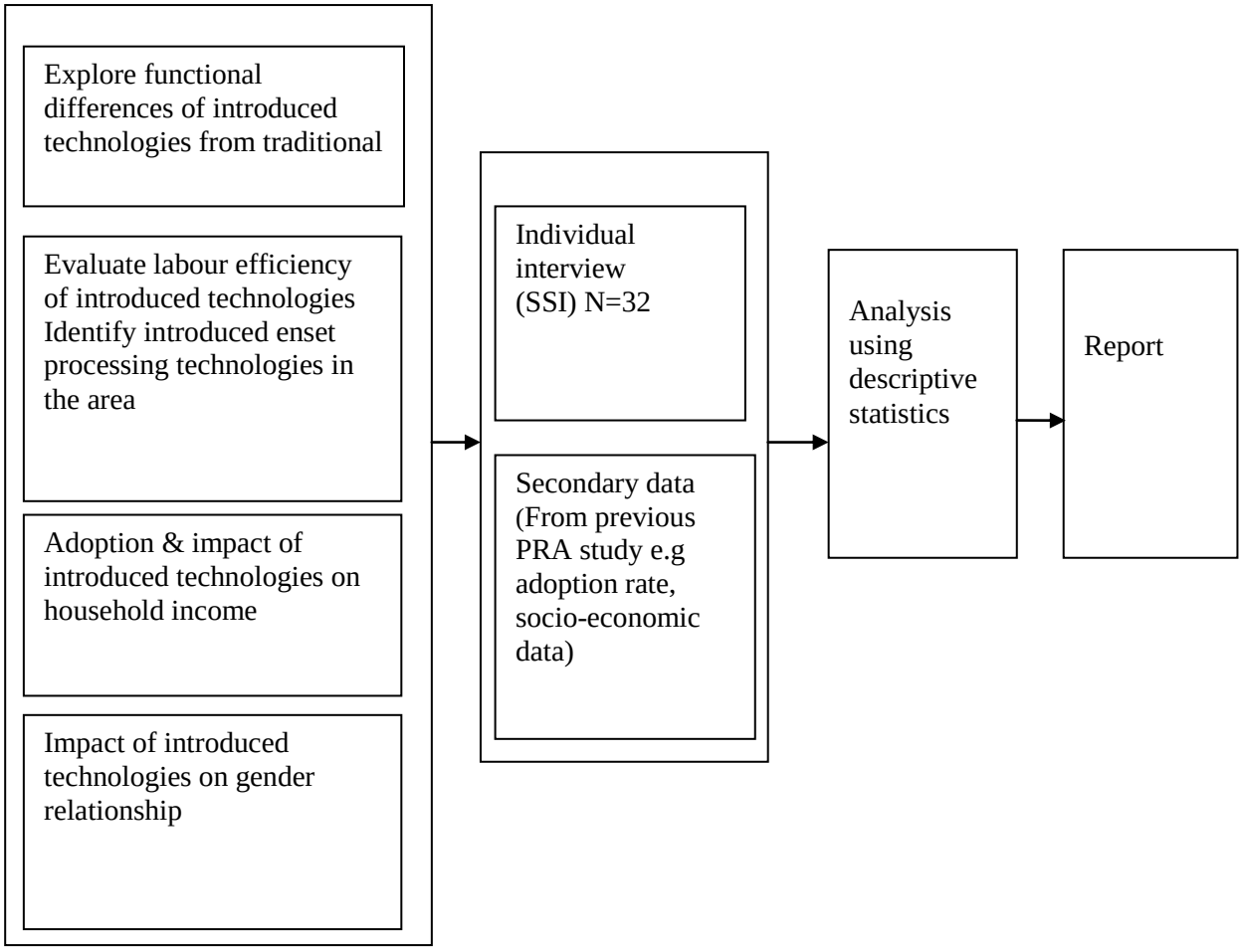
- What are the introduced enset processing technologies in the area?
- What are the main functional differences between the introduced technologies and the traditional enset processing practices?
- How efficient are the introduced technologies in terms of labour and processing time per unit of output? How economical is the introduced technologies? (Affordability)

- What is the adoption rate of the introduced technologies? (Acceptance by the society) Reason for non-adoption?
- What was the labour division in relation to enset processing before the introduction of technologies? What has been changed after the introduction of the technologies?
- What is the impact of the introduced technologies on the household income (for example in terms of the quality of the output, marketability) who decides on the income, what does this mean for gender relations?
- What is the impact of the introduced technologies in reducing burden (labour & time) of women? If time is saved, what do they do with the different time?

1.4. Research framework

The research framework in Fig.1 shown was an important part of the researcher that used as a guidance to conduct the study. The research was undertaken on basis of the research framework. The first column shows the objectives of the study in line with the research questions, the second, the methodologies which indicated the methods of data were collected. The third one was analysis of data. Based on this analysis, the report was prepared by used descriptive statistics and finally, the report was produced.

Figure 1 The research framework



1.5. Explanation of key terms.

Enset processing technologies-In this research, enset processing technologies means the technologies that are to processing enset scrapers and squeezers devices which aimed to solve the problems related to traditional enset processing methods which are inconvenient to and unhealthy to women. As it requires bowing or raising one leg and pressing the pseudo stem leaf sheaths with the heal so that it will not slip down. All these processed also make the processed unhygienic.

Adoption- implies the farmers those who are currently often used their enset processing activities that by the introduced technologies (such as scrapers and squeezers) which are manufactured by Sodo Rural Technology Promotion Center and Melkassa Research Agriculture institute.

Performance- in this research implies that how the introduced technologies are operated or processed the enset with efficiently and effectively to those farmers that comparing with the traditional enset processing methods.

2. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1. Literature review

2.1.1 Types of Enset product

The major food products enset plants are kocho, bulla. Kocho is a bulk of fermented starch made from a mixture of the decorticated leaf-sheaths and grated corm. It can be stored for a long period of time without being spoiled. The combination of kocho and kitfo is now virtually a common menu at restaurants. The best quality the enset food, bulla, is obtained mainly from fully matured enset plants. It can be prepared as a pan cake, porridge, and dumpling (Agric-service Ethiopia, 2008). Average yields of kocho range to 60 t/ha/ year, bulla 1.6 to 3.o t/ha/year with great variability of clone types and its maturity period. The yield of enset exceeds other root and tuber crops (Atnafua *et al*., 1980).

According to Bureau of Finance, Economic, and Development (2012) annual report explained that the enset production coverage in the Guragie zone was 7, 248, 875 quintals and covered by 17,037.00 hectares of the land (Table 1). From this table one can be suggested that the crop is the most important to the area that people used as staple food and multipurpose crops in the Southern regions of Ethiopia. Because, the crop is the only grow plant in this region and south Western part of Oromia region in the country. This high production indicated that the important of the crops with related to other crops. The others equally important major agricultural crops grown in the area were maize (1,948,725qu), wheat(1355170q), barley(776,003qu), Haricot bean(146,950qu),and teff(789157qu. (Bureau of Agriculture and Rural Development report document, 2010)

Figure 2 Kocho product

Figure 3 Bulla products

2.1.2. Appropriate technology

Bryceson (1985:8-9, cited in Stamp 1990:512, cited Henderson and Ellen, 1995) defines appropriate technology as those "objects, techniques, skills and process which facilitate human activity in terms of reducing human energy expenditure, reducing labour time, improving spatial mobility and alleviating material uncertainty. These objects, techniques and processes have arisen from the application of human understanding and knowledge of

matter and serve to enhance human capabilities. 'Human capabilities' denote not only an individual's physical and mental capacities but also the social freedom for pursuing one's capacities. This definition suggests that technology is more than a set of skills and materials; it also implies a mode of organizing work (Bourque and Warren 1990; Chaney and Schmink1976). Furthermore, Darrow and Pam view appropriate technologies based on the assumption "that people can and will work together to collectively bring improvements to their communities, recognizing that in most of the world important decisions are made by groups rather than by individuals"(Darrow and Pam, 1978, cited in Carr, 1985:8).

As Sen (1990:128) notes, "Technology is not only about equipments that permit the equipment and its operational characteristics but also about social arrangements that permit the equipment to be used and the so-called productive processes to be carried on."

Technology adoption in developing countries is likely if the technology is low in capital costs per unit of output, is highly adaptable to a particular socio-cultural environment, is controlled and maintained by those who use it, uses local resources to the greatest extent possible but uses all resources sparingly, and is flexible and adoptable to changing circumstances (Carr, 1985:8-9). Oblepias-Ramos (1991:165) emphasizes that technologies become more appropriate "when they carry a deliberate bias for a specific underprivileged sector of a community, as well as an appreciation of that sector's overall physical and cultural environment."

With regard to gender and appropriate technology, Henderson and Ellen (1995) cited that "providing small farmers, women in particular, with information on existing technologies does not result in technology transfer if the technology is not appropriate to their needs or if they do not have the necessary skills or interpret it and put it to use. The introduction of improved technologies to women, therefore, involves the transfer not only of information but also of skills in ways that encourage the development and utilization of indigenous resources." From this point of view, Henderson and Ellen (1995) emphasis that a wide range of gender issues must be taken in to account when contemplating the introduction of new technologies.

Women are central to overcome rural poverty. They play significant role in poverty reduction and food security because they are responsible for both production and reproduction. . Rural women in developing countries have longer working days than men because of their triple roles as farmers, caretakers of their families and cash earners through income-generating activities and microfinance. Additionally, increasing drought and deforestation in many parts of the world make women's workload even more burdensome as they have to walk ever-longer distances to find firewood and clean water.

The women in parts of enset growing regions such as southern western parts of Ethiopia have responsible to processes with their labour. The labour requires to scraping and squeezing the enset products which are the most crops to contribute most rural people used as staple consumption. The multiple roles of women can act as an obstacle to development interventions, which often put additional pressure on women's time. Women's heavy workload reduces the time available for participation in project-related activities or affects their ability to care for their families. Ensuring women's access to labour-saving technologies for water, energy and farm-related activities such as enset processors is fundamental, and the need for such technologies is greater than it has ever been before (IFAD, 2010).

Characteristics of Appropriate Technology

The first characteristic of appropriate technology is its reliance on the knowledge, abilities, and needs of local people. Any introduced technologies should be understood and controlled by the people themselves. The following criteria form a basis for assessing the suitability of technology (Henderson and Ellen, 1995:51-54).

Low cost

Affordability of the appropriate technology: Because rural women often have limited incomes, project inputs should be within their economic reach, and the women should have access to credit and a reasonable chance of being able to repay loans

Durability

Durability and easiness of the appropriate technology to maintain: Too often women have become involved with projects that distribute complicated mechanical equipment that breaks down. Technology transfer has a much greater chance of success if women are trained in the production and maintenance of new and locally based machinery (Stamp, 1999) and if that machinery is built to be long-lasting.

Profitability

The possibility that appropriate technologies offer to increase women's income: Saving can come in the form of time, labour, or money (Stevens, 1985). Profitability is also affected by access to markets. It is of no use to produce a commodity that cannot be sold locally and/or if women cannot obtain low-cost transportation to markets.

Efficiency

The possibility that appropriate technology improves efficiency: appropriate technologies enable women to increase the quality and/or quantity of their traditional products (Carr, 1984). For example, "Improved" solar stoves have been introduced in many Third World countries without considering women's time constraints or preferences. Subsequently, the solar stoves required adjustment throughout the day, taking time away from other tasks. In this situation, an open hearth in the house could provide warmth and light at night, which may be missing from a more efficient but enclosed stove (Adams and Solomon, 1991). These types of considerations determine how "efficient" a new technology may be.

Cultural Compatibility

Cultural compatibility of the appropriate technologies: Introduced technologies should be culturally acceptable and able to fit into women's (or men's) current work patterns (Nash, 1988; Stevens 1985). Often the traditional goods and services that women provide can be upgraded by appropriate technologies, and new or modified products can be made more competitive with those produced by capital-intensive industries (Carr, 1984). For example, the introduction to Ghanaian women of mechanical graters and pressing machines for processing of cassava was successful because appropriate characteristics were incorporated (Date-Bah, 1985). While increasing women's output, these devices cost little and did not represent a drastic change from previous production techniques; such experience indicates that the technological innovations that are most likely to be adopted by women are those that fit their needs, constraints, and opportunities.

Access to appropriate technology

Women must own and be able to maintain new technologies. Carr (1984) indicates that serious social constraints on women's access to technology include poor organization or poor project management, credit problems, and a lack of time, training, and support from husbands or the community. Control over technology also includes access to and control over the resources women require in order to use and benefit from the technology. According to Oblepias-Ramos (1991:163, as cited Henderson and Ellen, 1995), these resources include "training in attitudes, knowledge, and skills as well as access to capital, and extension assistance". Recognitions of women's roles as decisions makers in technology transfer project is also vital to their access to new technologies (Stamp, 1990).

2.1.3. Adoption

Studies indicated that adoption of innovations is not something that happens overnight rather it is the final step in a sequence of stages. Ideas varied about the precise number, nature and sequence of the stages through which people progressed. However, the most widely used characterization of stages in connection with the adoption of innovations (as well as the "acceptance" of policies, Van Woerkum *et al.,* 1999) derives from Rogers (1962, 1983 as cited by Cees, 2004). The model built heavily on normative theories about decision-making models and consists of the following stages:

- Awareness of the existence of a new innovation or policy measure.
- Interest collecting further information about it
- Evaluation reflection on its advantages and disadvantages
- Trial testing innovations/ behaviour changes on a small scale
- Adoption/acceptance applying innovations/behaviour changes

Adopter categories and their characteristics

An important finding from adoption research was that innovations are not adopted by everyone at the same time. Particular innovations are used quickly by some and only taken up later by others, while others never adopt them. More importantly, adoption research suggested that there was a pattern in the rate at which people adopted innovations, meaning that some would usually adopt early, while others would adopt late. Such conclusions were arrived at through the analysis of adoption indexes which were used as a measure for innovativeness, defined as 'the degree to which an individual is relatively earlier than comparable others in adopting innovations' (Rogers, 1983: 22). An adoption index was usually calculated by asking people whether, at a given time, they had adopted any of 10 to 15 innovations recommended by the local extension service. Individual would receive a point for each one adopted. According to Million (2003) those farmers who perceived traditional enset processing equipment as problematic are more likely to adopt improved enset processing equipment. According to this argument the introduced technologies are expected to invite women in the adoption decisions positively since the burden of their work load and energy/labour wastage will be reduced.

Income generation

Rural women themselves are the best decision makers regarding income generating projects involving new technologies. Income-generating project introduced by outsiders often assume that women's most basic need is income, whereas rural women working as agricultural producers have many others basic needs as well, including clean water, fuel, food, and health care (Stamp, 1990).

Although technology plays a central role in the development process, it has been widely argued that technological inputs in developing countries have not benefited women much, or at least not as much as men (Mies and shiva, 1993). At the same time, others have stressed the need to transfer technologies as a means of improving women's lives (Jain, 1985). Technology is relevant to many women, particularly, those in sectors such as food and drink processing, manufacturing (e.g. soap making, utensil making), or in agriculture (Everts 1982, cited Everts, 1998). Hence, technology can be seen as an opportunity to improve women's businesses, leading to increases in production, to new or changed products, or to products of higher quality. Such improvements could lead to greater security and / or economic autonomy for women (Jain, 1985).

Higher income is usually associated to access to markets. Million (2003) notes that households in Ethiopia who have better market access for their products such as kocho and bulla usually process enset more frequently not only for consumption but also for sale. Households, therefore, likely to prefer improved processing equipments to produce better quality products. It is hypothesized that improved technologies are expected to increase the quality of enset products and bring income for women and their households in general.

2.1.4. Work load on women and labour saving technologies

Women are generally engaged in various activities such as:

- Food processing: arrange stoves, pots, cooking utensils, means of carrying and transport, tools for conservation, for measuring, for grinding, grating, sieving, cutting, etc.;
- Cleaning: prepare means for scrubbing or washing textiles, cleaning aids; fetching water supply, means of transport, containers, sanitation;
- Caring for children: prepare carrying devices, means of improving children's health and safety.

In most developing countries, rural women have triple responsibilities of farm work, household chores, and earning cash to supplement family incomes-tasks that often added up to a 16-hour a day ((World Bank, FAO and IFAD, 2009). Although men even from poorer families now have access to improved technologies for use in farming and nonfarm enterprise activities, most women still struggle through their days using traditional technologies that are labour intensive and time and energy consuming. Since the mid 1980s, many programme have supported the introduction of labour- saving technologies such as cleaner and more efficient cook stoves, grain grinders, and hoes of different lengths and weights. Some have been more easily adopted than others; some have resulted in a changing division of labour with in the household that often benefits women but sometimes adds to their workload or even deprives them of economic opportunities.

A wide range of technologies could help address some of women's labour constraints. Over the last three decades years many development projects and programs have aimed at reducing women's time-poverty by increasing their access to these technologies. Many barriers remain to the adoption and sustained use of these technologies; however, women are still overburdened. In fact, women's workload is increasing in some areas as a result of men rural-urban migration in search of work and the spread of HIV and AIDS (Bishop-Sambrook 2003).

ITDG (1986) and Spence (1986) provide some examples about labour saving. In Nepal mechanized mills were found to reduce the time needed to process one kilogram of rice from 19 minutes to 0.8 minute, but women were walking for 10 to 180 minutes to reach the mill and waiting an average of 30 minutes for their turn. Such behaviour has been noted in many parts of Asia and Africa and suggests that women are more concerned with the energy savings than the time savings connected to mechanical crop processing. In Botswana sorghum mills have reduced the time needed to process 20 kilograms of sorghum from two to four hours to two to four minutes. Pounding traditionally takes place in the evening, whereas the mills operate only in the mornings. Women have solved this problem by sending grain to the mill with their children on the way to and from school.

2.1.5. Role distribution

On-farm activities

The roles of men and women in farming are well defined, with men responsible for land clearing and preparation and women responsible for planting, weeding, harvesting, and

postharvest activities such as threshing, winnowing, and grinding. All these tasks take up a great deal of time and energy, a burden that can be reduced in one of two ways: (1) making existing tasks easier and increasing productivity of existing labour and draft power and (2) changing farming practices to methods that use less farm power (IFAD 1998).

Increasing farm power

Improved technologies can increase labour productivity in farming, but they have mostly been adopted in relation to men's tasks, often with negative consequences for women. For example, tractors and animal-drawn ploughs have been used by men to increase the acreage under cultivation, leaving women to struggle with an increase in weeding and harvesting using only handheld tools. This adds to women's workload but can also result in major crop losses if weeding is done late or with insufficient care. Although many women now undertake men's tasks because of migration by men or death from HIV and AIDS, manufacturers and suppliers of farming equipment seem to be unaware of this changing division of labour and continue to distribute ploughs that are too heavy for women or have handles they cannot reach (IFAD 1998). Tools and equipment appropriate for women's tasks (for example, planting, weeding, and grinding) do exist, but many barriers block their adoption. Of all women's land related tasks, weeding with handheld hoes is the most punishing and time consuming, causing fatigue and backache. Long-handled hoes are available that could reduce the strain of squatting using traditional short-handled hoes, but in many parts of Africa these are rejected for cultural reasons. The reason why due to the poor socio economic status of women in most rural part of Africa impose strongly on the production tools and implement they use. Manufacturers of farm implements make different weights of hoes, including very light ones that are better suited to women's needs, but most women continue to use heavier hoes because they are unaware of the full range of available tools

Domestic chores

Interventions to reduce time spent by women on domestic chores fall into two categories: (1) integration of women's needs in mainstream infrastructure projects and (2) projects aimed at delivering time- and energy-saving technologies directly to women. Infrastructure projects aimed at supplying piped water, electricity, and rural roads are potentially important ways of reducing the time women spend collecting water and firewood and transporting crops from fields and to markets. However, it will take decades for piped water and the grid to reach the majority of poor rural communities. In the meantime labour-saving technologies and practices such as rainwater harvesting projects, protected springs, and improved stoves have a significant role to play in household role distribution.

Off-farm activities

A major objective of projects that introduce labour-saving technologies and practices is to help women divert time from subsistence farming activities and domestic chores into more productive, income-generating enterprises. Often the most remunerative of these enterprises are intensive in their use of water, fuel wood, or both, and involve laborious production and processing methods using traditional techniques and technologies. This can require quantities of women's time that simply may not be available to them. In some circumstances increasingly scarce water supplies and rising costs of fuel can threaten the existence of women's traditional food-processing industries unless they can gain access to improved technologies and practices.

2.2. Conceptual framework

In this research introduced technology means those technologies which are improved and distributed to farmers with the aim of reducing burden of labour and saving time and energy in particular related to enset.

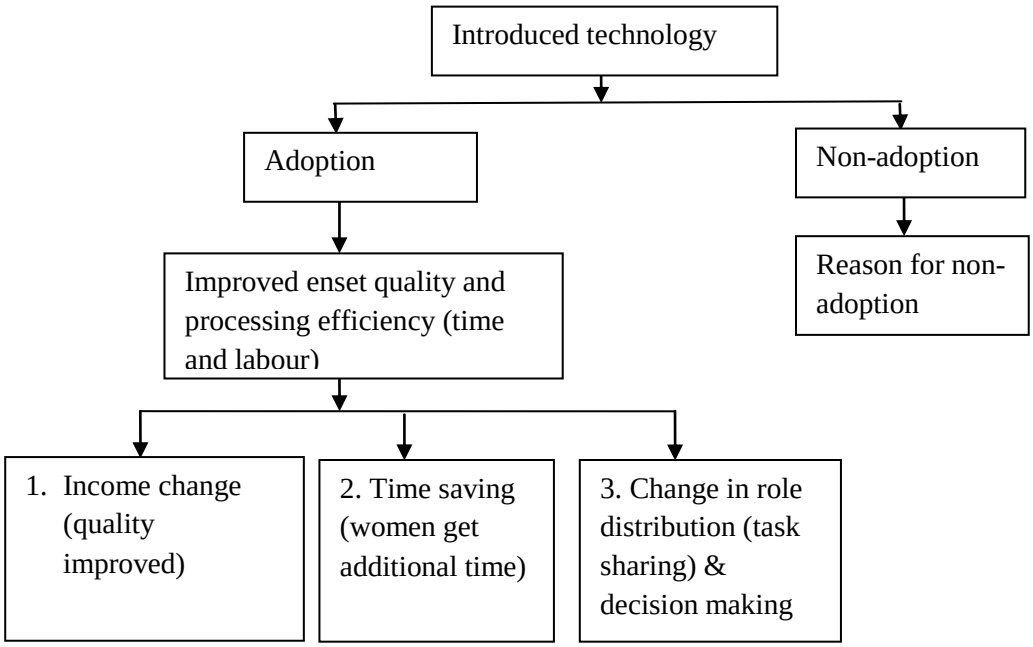
As Million (2003) cited in his research paper, the Ethiopian Nutrition Institute (ENI), Ethiopian Catholic Church and Sodo Rural Technology Promotion Centre (SRTPC) have demonstrated and distributed improved enset processing equipment, namely Kocho scraper and bulla extractor, between 1987 and 1992 (deribe,1996). Following these years various non government organizations (NGOs) regional bureau of agriculture and research centres and regional bureau of women and children and youth affairs also demonstrated and disseminated these equipments in different parts of the southern region of Ethiopia.

The concept diagram (Fig 4) shows that the assessment will be made to identify enset processing technologies that have been introduced by different organization. These technologies will be either adopted or not adopted for different reasons. Therefore, the reason for non-adoption will be assessed from secondary data sources. The adopted technologies are assumed to improve enset quality and the efficiency of enset processing reducing time labour requires for processing. Therefore, it is expected that the adoption of improved enset technologies are likely to bring income change, women will have additional time to do other activities easily and change is expected be observed in role distribution or task sharing and decision making power in the household.

Other literature agrees that appropriate technology has economic importance of labour-saving technologies for women become evident when a broader range of consequences is considered. A labour-saving innovation is beneficial if (1) it allows women to spend less time providing basic needs and more time on their preferred productive activities;(2) improves women's businesses, leading to increases in production, to new or changed products, or to products of higher quality; and (3) women's health improves due to a trend toward less strenuous labour requirements, where women's health is viewed as an important factor in shaping the health and development of the family and community, (Henderson, 1995, P. 51; IFAD,2009, P.289; Everts, 1998, P.11).

In the framework bellow shown that introduced technology are distributed to adoption or non-adoption of farmers to enset processing technology devices.

Figure 4 Conceptual framework



3. RESEARCH METHODOLOGY

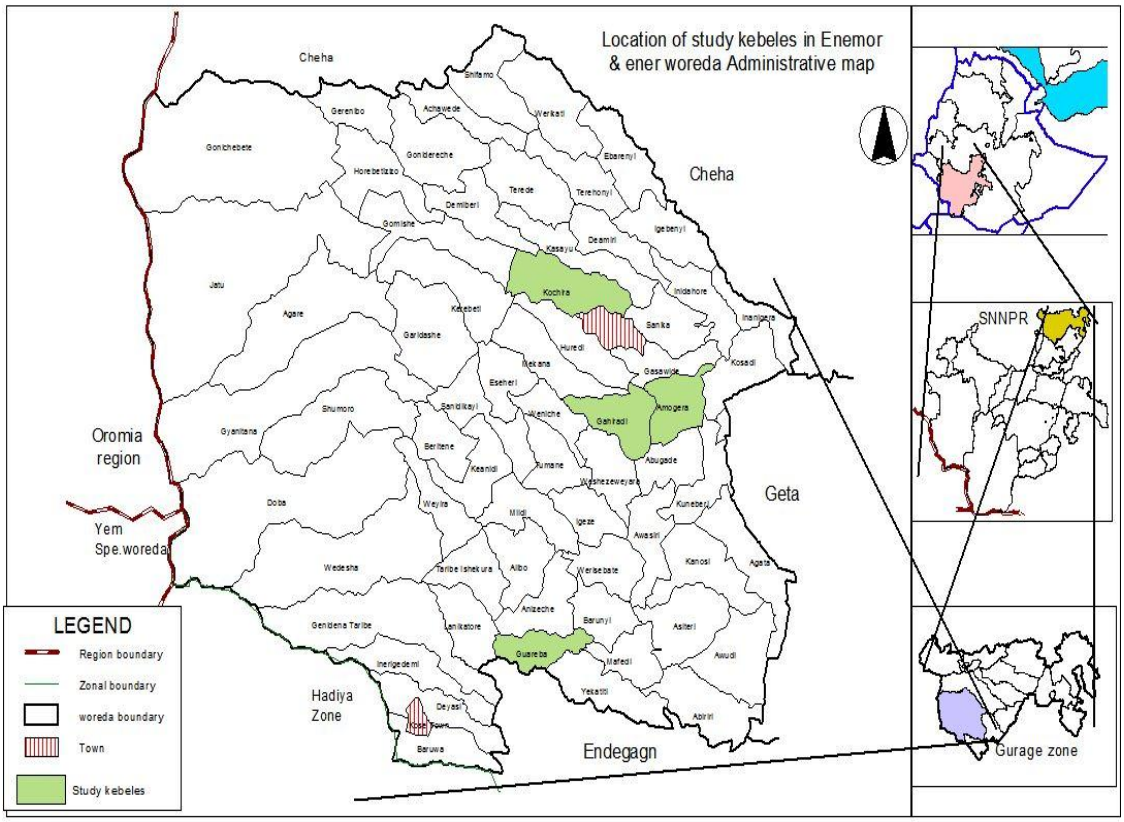
3.1. Study area

The study was conducted in Kochera, Amogera, Gahrad and Gorabah kebeles in Enemorena Ener district which is one of the 13 districts in Guragie Zone of Southern Ethiopia where enset and coffee are among the main food and cash crops of the area, respectively

Gurage is one of the 13 zones in SNNPRS and it has his own language called Guragenga. The town of Gurage zone is called wolkite and it is located 196 km South west of from Addis Ababa. For administrative issue Gurage zone is subdivided in to thirteen districts, namely, Kebana, Abeshage, Ezha, G/Gutazer, Sodo, Meskan, Mareko, Endegagne, Gumer, Cheha, Enemorena Ener. Muhir Aklil and Geta.

Enemorena Ener district is located 42 km from the Wolkite capital city of Gurage zone, 196 km from Addis Ababa and 452 km from Southern Ethiopian regional capital city of Hawassa (Southern Regions Bureau of Authority annual report, 2010). It has a total of 64 kebeles, populated by 182,687 people from this 86,315 male and 96372 female (project based on 2007 census result BoFED, 2010). The average population density was 200 per km2 (statistical abstract BOFED, 2012). It is indicated below in (Fig.5) (BOFED data collection-Dissemination core process regional statistical abstract, 2010).

Figure 5 Study area Administrative Map of the study areas (including the map of Ethiopia, SNNPRS, Gurage zone and district of the study area)



Source: project based on CSA census result of 2007 document (BOFED, 2012)

It has also a total size of 107,584 hectares. Majority of the areas is under agro-climate zone of *Weiyena Dega*, covering 57.53 percent of the total land. It is followed by *Kolla* with a total coverage of 26.85 percent and *Dega* taking the rest 16.22 percent. Annual crops take the leading land use type covering 27,410ha of land. Following, grazing land 26,340 ha, mixed land use 20,000 ha, perennial crops 8,000 ha, roads and social institutions 4,223 ha, plantation forest 4,050 ha, and natural forest 2,196 are among the many land use types in the wereda in order of importance. . (CASCAPE PRA study report document, 2012). Altitude ranges from 1400m to 3000m asl and annual rainfall ranges from 600-1000mm. the major soil types are 26% clay, 17% sandy, and 58% silts (Enemorena Ener district annual report document, 2012).

Livelihood systems of the population

Agriculture is the dominant economic activity in the district; crop production is the leading means of livelihood supplemented by livestock production. Major crops based on importance are maize (6249ha), *teff* (5900ha), wheat (5600 ha), coffee (4228 ha), barley (1875 ha), faba bean (452.6 ha), pea (270ha), and banana (122 ha), and enset, (589.2ha). The types of live stock are Cattle (1184337), sheep (392739), poultry (718726), and goat (156,696). In addition to this the district has get high income from chat crops. According to BoFED, 2012 projected document the district revenue amounts (13,568,840.00) Ethiopian Birr shown that it was the potential of the cash crop and has collected high revenue.

3.2. Selection of the study area

The main reason for selection of these areas is that in the Enemorena Ener district enset processing technologies have been introduced by Melkassa and Sodo Rural Technology Centres in different times for the last 7 -8 years. Besides the area is the project area of CASCAPE. Moreover, enset is widely used food in the area as compared to others districts of CASCAPE projects. The site was selected in consultation with respective staff members of district offices of agriculture.

3.3. The study approach

In this study, data were collected mainly in qualitative way through desk study and case study. Checklist was prepared in line with the research questions. In the desk study relevant literature was reviewed while the case study was conducted by interviewing individual farmers and personal observation on the performance of traditional enset processing and introduced technologies.

The qualitative method was chosen as it was the main approach appropriate for conducting case study. It was more effective in gaining knowledge and assessing the impact and adoption of introduced enset processing technologies in terms of time saving, income change and role distribution.

3.4. The data set and data type

For data set both Primary and secondary data were used. The primary data was collected from both technology users and non-users of women. Secondary data was gathered from specialized journals, scientific books, Sodo Rural Technology Promotion Centres evaluation reports and documents, regional and district departmental published and unpublished documents, CASCAPE project PRA studies report document, and internets. The primary respondents were reflected their own experience, ideas, feelings, and suggestions to its improvements in their practiced of both traditional processing and introduced enset technology users.

3.5. Sampling method and sample size

Data was collected mainly using individual interview that included both technology users and non-users. Purposive sampling was used for individual interview targeting women. A total of 32 individuals were interviewed from four Kebeles. All (16) farmers from each kebele who were supplied with enset processing technology were interviewed where as the rest 16 non user farmers were selected randomly. Secondary data was searched on the introduced technologies and the rate of adoption and socio-economic characteristics of the study areas.

3.6. Data collection procedure

The researcher first takes took an appointment with his own organization manager and the Hawassa University South Capacity building for scaling up of evidence-based practices in agricultural production in Ethiopia (CASCAPE) project coordinators. After that he was discussed with each individual about the overall objectives of his research. Then the researcher travelled to the Enemorena Ener district.

The case study was conducted by the researcher himself. A checklist is used for semi-structure interview (SSI). Before the actual case study, pre- testing of check list was undertaken. On the basis of the pre-test, some modifications were made on the check list.

The interview was carried out based on purposive selected for technologies users and random sample technique for non-user farmers. Finally, the study was conducted preparing and using Checklist (in Annex I). Most of the data were collected through individual interview or SSI. In addition personal observation was collected on the current status of the introduced technologies and on the application of the traditional method.

In the research all the research ethics were considered during the data collection. During the data collection period, it was adjusted the time with individual willing that farmers were free of work to be able to give information for the researcher. The researcher led the overall process and discussion with the concerned individuals.

In cases where farmers were challenged to give enough information (such as quantification of enset product and estimation of annual income), consultation was made with professionals for estimation. Accordingly, the annual income of a household was estimated as the product of average number of ensets processed per anum per household X average product per plant X average price of the product. The number of enset processed per anum per household was estimated to be 20 plants. The amount of area allotted to enset grown was also estimated as the sum of the area/ha estimated by respondents before using the introduced technologies and after used or the introduction of the introduced technologies divided by the total respondents. Ranking was made for activities that women do with the time saved due to the introduced technology considering the frequency of the response given for each rank.

Introduced Technology in this paper means those manufacturing by Sodo Rural Technology Promotion Centre (SRTPC) and Melkassa Institute of Agriculture Research (MIAR) (such as enset scraper and squeezer).

3.7. Data analysis and interpretation

The data was analysed using descriptive statistics through clustering the qualitative data. The result was interpreted and discussed in comparison with other findings.

3.8. Limitation of the study

The major limitation where faced the researcher associated with this study was the followings:

- Shortage of documented local information on the introduced technologies.
- Some farmers had limited knowledge in estimating some of required data (for example quantifying enset product, estimating annual income).

To overcome these problems the researcher tried to search the data by contacting different local people who were know where the technologies are distributed. Based on this information the data was gathered. With regarding to farmers limited knowledge about the estimation, it was attempted to reach common understanding that used their local estimation ways of data was taken in to considerations.

4 RESULT

4.1. The study area and respondents

The case study was conducted in Enemorena Ener district where improved enset processing devices had been distributed. In the study area, enset processing is mostly carried out using traditional methods. Introduced technologies were delivered to the study area in 1997 and 2004 by Sodo Rural Technology Promotion Centre (SRTPC), and latter in 2012 by Melkasa Agricultural Research Centre (MARC). Scrapers and squeezers are the main introduced enset processing technologies available in the study area. These technologies were locally manufactured by the SRTPC and MARC. The SRTPC has manufactured 3373 introduced technologies, consisting of 2214 scrapers and 1159 squeezers, as of 2010. According to the district office of agriculture staffs reported document, a total of 94 introduced technologies (such as 80 scraping and 14 squeezing) are distributed to farmers that manufactured from Sodo Agriculture Research Promotion Centre in1997 and 2004. And later in 2012 about 10 scrapers were distributed by Melkassa Agriculture Research Institute. These technologies perform different functions to make different products. While scrapers are used to make a product called “Kocho”, squeezers are used to make the fine product called “Bulla”.

Based on consultation of Office of Agriculture, thirty two respondents were selected from four kebeles of the district. All of the selected respondents were women of which 50% of them were given the introduced technology while the rest were not given. The main reasons for only selecting women respondents were (1) The technologies are distributed for Women that aim to reduce burden of women; (2) Enset processing activities are usually done by women.

4.2. Types of enset processing technologies in use and reason

Table 1 provides a descriptive statistics about the use of traditional and introduced enset processing technology. Accordingly, this study was identified that the traditional methods are the most commonly used enset processing equipment. From those who used the introduced technology, only 6 (or 38%) used frequently the introduced technologies often. This implies that farmers are mostly used frequently by their introduced technologies to scraping and squeezing their enset plants. Accordingly the women have their own plan to process their enset plants. Once they started to process the enset plant they spent about 4 to 5 hours. That is, even those who had access to the introduced technology 10 continued to use the traditional enset processing technology often. All the users of the traditional method and those that used both cited lack of access to (50 %) and lack of money (50 %) about the introduced technology as the main reasons for not using the introduced technology. It should be noted that those (all 16) who had access to the introduced enset processing technology had to share the equipment with four other people. However, high cost and lack of knowledge and lack of acceptance were not mentioned as reasons for not adopting the introduced technologies.

Table 1 Types often used enset processing technology

Type of technology use	No. of respondents	percentage	Often uses	percentage
Traditional only (n=16)	16	100	16	100
Introduced only (n=0)	0	0	0	
Both (n=16)	16	100	6	38
If not what are the reasons for not using introduced technologies (N=26)	No. of respondents	Percentage		
Don't like (accept)	0			0
Lack of money	13			50
High cost	0			0
Lack of skill how to use it	0			0
Lack of access	13			50

Figure 6 Traditional methods of enset processing

Figure 7 Types of introduce technologies to processing enset

4.3. Affordability of introduced technology

The affordability of the introduced enset processing technology is displayed in Table 2. Accordingly, 9 of the respondents (28%) said they can afford to buy the technology. Whereas majority (72%) of the respondents replied that they could not afford to buy the introduced technologies. Of those who said they did not afford, 57% of them cited lack of money and 35% said high cost of the introduced technology and lack of arrangement to buy it in groups as the main reasons. However, very few farmers responded that they did not purchase the introduced technology due to their preference to the traditional processing method and the decision to purchase requires also the involvement of husbands.

Table 2 Afford to buy introduced technology (N=32)

Affordable to buy?	No. of respondents	Percentage
Yes	9	28
No	23	72
If no, reasons not afford to buy introduced technology		
Lack of money	13	57
High cost and no arrangement buying in group	8	35
Prefer to traditional processing	1	4
Could not decided by myself without my husband decision	1	4

Source:Field result, August, 2012

4.4. Functional difference between traditional and introduced technology

Decisions made to process matured enset plant: Under the traditional technology, the decision to process the matured enset was largely made by both women and men (47%), followed by women (34%) and men (19%). Likewise, under the introduced technology, the decision to process the matured enset was largely made by both women and men (56%), followed by women (31%) and men (13%) (Table 3).

Table 3 Decision to make process matured enset plant

List of enset processing method and technologies	women	men	Women and men
Traditional (n=32)	11	6	15
Percentage	34	19	47
Introduced technologies (n=16)	5	2	9
Percentage	31	13	56

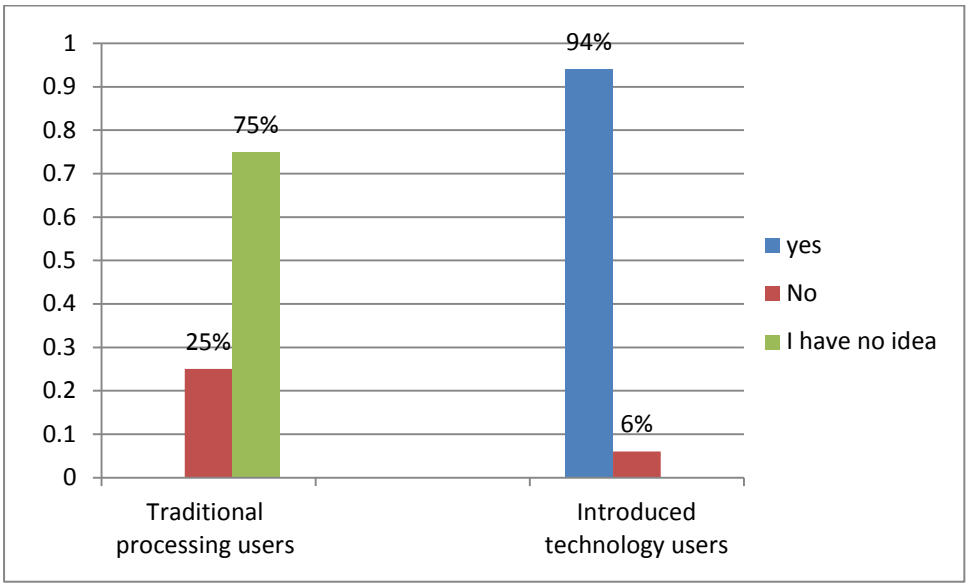
***Note**: respondents who use traditional technology alone did not respond to introduced technology*

Change in role distribution among the household: As shown in Fig. 8, 94% of the respondents who used the introduced technology claimed that the introduction of the introduced technology changed the role distribution in the household.

> *For instance one woman in this area said that "when I used to process enset with introduced technologies my husband helps me to move the devices to my back yard area when I want to process the plant. But my neighbour women who used the traditional method her husband and other family members did not participate any more". The other women who have the large enset area and used the improved devices said "Thank the government for giving the technologies to enable my son to work on the enset scraping and squeezing tasks-She said also "For-the last decades the work was given only for women and girls but now-a-days the technology has some green light to involve my family members on the activities due to the introduced technologies; she was also added some comments that it is necessary to improving its efficiency particularly the narrower part of the squeezing devices has to be wider and the scraper which was manufactured by Melkassa need to elongate its length as flexible and adjusting according to the length of my house members".*

Very few of them replied to the contrary that there is no role change. On the other hand, most of respondent farmers (75%) who are using only the traditional processing method replied that they have no idea on the role change over time while others (25%) said no change.

Figure 8 Change in role distribution among the household due to introduced technologies



Role of household members in different enset processing activities: Table. 4 display the enset processing activities within the household under the introduced enset processing technology. When using introduced technology; the respondents replied that enset plant cutting and carrying activities were mainly carried out by men with some support from other household members – boys, women and girls, respectively. Whereas, activities like peeling, scraping, squeezing and transporting extracts are more done by women with little support from other family members. But men are not at all involved in squeezing and follow-up of kocho fermentation whereas boys have supporting role in squeezing. Follow-up of kocho fermentation is the duty of merely women. Dig the land to bury scraped products is more done by men. In general, women are involved in all enset processing activities and men take biggest share in cutting and carrying the plant while boys and girls have supporting role.

Table 4 Harvard matrix- household members division of labour indifferent enset processing activities when introduced technologies (enset scraper and bulla squeezer) are used (N=16)

(More answers possible)

List of activities	Women	Men	Girls	Boys
Cutting	2	12	0	4
Carrying	5	9	3	8
Peeling	14	6	3	5
Scraping	16	2	4	5
squeezing	16	0	4	3
Transporting	16	3	7	6
Dig the land to bury scraped products	8	11	1	3
Follow up of kocho fermentation	16	0	0	0

With regard to the traditional technology, the enset processing activities within the household are displayed in Table 5. When using traditional enset processing method, enset plant cutting and carrying activities were mainly carried out by men and women although men are more involved in cutting and women in carrying. Boys have more roles to support their parents in cutting and transporting as compared to girls. Activities like peeling, transporting

extracts and dig the land to bury scraped products are more done by women with little support from other family members. Men and boys are not totally involved in scraping, squeezing and follow-up of kocho fermentation. More or less, scraping, squeezing and follow-up of kocho fermentation is the duty of merely women. In general, women are involved in all enset processing activities and men take biggest share in cutting and carrying the plant while boys and girls have supporting role in most activities.

Table 5 Harvard matrix- household members division of labour in different enset processing activities when traditional processing method is used (N=16) (more answer possible)

List of activities	Women	Men	Girls	Boys
Cutting	8	8	0	2
Carrying	9	9	2	5
Peeling	14	1	0	1
Scraping	15	0	0	0
squeezing	16	0	2	0
Transporting	15	4	5	3
Dig the land to bury scraped products	8	9	1	4
Follow up of kocho fermentation				

4.5. Efficiency of enset processing methods

Farmers were asked to give their general views on whether there is workload difference when using the traditional and the introduced enset processing technologies. Of the interviewed respondents (n=32), majority (63%) of them replied that there is workload difference when using the traditional and the introduced enset processing technologies (Fig. 9). However, 34% of the respondents did not realize whether there is work load difference or not while 3% of them said there is no difference.

Regarding the number of days required to follow up kocho fermentation, great majority (91%) of the respondents said that follow up of kocho fermentation takes 8 to 10 days (Fig.5). However, few farmers said that the follow up can take up to 15 days. This activity is similar under introduced and traditional methods.

Table 6 presents comparison of the introduced and traditional technology with regard average time spent in scrapping and squeezing activities. As estimated by the respondents, the average time required to scrape a single plant is 121min. and 73 min. hours with the traditional and introduced methods, respectively. Similarly, the average time required to squeeze a single plant is 103 min. and 66min. hours with the traditional and introduced methods, respectively.

All of the interviewed farmers (n=16) perceived that the introduced technologies saved their time in general and the women also explained that their husbands are happy, appreciate and recognized the time saved. Respondents were also asked how they utilize the time saved due to practicing the introduced technology. Most of the respondents said that they use the time saved mainly for farm activities, going to market and other household works, taking care of children and social activities, income generating activities, and for praying (Table 7). According to ranking made by them, they allot the saved time more perform household works, farming activities, looking after children (going to market), and income generating activities, other social activities, taking a rest, and praying, in this order of

importance (Table 8). This activities are undertaken by farmers were after the introduction of technologies.

Figure 9 comparison of work load difference between the traditional and introduced ensent Processing technology (N=13)

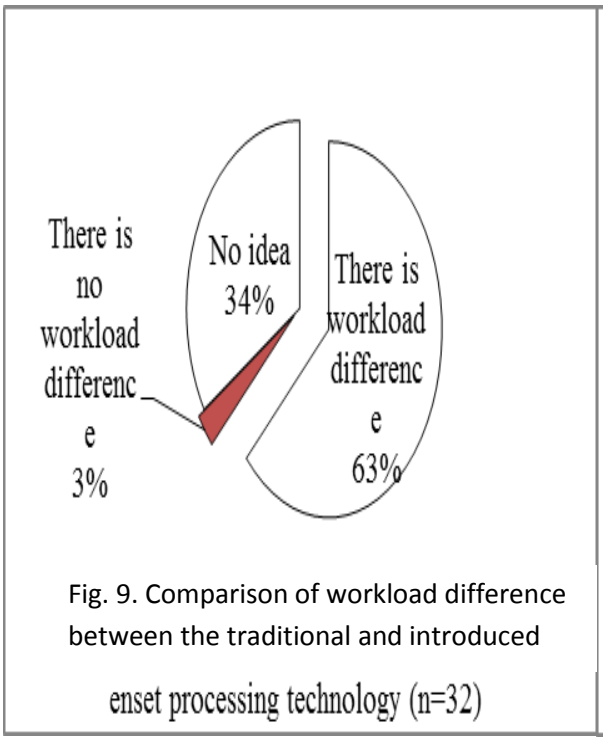


Fig. 9. Comparison of workload difference between the traditional and introduced enset processing technology (n=32)

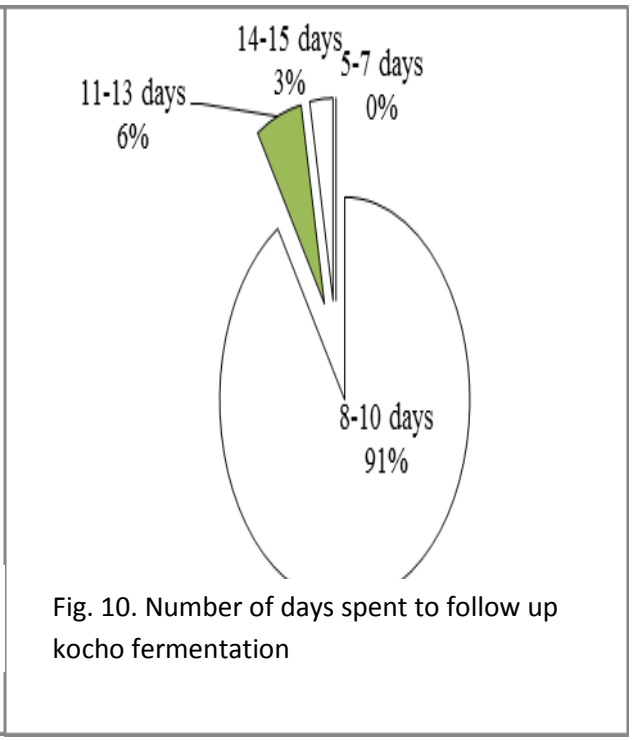


Fig. 10. Number of days spent to follow up kocho fermentation

Table 6 Average time spent to scrap and squeeze one enset plant

Activities	Average* time spent (hours)		
	Traditional	Introduced	Difference
Scraping	121 minutes	73 minutes	48 minutes
Squeezing	103 minutes	66 minutes	37 minutes
Total no. of respondent	32	16	

** The sum of time estimated by respondents divided by number of respondents*

Table 7 Activities those women do with the time saved due to the introduced technologies

Saved time by using introduced technologies (N=16)	No. of response
Yes	16
No	0
If yes, types of works that women do with the time saved (N=16)	
Farming activities (like sowing ,weeding , harvesting , digging the land, animal feeding etc)	15
Looking after children	14
Other household works	15
Engaging to income generating activities	6
Going to market	15
Take rest	5
Other social activities	14
Others (such as praying)	2

**Multiple responses was given*

Table 8 Ranking activities that women do with the time saved due to the introduced technologies (N=16)

List of ranks	Farming activities	Looking after children	household works	Engaging to income generating activities	Going to market	Take rest	Other social activities	others(such as praying)
1st	4	0	12	0	0	0	0	0
2nd	5	3	2	1	3	0	0	0
3rd	5	8	0	0	1	0	0	0
4th	1	2	0	0	1	1	10	0
5th	0	1	0	0	9	2	3	0
6th	0	0	0	3	0	2	2	0
7th	0	0	0	1	0	0	0	2
8th	0	0	0	0	0	0	0	0
Over all rank	2nd	3rd	1st	5th	3rd	7th	6th	8th

Labour requirement: About 94% of the respondents (n=16) said that there is difference in labour requirement between the traditional and the introduced enset processing methods. However, the rest (6%) said that there is no difference in labour requirement between the two methods (Fig.10).

Division of labour: Respondents were asked to provide the labour required to process a single plant in terms of male labour and female labour (Table 9). Accordingly, cutting a single enset plant is mainly done by one person (male) with some support from female. Carrying is done mainly by one male and one female proportionally although in some cases two female are involved. Peeling is done mainly by one female and but in some cases one male is also involved. Scraping and squeezing are done in most cases by one female and in some cases by two female in traditional method. However, there is little involvement of male in scraping activity in the case of practicing introduced technology. Transporting processed products is done in most cases by two female but in some cases by one female and one male. Digging the land to bury scraped products and follow up of kocho fermentation is mainly carried out by one woman (Table 10).

As indicated in bellow Table 10. the introduced technology does not have the other activities like cutting, peeling, carrying, transporting extracted product, dig the land to burry scrape products, and follow up of kocho fermentation that is similar ways with traditional methods of enset processing activities.

Table 9 Reaction of respondents on number of persons involved in to process a single enset plant using traditional and introduced methods by male labour

List of activities	Male Labour									
	1 person		2 person		3 person		Not men involved		I do not know	
1.	No. resp.	%	No.resp.	%	No.resp.	%	No.resp.	%	No.res.	%
2. Traditional (N=32)										
Cutting (N=32)	24	75	8	25	0	0	0	0	0	0
Carrying (N=32)	21	66	0	0	0	0	11	34	0	0
Peeling (N=32)	14	44	0	0	0	0	10	31	8	25
Scraping (N=32)	0	0	0	0	0	0	32	100	0	0
Squeezing (N=32)	0	0	0	0	0	0	32	100	0	0
Transporting process products(N=32)	5	16	0	0	0	0	27	84	0	0
Dig the land to bury scrape products (N=32)	10	31	0	0	0	0	22	69	0	0
Follow up of kocho fermentation (N=32)	0	0	0	0	0	0	32	100	0	0
3. Introduced (N=16)				0		0		0		
Scraping (N=16)	1	6	0	0	0	0	15	94	0	0
Squeezing (N=16)	0	0	0	0	0	0	16	100	0	0

Table 10 Reaction of respondent on number of persons involved in to process a single enset plant using traditional and introduced methods by female labour

List of activities	Male Labour									
	1 person		2 person		3 person		Not men involved		I do not know	
1.	No. resp.	%	No.resp.	%	No.resp.	%	No.resp.	%	No.resp.	%
2. Traditional (N=32)										
Cutting (N=32)	8	25	1	3	0	0	23	72	0	0
Carrying (N=32)	20	32	12	63	0	37	0	0	0	0
Peeling (N=32)	20	63	10	31	2	6	0	0	0	0
Scraping (N=32)	15	47	13	41	4	12	0	0	0	0
Squeezing (N=32)	30	94	2	6	0	0	0	0	0	0
Transporting process products(N=32)	12	38	19	59	0	0	1	3	0	0
Dig the land to bury scrape products (N=32)	22	69	2	6	0	0	8	25	0	0
Follow up of kocho fermentation (N=32)	32	100	0	0	0	0	0	0	0	0
3. Introduced (N=16)								0		
Scraping (N=16)	12	75	3	19	1	6	0		0	0
Squeezing (N=16)	16	100	0	0	0	0	0	0	0	0

.

4.6. Income from enset product

About 59% and 63% of the respondents said that all enset products (including bulla and kocho) are sold by women only respectively (Fig 11). However, about 37% and 41% of the farmers do not sell enset products because they do not have surplus to sell. According to 75% of respondents the new technologies lead to higher prices for processed enset, few respondents said that they have not realized the price difference.

There is a price change in enset products processed by traditional and introduced technologies (Table 11). According to majority of enset product selling respondents, the price of kocho from an enset plant ranges from five to ten Birr with traditional enset processing method. Whereas, the price of same product per plant with introduced technology ranges from eleven to twenty Birr. Likewise, the price of bulla from an enset plant ranges from eleven to twenty Birr with traditional enset processing method and from twenty one to thirty Birr with introduced processing method.

The majority of the respondents (75%) claimed that there was income difference per processed enset depending on the type of technology being used. Accordingly, income from one processed enset under the traditional and introduced technology was about 275.00 and 382.00 Ethiopian birr respectively showed different amount of income due to the price change (Table 12).

When it comes to management of the earned money, all the respondents said that women had full control of the money (Table 10). Accordingly, the women spent the earned money mostly to buy household expenditures, such as kale, coffee, salt, kerosene, potatoes, injera, social contribution (edir and equb), oil, and shiro, in this order of importance (Table 13).

Figure 10 Responsibility of selling enset product against sex (N=32)

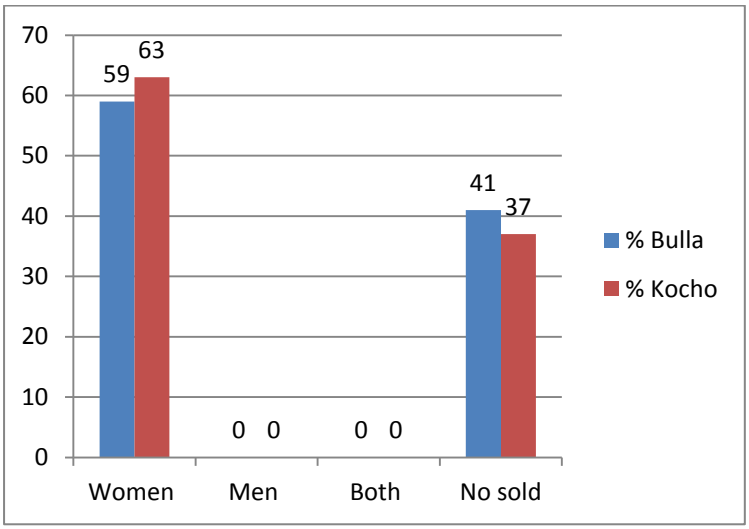


Table 11 Response of farmers to products sells per plant enset in traditional and introduced process (Ethiopian birr) and management of the earned money by sex

If yes, the price difference between enset product processed by traditional and introduced technologies	5-10 birr	11-20 birr	21-30 birr	31-40 birr	41-50 birr	No sell
1) Traditional						
Bulla	3	2	1	0	0	10
Kocho	1	4	1	0	0	10
2) Introduced						
Bulla	0	6	4	1	2	3
Kocho	0	1	6	3	3	3
Management of the earned money by sex (N=32)	No of respondent	percentage				
Women	19	59				
Men	0	0				
Both	0	0				
Not applicable(used only for consumption)	13	41				

Table 12 Estimation of the amount of income generated from one enset plant using traditional and introduced processing methods (Birr)

Product type (N=16)	Traditional	Introduced
Bulla	59.07 Birr	91.65 Birr
Kocho	216.00 Birr	290.28 Birr
Total income/year/farmer(HH)	5501.40 Birr	7638.6 Birr

Note: average no. of plants per HH =20

Table 13 Utilization of the enset sells (money) for different purposes (N=16)

Items of purchased	No. of respondents
Coffee	14
Salt	13
Oil	5
Kale	16
Onion	2
Red pepper	2
Injera*	7
pea	3
Shiro*	5
gas	11
potatoes	8
Tax payment and labour wage	2
Saving and social contribution	6

**Multiple responses are given*

**shiro -local food eating with injera usually prepared from peas or beans*

**Injera s-staple food of Ethiopian people which made from teff crop*

4.7. Enset products and area allotted to enset after introduction of technology

With regard to quantity difference, 75% of the respondents said that there was a quantity difference per enset processed depending on the type of processing technology used- Whereas few of respondents (25%) cited the absence of quantity difference between traditional and introduced technologies (Fig12)-the- Majority of the respondents estimated that the amount of bulla product extracted using the traditional processing method ranges from 2 to 3kg per enset plant where as kocho product ranges from 6 to 7 kg per plant. Conversely, under using the introduced technologies, the amount of bulla and kocho product ranges from 4 to 5 and 6 to 7 kg per plant, respectively (Table14).

All of them respondents said that after introduction of the processing technology, the area allotted to enset cultivation showed an increasing trend as compared to the area before the introduction of the technology. They estimated the area allotted to be 0.22 ha and 0.34 ha before and after the introduction of the technology (Table 15).

According to the respondents (n=32) men have a major role in deciding whether to increase or decrease the land area of enset cultivation, whereas decision on cash was usually made by women (Fig. 13). Accordingly, with regard to amounts of cash, women did control 91% and 100% of the cash generated from sale of the enset products of bulla and Kocho under both the traditional and introduced technology (Table 16).

Figure 11 Responses of farmers on whether there is difference in the amount of enset product processed by traditional and introduced technologies

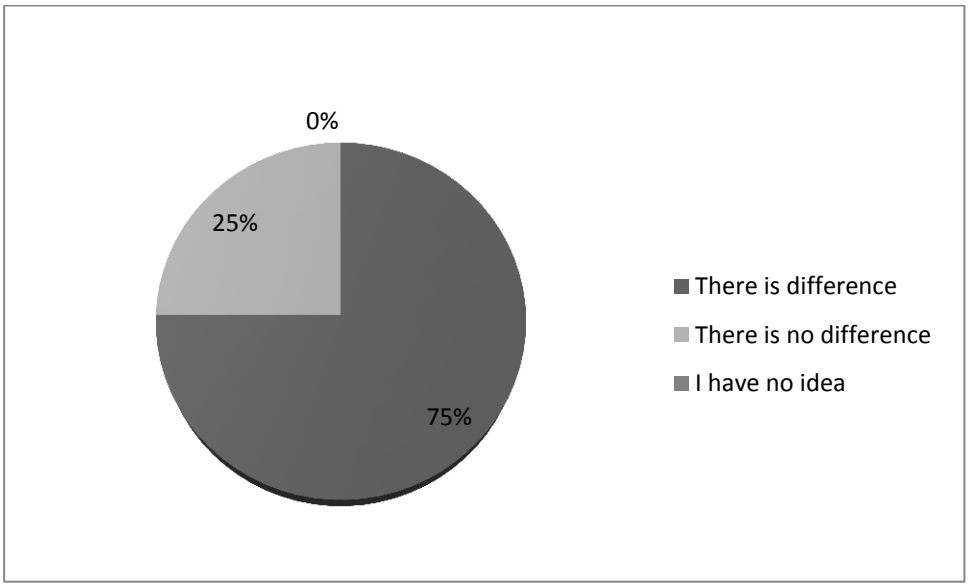


Table 14 Quantity difference in processed product between traditional and introduced technologies

If yes, the amount of processed product per plant having similar size in traditional and introduced processing	2-3kg	4-5kg	6-7kg	7-8kg	9-10kg	11-15kg	No answer
1) Traditional(N=32)							
Bulla	19	7	1	0	0	0	5
Kocho	0	1	14	8	1	3	5
2) Introduced(N=16)							
Bulla	4	9	0	0	0	0	3
Kocho	0	0	5	3	2	4	2

Table 15 Amount of area allotted to enset grown

Change in area allotted to grow enset before and after the introduction of the improved enset processing technologies (N=16)	No. of respondents	Percentage
Yes	16	100
No	0	0
If yes, types of practicing enset processing methods	*Average area per HH	
Before using introduced technology (traditional) (N=16)	0.22ha	-
After using introduced technology(N=16)	0.34ha	-

*The sum of area estimated by respondents divided by number of respondents

Figure 12 Decision by women and men to increase or decrease enset land and control over cash generated (N=32)

Table 16 Amounts of cash controlled by women and men in traditional and introduced enset processing (N=16)

Amounts of cash	Traditional				Introduced			
	Women	Men	percentage		Women	Men	percentage	
			women	men			Women	Men
10-30%	1	1	6	6	1	1	6	6
31-50%	2	1	13	6	2	2	13	13
51-70%	1	2	6	13	1	2	6	12
71-90%	2	0	12	0	0	0	0	0
91-100	6	0	38	0	7	0	44	0

4.8. Adoption of the introduced technology and reasons for not adopting

As far as the present status of the introduced technology is concerned 63% of them did not use the introduced technology any more. The main reasons cited by the respondents were unavailability of the equipment when needed (because five people had to share one), out of use, and time taking to take the enset where the equipment was located, in this order (Table 17).

In the study area, the agriculture office (75%) and World Vision (25%) were the ones that distributed the introduced technology. The introduced technologies were manufactured by the Sodo and Melkssa rural technology centres. However, 97% of the respondents (n=32) claimed that they had no access to credit to purchase the introduced technology. Only 1 respondent (3%) got credit from the agriculture office to purchase the equipment. Financial institutions like Omo Microfinance and NGOs were not suggested as credit sources by the respondents (Table18).

All of respondents claimed that there was no opportunity for repairing the equipment once the technology was being introduced. Institutes which manufacture the implements are not also giving repairing service.

Table 17 Current status of using introduced technologies

Still using the introduced technologies (N=16)	No of respondents	Percentage
Yes	6	37
No	10	63
If no, reasons not continuing to use introduced technologies (N=10)		
Not available when needed (group of five)	7	70
Time taking	1	10
Out of work (old)	2	20

Table 18 Institutes currently to supply the introduced

name of institute to supplied introduced technologies(N=16)			
Agriculture office	Sodo Rural technology centre	12	75
	Melkassa rural technology centre	0	0
World vision	Sodo Rural technology centre	0	0
	Melkassa Rural technology centre	4	25
Institute available to provide credit for purchasing the improved technologies (N=32)			
Yes		1	3
No		31	97
If yes, name of institute to provide credit for purchasing the improved technologies (N=32)			
Omo micro finance		0	0
Agriculture office		1	3
Other non government organizations		0	0

4.9 Farmers perception and feedback on the introduced technology

While 44 % of the user responded that they gave their feedback to extension agents to modify certain functionalities of the introduced technologies, 56% of the user did not give any feedback about the technology. This is because some women responded that the extension agents did not ask about their feedback on introduced technology. For those who gave their feed-back, the modification suggested by them included widening of the squeezer's hole, replacement of the scraper rope, and increasing the plumber of the scraper length.

Table 19 summarises the major defects of the traditional method and the introduced technology. With regard to the traditional method, difficulties are: difficulty to work during pregnancy because of they have to put their legs on the stem of enset (picture 1), old age, and health complication, does not attract men to be involved in enset processing, consumes much time and energy, poor sanitation, and difficulty of scrapping. Likewise, with regard to the introduced technology, the scraper rope is tedious (part of scraper that used to tie the peel enset to process) and time taking and the technology is not easily accessible and affordable.

Respondents, on the other hand, listed the strong features of the traditional and the introduced methods (Table 20). The major good features of the traditional method included availability of the material at local level; farmers have well experience and can use their indigenous knowledge, and enable the family to work together in groups, and improves social bondage. With regards to this the researcher was interviewed farmers whether the introduced technologies are reduced their social bondage or not. Most of the respondents were explained due to the introduction of the introduced technology it was not reduced their social bondage. Because the introduced technologies reduced their time and labour so as farmers could enable to participate jointly by other social community works such as Equb, women saving and credit groups etc. Similarly, the major good features of the introduced method were good quality enset product, reduce workload and time, hygienic, and higher income due to high unit price amongst others.

Table 19 Farmers perceptions on defects of introduced technologies and traditional enset processing tools (N=32)

	No of respondent
Major defects or weakness of traditional enset processing and introduced technologies	
1) Traditional (N=32)	
Poor sanitation during processing	11
Time and energy consuming	12
Bulla scraper area is narrow and time and energy taking	0
Not easily accessible and affordable	0
Cannot work during pregnancy and old age, and affect women health	21
Difficulty to scrape the enset	10
Promoting the existing culture (not appropriate for men to involve)	14
2) Introduced (N=16)	
Bulla is squeezed by feet and bring untidy and labour burden	0
The scraper rope is tedious and time taking	12
Time and energy consuming	0
bulla scraper area is narrow and time and energy taking	4
Not easily accessible and affordable	12
Cannot work pregnancy and old women, and affect women health	0
Difficulty to scrape the enset (short, no supporter)	8
Promoting the existing culture (not involved male)	0
No answer	1

Table 20 Major strengths of traditional enset processing and introduced technologies (more answer possible)

Strengths	No of respondents
1) Traditional (n=32)	
Can participate family members	0
Enables to work in groups (geze) & improves social bondage	14
Experience and can easily use their indigenous knowledge	19
Decrease work load and time	8
Hygienic	0
Improved quality	0

Can sell with high price	0
Increased household income	1
Locally available	20
2) Introduced (n=16)	
Can participate family members	8
Enable to work in groups (geze) & increase social bondage	0
Experience and can easily use their indigenous knowledge	0
Decrease work load and time	13
hygienic	9
Improved quality	15
Can sell with high price	8
Increased household income	5
Locally available	0

Source: field study August 2012

5. ANALYSIS AND DISCUSSION

This chapter discusses the performance of the introduced enset processing technologies relative to the traditional methods in terms of time saving, income change, and role distribution.

5.1. Types of available enset processing technologies and their adoption

In the study area the types of enset processing technologies were identified related to the enset scraping and squeezing devices. Diffusion of the technologies to farmers is usually carried out through field demonstration. However, only few farmers use the introduced technologies. Based on the discussion with experts working for the rural development and agriculture office and responses of the women, the reasons for non-adoption could be attributed to a number of factors.

First, these technologies are not sufficiently available due to the limited human and financial capacity of the rural technology centres in the country. Second, enset agriculture seems to be given low emphasis by policymakers. This supports the findings of Steven et al. (1997) who revealed that enset agriculture has received little attention on research, development and extension. Third, lack of follow up by the rural technology centres or their collaborators to maintain the introduced technologies, which are available in the hands of the farmers. According to respondents, there was no responsible body to facilitate and solve women problems with regards to enset processing; (1) less attention given to both the manufactured centres and other government institutions;(2) there was no training activities, follow up actions and monitoring activities and; (3) no continuous assessment with regard to the efficiency of the introduced technologies after providing to those farmers. Fourth, low adoption could be attributed to lack of financial resources to buy the technologies (see section 5.2). Fifth, enset agriculture seems to be given low emphasis by policy maker because it is not a cash crop, not a high production crop, region specific crop and it is usually women crops but in some cases men are involved in growing enset.

Other evidences agree with this result that financial problems are the main causes of non-adoption (Million, 2008). Other causes are of the insufficient number of introduced technologies that most farmers are non-adopter because farmers that did not feel like sharing it with other group members. According to this argument the introduced technologies are expected invite women in the adoption decisions positively since the burden of their work load and energy/labour taking will reduced due to involvement of their partners men and other male household members by applying these technology.

5.2. Affordability of introduced technology

From those currently using the introduced technologies, only 9 of them owned the technology individually; the other 7 farmers owned the technology in a group of five households. That means only 9 farmers were able to afford to buy the technology at the individual level. Hence, the large majority of the respondents were not able to afford to buy the technology. They cited lack of money and access to buy the technology. This is an expected result as many farmers living in rural area have lack of cash. However, it also implies lack of institutions that would provide credit for farmers to buy these technologies. Perhaps, collection action in the form of women groups may help them to access credit facilities. Studies elsewhere show the importance of the availability of credit for the adoption of new technologies (Carr, 1984). In terms of accessibility, it was observed that rural technology centres that are responsible to supply the technology were being located in far places.

5.3. Difference in performance between traditional and introduced technology

The main activities in enset processing include the following: decision to process matured enset plant, cutting of the enset, peeling, scrapping, squeezing to produce the bula,

transporting extracted products, digging a pit, and fermentation of the kocho. Before starting all the enset processing activities the number of matured enset plant should be decided either by men or women or both to implement the task by one of the enset processing methods. However in both methods, the decision to process the matured enset plant is made jointly by men and women. The main functional difference between the traditional methods and the introduced technologies rests on the scraping and squeezing activities.

In general, the introduced technology is expected to perform the scrapping and squeezing activities more efficiently and effectively than the traditional methods. Hence, any difference in role distribution, time saving, and income within the household is attributed to the difference in the two main enset processing activities (scraping and squeezing).

Role distribution: In terms of change in role distribution due to the introduced technology, it is shown that more boys, girls, and men are involved in the scraping and squeezing activities when a household used the introduced technology. Therefore, these technologies are required men and boys to help women. This was expected as labour-saving technologies and practices tend to affect household role distribution (IFAD, 2009). But under the traditional method, nearly all the scrapping and squeezing activities are performed by women. Under both methods, the cutting and carrying activities are often performed by men, with some support from the rest of the household members, while women involve in all the enset processing activities, particularly in scrapping, squeezing, and fermentation (see Harvard Matrix page 21 chapters 4).

Efficiency of enset processing methods: As expected, the study showed the presence of workload difference (labour hour) between the traditional methods and the introduced technologies. As explained before, such difference mainly relates to the time saved from scrapping and squeezing activities. Accordingly, the results showed that farmers who used the introduced technologies on average saved 48 and 37 minutes per enset plant for scrapping and squeezing activities, respectively, compared to the processing time that could have been used to perform these activities under the traditional methods. The amount of labour used to process per one enset plant was found different on labour requirement between introduced and traditional methods of enset processing activities. Under the traditional methods, enset processing takes two women labours mostly in scraping (41%). While under introduced technologies, majority of farmers, (75%) and (100%), could perform the tasks themselves without being assisted by other additional women labour to scraping and squeezing, respectively. This is in line with the literature, such as Henderson and Ellen (1995:51-54) who claimed that improved technologies improve efficiency.

The women expressed that their husbands recognized the time saved and were happy about it. The main reason for the husbands being happy could relate to the extra time available for the women for other farming activities. This was confirmed from the respondents about the allocation of the saved time over other activities. That is, women spend the saved time primarily on farming activities, going to market, involve with their house hold works, and taking care of their children and other social activities, in this order. Studies elsewhere have shown that a labour-saving technology is beneficial if (1) it allows women to spend less time providing basic needs and more time on their preferred productive activities, (2) improves women's businesses, leading to increases in production, to new or changed products, or to products of higher quality (Henderson, 1995, P. 51; IFAD,2009, P.289; Evertsen, 1998, P.11).

Income effect of enset processing technologies: The study showed that the use of introduced technology has brought an increase in household income. The increase in income was mainly attributed to improved product quality (both kocho and bulla) and the resulting high price from the sale of these products. Furthermore, the introduced technology has decreased wastages, particularly bula, and, hence, improved the quantity of the processed products. Subsequently, the study showed that the estimated bulla product

extracted by using the introduced technology was higher by 2 kg per enset plant than the traditional methods. This shows that there is some yield improvement with the improved processing method. Nevertheless, the estimation made by the respondents seems low according to the views of staff members of offices of the agriculture who estimated a higher output per enstet. The third factor that generated higher income attributed to area expansion. This is because, when farmers started using the introduced technology, farmers increased the number of enset plants. However, the introduced technologies are saved the women time; due to the area expansion still the women time is left.
In the results, while area covered by the enset plant was 0.22ha before the introduction of the technology, the area coverage per farmer was 0.34ha after the introduction of the technology. Overall, there was an increase of 32.58 and 74.28 Ethiopian Birr for bulla and kocho per one enst, respectively, because of the use of the introduced technology.

In addition, the result showed that income generated from the sale of enset products is controlled by the women in more than 90% of the time irrespective of the two enset processing methods. The main reason could relate to cultural practices. In general, enset plants are grown around the house, and often enset management activities are left to the women by the society, as the enset processing is left for the women. Hence, by giving all the activities related to enset, including the money generated, to the women, the men can avoid giving money to the women for household expenditures, such as to buy sugar, salt, oil, and the like. This was reflected in the results (Table 10). Women spend the money generated from enset products to buy household expenditures, such as kale, coffee, salt, kerosene, potatoes, etc.

6. CONCLUSION AND RECOMMENDATION

6.1. Conclusion

The study was conducted in Southern Nations Nationalities and People's Regional State of Guragie Zone in Enemorena Ener district in four kebeles or local villages. This conclusion has been drawn from the main findings of the study in which sources of information were triangulated. The triangulation includes the secondary information collected during desk study and the primary data gathered at field work in Gahrad, Amogera, Kochira and Guareba kebeles in Enemorena Ener district.

The main objective of the study was to find out the performance of the introduced enset processing technologies relative to the traditional methods in terms of time saving, income change, and role distribution. This chapter consists of the conclusion and recommendations parts; where the conclusions are explained briefly about the findings of the study while the recommendations are complied based on the results. The finding results are analysed by using descriptive statistics.

The results of this study showed that in the study area, enset processing is mostly carried out using traditional methods. Enset processing is still mainly performed by women even after introduced technology (such as enset scraper and squeezer) is used. From the total introduced technologies (2214 scrapers and 1159 squeezers) manufactured by SRTPC about 94 introduced technologies (80 scraper and 14 squeezer) were distributed in 1997 and 2004 by Sodo Rural Technology Promotion Centre (SRTPC) and later in 2012 that only 10 scraper were introduced by Melkasa Agricultural Research Institute (MARI). However, only few farmers used the introduced technologies often.

Based on the discussion with (N=3) experts working for the rural development and agriculture office and responses of the women, the reasons for low adoption could be attributed to a number of factors, such as (1) these technologies are not sufficiently available due to the limited human and financial capacity of the rural technology centres in the country; (2) enset agriculture seems to be given low emphasis by policymakers. Because it is not a cash crop, not a high production crop, region specific crop and it is usually a women crop but in some cases men are involved growing enset; (3) lack of follow up by the responsible body and low communication among different organization working on promoting enset processing technologies to maintain the introduced technologies, which are available in the hands of the farmers;

(4) low adoption could be attributed to lack of financial resources to buy the technologies; (5) Though the technologies are saved women time and energy than the traditional methods, they had a little bit defects such as the squeezer hole and the flat scraper are narrow; as a result taking longer time to produce bulla and kocho; (6) lack of money and access to buy the technologies; and (7) lack of institutional support that would provide credit for farmers to buy these technologies.

In general, the adoption rates of these technologies were low. However, it could invite women in the adoption decisions positively since the burden of their work load and labour will reduced due to involvement of their partners men and other male household members by applying these technologies.

The main activities in enset processing in the area decision to process matured enset plant, cutting of the enset, peeling, scrapping, squeezing to produce the bulla, transporting extracted products, digging a pit, and fermentation of the kocho. In both methods, the decision to process the matured enset plant is made jointly by men and women. This

decision was undertaken mainly focussed only the cases that was to made decision to be processed or not.

This study was found that the change in role distribution among households due to the introduced technologies is in a way that more boys, girls, and men are involved in the scraping and squeezing activities when a household used the introduced technology. Under the traditional method, nearly all the scrapping and squeezing activities are performed by women. Under both methods, the cutting and carrying activities are often performed by men, with some support from the rest of the household members, while women involve in all the enset processing activities, particularly in scrapping, squeezing, and fermentation.

The study investigated the efficiency of introduced technologies in terms of labour and processing time per unit of output. As a result, it analysed and found that there is a paramount workload difference (labour hour) between the traditional methods and the introduced technologies. Such difference mainly relates to the time saved and labour reduced from scrapping and squeezing activities. According to the results, farmers who used the introduced technologies on average saved 48 and 37 minutes for scrapping and squeezing activities, respectively, compared to the processing time that could have been used to perform these activities under the traditional methods.

The amount of labour used to process per one enset plant was found different on labour requirement between introduced and traditional methods of enset processing activities. Under the traditional methods, enset processing takes two women labours mostly in scraping (41%). While under introduced technologies, majority of farmers, (75%) and (100%), could perform the tasks themselves without being assisted by other additional women labour to scraping and squeezing, respectively. Therefore, it is concluded that the introduced technologies were able to reduce the number of farmers labour involved than the traditional enset processing activities. However social bondage might be reduced.

This study also investigated the effects of introduced technologies by reducing burden of women time and labour. As such, women start spending the saved time primarily on farming activities, going to market, involving with their house hold works, and taking care of their children and other social activities. Even though women are still seems very busy, they got an advantage of some extra time to manage their rest of activities that women should do by their getting bed time.

The study also revealed that introduced technologies have a positive effect on the household income but the income is apparently not enough to cover for the expensive technology; because women mostly used the income to purchasing their household consumption. This income was mainly attributed to improved product quality (both kocho and bulla) and the resulting high price from the sale of these products. Furthermore, the technologies had decreased the wastages of the enset products during the processing, thereby improving the quantity of the processed products, particularly bulla, while regarding on kocho product, it was estimated similar quantities with traditional methods. There was also an area expansion where farmers increased the number of enset plants. In the results, while area covered by the enset plant was 0.22ha before the introduction of the technology, the area coverage per farmer was 0.34ha after the introduction of the technology. Overall, it was shown that the prices of bulla and kocho products were higher under the new technologies than traditional methods. As a result, the income per enset plant was increased to 32.58 and 74.28 Ethiopian Birr for bulla and kocho, respectively, because of the use of the introduced technology.

In addition, income generated from the sale of enset products is controlled by the women in more than 90% of the time irrespective of the two enset processing methods. The main reason could relate to cultural practices. Generally, enset plants are grown around the house, and often enset management activities are left to the women by the society, as well

the enset processing is left for the women. On the other hand, the management of money from earned enset products were controlled by women. Women spend the money generated from enset products to buy household expenditures, such as kale, coffee, salt, kerosene, potatoes, etc.

Accordingly, the majority of respondents reported that the introduction of the new technologies has also improved gender relations among the households since women started participating in productive roles. As a result, their income creates the economic power of women so that they can play an important role in the economic spheres of the household income. In addition, it might change the negative attitudes of men and thereby enables them to increase their decision making role over resources of household. In general, the introduced technologies produce positive feature of improving gender relations among households.

6.2. Recommendations

Based on the major findings of this paper the following recommendations are presented with policy implications:

- Farmers adoption rate is very low on account of a number of factors. This requires a number of potential tasks to be done, which include: (1) the technologies should sufficiently be made available through increasing the limited human and financial capacity of the rural technology centres in the country; (2) policymakers should give particular attention on enset agriculture; (3) There should be a follow up and a feedback mechanism to improve the acceptability and efficiency of the next generation of enset processing technologies by the research and the rural technology centres or establishing collaboration between partners to maintain the introduced technologies, which are available in the hands of the farmers; and (4) increasing the financial resources of farmers to buy the technologies would reduce the constraint that hinders most farmers from adopting the technologies. Therefore, linking farmers with credit institutions is significantly important.
- It is imperative to create mechanisms to make the technologies easily accessible to farmers. The introduced technologies are not fully reached by women with regards to moving farmers from their traditional methods of the enset processing practices in the study areas. In the process of providing the introduced technologies to farmers, it was identified that less efforts influenced farmers adoption rates because of lack of continuity and complexity of procedures that make farmers reluctant to use the technologies**.**
- Designing strong strategy is essential to make access the introduced technologies to the majority of farmers and it is also necessary that the technology institutes should provide better new technologies and maintenance service on existing technologies on regular basis. For this purpose, consideration of farmers' feedback is vital to enhance their efficiency.
- It is necessary to establish strong network and collaboration between partners among the farmers and institutes related with the area of enset processing programmes and projects (like Sodo Rural Promotion Centre, Melkassa agricultural research institution, university of Hawassa agriculture, Enemorena Ener agriculture office and women and children Affairs office and other Non-governmental organizations such as world vision, and catholic church). This will help to make the technology better accessible to women and to enhance the adoption rates of the technologies.

- Empowering women in the household is an important measure to Improving gender relationships. The involvement of men on enset processing mainly in scraping, squeezing and fermentation tasks can change the existing cultural aspects of gap between men and women towards involving with enset processing activities. The

introduced technologies changed the role of enset processing activities particularly enset scraper and squeezer devices among the household members. As a result, it is necessary to involve men equally when the enset technologies are being demonstrated and providing training either by manufactured institutions or extension workers.

- It is also important to involve men and women in introduction of a new technology but also in the design and the testing because then some of the technological problems (like tedious rope, in conveniences of short scrapers and narrower of squeezing hole Work) can be avoided.

- Finally, it is vital to conduct continuous education to raise the awareness of the community to improve the participation of male in enset processing activities particularly the enset scraping, squeezing and fermentation processes. This will have paramount advantages for the overall communities in the study areas to reduce women farmers work overload.

References

Agric-service Ethiopia 2008. Enset value chain, Consultancy report, Amaro special district.

Bekele A., Zewdue M., Yeshitila M., Tesfaye E., 2008. Post-harvest management of ensetproducts: In: Woldegiorgis, Endale Gebre and berga Lemega, Eds). Root and Tuber Crops: The Untapped Resources, Addis Ababa, Ethiopia. pp235-251.

BoARD = Bureau of Agriculture and Rural Development Report Document, 2010. Hawassa. Ethiopia

BoFED=Bureau of Finance Economic Development, 2012. Project based on 2007 Census Result document. Ethiopia.

BoFED=Bureau of Finance Economic Development, 2010. Data Collection-Dissemination Core Process Regional Statistical Abstract Document. Ethiopia

BOTA=Bureau of Transport Authority, 2010. Annual Report Document. Ethiopia.

BoFED, 2011. Regional Stastical Abstract Document. Southern Nations Nationalities and Peoples Regional States Bureau of Finance Economic Development-Data Collection Core Process Regional Statistical Abstract. Hawassa.

Bravo- Baumann, H. 2000. Capitalization of experiences on the contribution of livestock projects to gender issues. Working Document. Bern, Swiss Agency for Development and Cooperation.

Brandt A. et al. 1997. The Tree against Hunger. Enset Based Agricultural Systems in Ethiopia. American Association for the advancement of Science with Awassa Agricultural Research Centre. Kyoto University Centre for African Area Studies and Universities of Florida.

Everts,S. ed., 1998. Gender and technology: Empowering women, engendering development. United Kingdom: Biddles Ltd, Guildford and King's Lynn.

Hawassa University, 2012. *Participatory Rural Appraisal study Report for Malga, Bulle, Enemorena Ener and East Azernet Berbere Weredas*. South Capacity building for scaling up of evidence-based practices in agricultural production in Ethiopia (ASCAPE). Hawassa, Ethiopia.

IFAD= International Fund of Agriculture Development.2009. Gender in Agriculture sourcebook. World Bank Publications.

Henderson, H. K. and Ellen H. eds., 1995. Gender and agricultural development: surveying the field. Arizona: The University of Arizona press/Tuscon.

Leeuwis C. 2004. Communication for rural innovation: rethinking agricultural extension. 3rd edition. Black well publishing.

Marilyn C. and Maria H., 2010. Lightening the Load Labour-saving technologies and practices for rural women Published by International Fund for Agricultural Development (IFAD) and Practical Action Publishing Ltd:
available at http://www.ifad.org/gender/pub/load.pdf (accessed by 10 -9-2012)

Million T. 2008. Socioeconomics and Technology Transfer. Gebremedihen Woldegiorgis, Endale Gebre and Berga Lemaga, (Eds). In: Root and Tuber Crops, The untapped Resources, Addis Ababa. Ethiopia.

Million T., 2003. Determinants of adaptation of improved enset processing devices in Wolaita, Kembata- Tembaro and Guragie zones, Southern Ethiopia. Ethiopian journal of development research vol.25, No 2.

OECD (Organization for Economic Co-operation and Development) available at: http://www.oecd.org/dataoecd/47/52/44896176.pdf (accessed 25 May 2012).

Office of Agriculture, 2012. Annual Report document. Guncherie. Ethiopia

Office of Agriculture, 2012. Enemorena Ener, District Annual Report Document. Ethiopia

Steven A. B., Anita S,Clifton H., Terrence J. M.,Endale T., Mulugeta D., Gizachew Wolde-M., Gebre Y., Masayoshi S., and shiferaw T. 1997.THE TREE AGAINST HANGER Enset-based Agricultural system in Ethiopia.Pp1-56. American Association for the Advancement of Science with Awassa Agricultural Research Center, Kyoto University center for African Area Studies and University of Florida.

SRTPC=Sodo Rural Technology promotion Center, 2010. Enset Food Preparation Devices. Training Manual .Sodo.

Annex I- Checklist

Basic information of the respondent

Name: ----------

Kebele (Location) ----------

SSI- questionnaires

1. What types of enset processing do you use? (More answer possible)
   (a) Traditional (b) Introduced technology (c) both
   If both technologies are being used which one do you often use?

   If you don't use introduced technologies, why? (a) I don't like (accept) (b) lack of money (c) high cost (d) lack of knowledge (e) others (specify) ----------
   ----
2. Can you afford to buy the introduced technologies? (a) yes (b) no
   If no what is the reason? ----------
   ----
3. Who makes decisions to process matured enset plant (in terms of quantity and time) when using the:
   A. Traditional enset processing (a) women (b) men (c) women and men
   B. Introduced Technologies (a) women (b) men (c) women and men
4. Is there change in role distribution among the household due to the introduction of technologies? (a) yes (b) no
5. How is enset processing activities distributed among the household members?
   A. In introduced technologies/squeezer and scraper (more answer is possible):
   - Cutting (a) women (b) men (c) girls (d) boys
   - Carrying (a) women (b) men (c) girls (d) boys
   - Peeling (a) women (b) men (c) girls (d) boys
   - Scraping (a) women (b) men (c) girls (d) boys
   - Squeezing (a) women (b) men (c) girls (d) boys
   - Transporting (a) women (b) men (c) girls (d) boys
   - Dig the land to bury scrape products (a) women (b) men (c) girls (d) boys
   - Follow up of fermentation (a) women (b) men (c) girls (d) boys

   B. In Traditional enset processing (more than one answer is possible):
   - Cutting (a) women (b) men (c) girls (d) boys
   - Carrying (a) women (b) men (c) girls (d) boys
   - Peeling (a) women (b) men (c) girls (d) boys
   - Scraping (a) women (b) men (c) girls (d) boys

- Squeezing (a) women (b) men (c) girls (d) boys
- Transporting (a) women (b) men (c) girls (d) boys
- Dig the land to bury scrape products (a) women (b) men (c) girls (d) boys
- Follow up of fermentation a) women (b) men (c) girls (d) boys

6. Is there a workload difference in processing between traditional and introduced technologies? (a) yes (b) no

   If so, how long does each activity takes to process one enset plant using traditional and introduced technologies (in hour)?

Activities	**Traditional processing**	**Introduced technologies**
Cutting		
Carrying		
Peeling		
Squeeze		
Transporting		
Dig the land to bury scrape products		
Follow up of fermentation		

7. Do you think the introduced technologies have saved your time? (a) yes (b) no

   If yes what do you do with the time saved?

(a) Farming activities (b) looking after children (c) other household works (d) engaging to income generating activities (or non-farm) (e) going to market (f) take rest (g) other social activities (h) others (specify) ----------

Please Rank them according to your preferences:

1st----------
2nd----------
3rd----------
4th----------
5th----------
6th----------
7th----------
8th----------

According to your views or eyes how did you get the feeling of your husband by your saved time? (e.g.do they appreciate it or not and what else..)----------

8. Is there labour difference between traditional enset processing and introduced technologies? (a) Yes (b) no
   If yes how many persons are involved?

Activities	**Traditional processing**			**Introduced technologies**		
	Number of person			Number of person		
	male	female	age	male	female	age
Cutting						
Carrying						
Peeling						
Squeeze						
Transporting						
Dig the land to bury scrape products						
Follow up of fermentation						

9. Who sells the processed enset products?
   i. Bulla? (a) women (b) men (c) both
   ii. Kocho? (a) women (b) men(c) both
10. Is there a price difference between enset products processed by traditional and introduced technologies? (a) yes (b) no
    If yes, what is the selling price of the products per one enset (in Ethiopian Birr)?

Product type	Traditional processing	Introduced technologies
▪ Bulla	----------	----------
▪ Kocho	----------	----------

11. Who controls the money earned by processed enset: (a) women (b) men (c) Not selling
12. What do you buy with the money that you get from enset sells? ----------
    ---

    ---

13. Is there a quantity difference in processed product between traditional and introduced technologies? (a) yes (b) no
    If yes, what is the amount of processed product per plant having similar size?

Product type	Traditional processing	Introduced technologies
▪ Bulla	----------	----------
▪ Kocho	----------	----------

14. Is there income difference between traditional and introduced technologies?
    (a) yes (b) no

If yes, how much income did you get per one enset plant (Ethiopian Birr)?

Product type	Traditional processing	Introduced technologies
▪ Bulla	----------	----------
▪ Kocho	----------	----------

15. Is there change in area allotted to grow enset (or number of ensets grown) before and after the introduction of the improved enset processing technology? (a) yes (b) no
    If yes, how many areas allotted to enset (or how many ensets were grown) before and after the introduction of the improved enset processing technology (ha/number of plants)?
    A. Before (traditional) ----------
    B. After (improved) ----------
16. Who decided to increase or decrease land for enset plantation? (a) women (b) men (c) Both
17. Who controls the cash generated from the enset sell? (a) women (b) men (c) Both
18. From cash generated enset product sells (per plant), what amounts are controlled by women/men (Birr)?

	Traditional processing	Introduced technologies
Women	----------	----------
Men	----------	----------

19. Are you still using the introduced technologies? (a) Yes (b) No
    If no, what is your reason for not continuing to use?
    a)----------
    b) ---------- ----------
    c) ----------

20. Is there any institute to supply the introduced technologies? (a) Yes (b) no

If yes who provided you? ----------

21. Is there any institute available to provide credit for purchasing the improved technologies? (a) yes (b) no
    If yes who provided you? ----------
22. Is there any opportunity to repairing the introduced technologies? (a) yes (b) no
    If yes who repairs the introduced technologies? ----------
    ----
23. Is there any feedback given by you to modify the introduced technologies? (a) yes (b) no
    If yes please specify yours provided feedback ----------
    ----

24. What are the major defects /weakness of traditional and introduced technologies?
25. What are the major defects or weakness of traditional and introduced technologies?

A. Traditional methods ----------

B. Introduced technologies ----------

---

26. What are the major strengths of both traditional method and introduced technologies?

A. Traditional processing ----------

B. Introduced technologies ----------

