The District Stakeholders' Perception towards Improved Wheat Technologies Delivered to Smallholder Farmers: The Case Study in Chencha District in Gamo Gofa Zone, Ethiopia

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By

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Dedication

I dedicate this research paper to my father Mr. Daniel Molla and my mother Mrs. Dalbaze Dalka who supported me in my life to reach today's success.

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Acronyms

AMRC	Arab Minch Research Center
CSA	Central Statistics Agency
DAO	District Agricultural Office
DAs	Development Agents
FGD	Focus Group Discussion
FTC	Farmers Training Centres
GDP	Gross Domestic Product
GGZDA	Gamo Gofa Zone Department of Agriculture
GGZ	Gamo Gofa Zone
GR	Green Revolution
GTP	Growth and Transformation Plan
IWP	Improved Wheat Production
IWTs	Improved Wheat Technologies
Kg	Kilogram
Masl	Metre above sea level
Mm	Millimetre
NGOs	Non-Government Organisations
SEA	South East Asia
SNNPR	South Nation Nationalities Peoples Region
SNNPRAB	South Nation Nationalities Peoples Region Agriculture Bureau
SNNPRSME	South Nation Nationalities Peoples Region Seed Multiplication Enterprise

Abstract

Chencha district in Ethiopia is one of the potential wheat growing districts of Gammo Gofa Zone (GGZ) in South nation nationalities people's region (SNNPR). Wheat production encompasses about 42% of the cereals production in the district. Over 90% of smallholder farmers, are involved in the wheat production since it is the main staple food and cash crop for them. More than a decade, different stakeholders in the district, zone and region have greatly involved in the promotion of improved wheat technologies (IWTs) through the intensification (scaling up) strategy. The key IWTs relate to land preparation, row planting, improved seeds, inorganic fertilizers, weeding and disease management. Despite efforts in material, time and human resources have been made, the changes acquired have been low with compared to the goal of the district. The study shown that the average productivity has been 24.5 from expected 50 quintiles per hectare and, the land occupied by IWP and the participation of smallholder farmers has been below 30% from the expectation.

Based on the low performance and other associated problems, the study sought to explore challenges behind IWTs. The main objective of the study is to investigate the perception of district stakeholders' towards IWTs in the production processes in the district. To achieve this objective, a qualitative research approach and case study strategy employed. The empirical data collected from 18 stakeholders through interviews and FGD as well as through participant observation in five places in the study area based on checklists. The findings of the field study were analysed qualitatively based on the model of basic variables of the research. These are: evaluative frame of reference, perceived self-efficacy, perceived effectiveness of social environment and perceived social pressure.

The research results' were summarised as follows. The research centres had not assessed the needs of the stakeholders in the district before the design and adoption of IWTs in the district; the tertiary stakeholders imposed primary and secondary stakeholders to receive IWTs that they were unfamiliar. Some of wheat varieties were disease susceptible (HAR 604 and HAR 1685) as well as planted out of agro-ecological zone (HAR 1685 and HAR 604). The stakeholders did not able to acquire the required type and size of improved seeds at right time. The price of the inputs was expensive as perceived by the stakeholders. Trainings knowledge's and skills of IWTs (land preparation, row planting, keeping ratio, weeding etc.) had not been put in place due to limitation in labour mobilisation, quality of trainings, attitude, skills and animals feeding, land size and risk perception. Over 28 villages' farm had been affected soil acidity because of soil erosion, recurring cultivation, and use of chemical fertilizers, while the soil test and treatment was not rapid as the prevalence and destruction of acidity. Most primary and secondary stakeholders were not happy on the support delivery- top to down approaches (campaigns) of tertiary stakeholders due to high pressure. Support networks mainly gave the same solution for diverse problems of direct stakeholders, and did not consider differences in less-favoured stakeholders. The linkages between research-extension-farmers were very weak. The existing extension systems were not functional, and had not achieved their ultimate goals. Moreover, the stakeholders did not have an adequate budget and facilities to deliver services effectively. Because of these factors, the stakeholders could not become effective in the innovation processes.

Key words: Improved wheat technology, human perception, stakeholders, effectiveness, productivity, innovation processes

CHAPTER ONE: INTRODUCTION

1.1. Overview of Ethiopian agriculture

In Ethiopia, 85% of people live in rural areas and over 90% of the poor are in the rural area. Ethiopia is one of the most heavily dependent countries on agriculture. The agriculture sector supports about half of GDP, 60 percent of exports, more than 80 percent of total employment and provides basic needs and income to the rural poor. (Mojoa et al., 2010 and Xinshen, 2010). In Ethiopia Growth and Transformation Plan (2010/11-2014/15), smallholder agriculture is one of the focus areas of the strategy of the agricultural sector. About 11.7 million-smallholder household's contributes approximately 95% of agricultural GDP. It is the dominant livelihood activity for the majority of Ethiopians. Nearly 55 per cent of all smallholder farmers operate on a hectare and less than a hectare of land.

Cereals are the dominant crop in Ethiopia's agriculture; more than 70% of arable land is devoted to cereal production. Thirty two percent of agricultural GDP comes from cereal produce. They are a staple food of the majority of Ethiopians, and account for about 45% of food expenditure for an average household (Diao, 2010; Devereux and Guenther, 2009).

Ethiopia is the second largest wheat producer in sub-Saharan Africa, after South Africa. Among the cereals, it ranks fourth after teff, maize, and Sorghum in area coverage and third in total production. Wheat accounts for nearly 20% of daily caloric intake in Ethiopia, second to maize. As stated in the research paper of Schneider and Anderson (2010, P.4), "household consumption accounts for about 60% of wheat produced, 20% is sold and the remainder is used for seed, in-kind payments for labour, and animal feed".

Wheat is largely grown in the highlands of the country and constitutes roughly 13% of the annual cereal production. The crop grows at an altitude ranging from 1500 to 3000 masl. The most suitable agro- ecological zones, however, fall between 1900 and 2700 masl. Seventy-five percent of the wheat grows in the regions of Arsi, Bale, and Shoa, a belt stretching from just north of Addis Ababa to the southeast of the country. Most of the wheat grown in Ethiopia is bread wheat. There is some durum wheat grown too. (Hossain et al., 2004; Taffesse et al. 201; Tefera, A., 2012).

According to the data of CSA of Ethiopia (2001/01-2008/09), productivity has shown a growth. This growth results from an increase in area cultivated (IFRI, 2010). There is a remarkable gap between the average farmers' yield and the potential farm yield. According to Schneider and Anderson (2010), ''Ethiopian wheat yields fluctuated between 88% and 99% of the regional average yield between 2004 and 2008 (averagely 16.1 qt. per a hectare). As suggested by various studies, the causes for this difference were associated with socio-economic, biotic, abiotic and management constraints. These are limited access to inputs, lack of quality seed, and lack of capacity of seed multiplication. Moreover, low seed rate, high production cost, limited nitrogen fertilizer, and depletion of soil fertility, and less access to credits, inadequate access to information and lack of ability to change theoretical knowledge into practice, incidence of diseases and weed competition, production risks, lack of access to market (Schneider and Anderson, 2010; Diao, 2010; Hossain, 2004). The mentioned constraints can be considered as technical and resource based problems. However, behind each constraint, there are responsible direct and indirect stakeholders in all administrative levels in the production processes. The likely responsible

stakeholders regarding the study area are SNNPR regional stakeholders (e.g. policy makers, politicians, practitioners, researchers, and input suppliers), GGZ zonal stakeholders (e.g. politicians, and practitioners, Chencha district stakeholders (politicians, practitioners, and NGOs), and village stakeholders (development agents and smallholder farmers). A top-down adoption and diffusion of innovation approach caused these constraints as commented by many researchers. A weak support networks and co-ordination; absence of all stakeholders' involvement in the design process; weak institutional performance; policy gaps (stakeholders lack of detail information about seed, plant breeders' rights, access and community rights, biodiversity and the environment policies and implementation); and intervention gaps were related difficulties too (Gebreselassie, 2006; Feyissa, 2006). Furthermore, researchers suggested the necessity of rapid expansion of infrastructural networks in the analysis of country GTP (Alemu et al., 2008; Mellor and Dorosh, 2010). To bring the desired results, both technical and social related issues are equally important in wheat production in the district.

As broadly explained above, the challenges associated with wheat production processes are several. These challenges need further effort from all actors who are involved in the development action. Thus, stakeholders should explore each aspect of problems before designing any intervention in order to find the root causes of problems. So that, based on this background information this research seeks to investigate the district stakeholders' perception in Chencha district focusing on wheat technologies promoted by research centres to farmers.

1.2. Wheat production and technology adoption in Chencha District

Chencha district is one of the wheat growing districts with great potential of Gammo Gofa Zone in SNNPR. The district covers above 35% of the zonal wheat production. Wheat is cultivated as a rain fed crop by smallholder farmers. About 90-95% is grown during ''the longer rainy season" or "Meher" (in Amharic Language), which starts in June and ends in December. Only 5-10% of wheat is grown in "short rainy season," or "Belg" (in Amharic Language), which stats in March and ends in July. Its production ranks second place among cereals, and accounts for more than 40% of the total cereal output (CSA, 2008). Farmers grow only bread wheat in the district. According data of the CSA (2008), the crop has shown growth in productivity due to increased use of farmland rather than efficient utilisation of technologies and farming practices. Currently, the average productivity is roughly 16 quintals per hectare.

The policy emphasis of the government is intensification. Use of technological packages combining credit**,** improving production capacity of actors and better management practices are the central elements. The government wants to achieve productivity doubled within five years (2010/11-2014/15), and expects all farmers to adopt all technologies promoted by research centres. The government might not consider the actors' perception of technologies, and the reasons why smallholder farmers disregarded the adoption of wheat technologies as expected (Leeuwis, 2004; Gebreselassie, 2006). The approach seems the traditional approach of the technology. In this traditional technology transfer, innovation perceived as a single commodity that transferred to the farmers (Leeuwis, 2004).

1.3. Research issue

Wheat is the major staple food and cash sources of most smallholder farmers in Chencha district in Gamo Gofa Zone (GGZ), Ethiopia. Wheat is widely grown in many villages of the district. In the district, increasing productivity in terms of quintile per hectare is the main concern of the different government offices and local NGOs. In the village, development agents, smallholder farmers, and co-operatives are also the key actors in the process of wheat production. They are direct and indirect stakeholders of improved wheat production process and system. They have both a direct and indirect relationships with the production process. Smallholder farmers have a direct linkage as they interact directly with production process and system, and district office leaders, agriculture experts and local NGOs and village DAs and co-operatives have indirect linkage to the wheat production process as they affect production system and are affected indirectly by the production system (Karim, 2007). Because of these relationships, farmers are direct stakeholders, and district office leaders, agriculture experts, local NGOs, and village DAs and co-operatives are indirect stakeholders. Both stakeholders from the district and village have a great influence on the production process. These stakeholders have their own function. District government office leaders such as agriculture, cooperative, health, education, road, finance, women affair, etc. are involved in the mobilisation of direct stakeholders in fertilisers and seed adoption, input supply, technical support and advisory services. Mostly, the district agriculture office (DAO) does the technical support function and a central actor in all functions. NGOs are involved in providing trainings and rarely in input supply. Cooperatives are participating in facilitation of storage services and distribution of chemical fertilizers. Smallholder farmers are the main body and actors of wheat growing practices as well as expected adopters of wheat technologies promoted from research centres through the DAO.

Based on this relationships and functions, smallholders farmers are direct- primary stakeholders of the Gamo Gofa Zone Department of Agriculture (GGZDA), SNNPR Agriculture Bureau, and Research Centres, and while others are the indirect-secondary stakeholders. Among other stakeholders, in line with its defined responsibilities, the DAO usually transfers improved wheat technologies (IWTs) to farmers. These IWTs include improved seed varieties, fertilizers, chemicals, limes, and planting space as well as weed management practices (Spielman, Kelemwork, and Alemu, 2011).

The sources of IWTs are research centres in the country. The designing processes of IWTs are not clearly known by stakeholders in the district and village. These stakeholders do not have involvement opportunity in the design processes of IWTs. Until the year 2012/13, there was no research organisation residing nearby the Chencha district as well as Gamo Gofa zone. DAO often goes a distant area and purchases improved seeds from the Regional Seed Enterprise (Feyissa, 2006). Most direct stakeholders do not receive and use these technologies as expected by indirect stakeholders of the district and zone. The expectation is that all direct stakeholders should adopt the improved wheat seed and fertilisers according to the recommended packages. Researchers formulate the recommendation of the packages. The recommended packages comprise seed to fertiliser ratio, DAP to UREA fertiliser ratio, input to land ratio and other technical aspects of wheat growing. Direct stakeholders and the district stakeholders have not been involved in and contribution for the package formulation. Nevertheless, GGZAD, SNNPRAB, and researchers always need them to undertake these packages.

As obtained from various sources of information, there is frequently disagreement between zone government and stakeholders of district and village when the zone and region government provides improved inputs to them. The provided inputs especially seeds mainly do not fit with the needs of the smallholder farmers. Smallholder farmers do not know some seed varieties. Other varieties are not as productive as expected by farmers, and are disease susceptible. High price perception of smallholder famers of both seeds and fertilisers is also another cause for the disagreement. At this moment, farmers articulate their need to other inputs. The created disagreement between these stakeholders enforces the indirect stakeholders to dedicate more human, material, and time resources for mobilisation tasks. The reasons for the devotion of these resources are the perceived gap of attitude and skills, and perceived resistances of district and village stakeholders. The government scaling up strategy on crop production also obligates district and village stakeholders to give priority for intensification. The idea of this 'scaling up' strategy is the way that enabling all direct stakeholders to adopt improved technologies, which are perceived as productive by the research centres. So far, the strategy has not brought the desired changes in the district concerning the adoption rate of IWTs (EDRI, 2012).

In relation to productivity also, there is a substantial gap between the average farmers' yield and the potential farm yield. As defined by Scheider and Anderson, (2010), yield gaps are "the difference between yield potential and average farmers' yield over a given spatial or temporal". This type of yield gap is the difference between potential farm yield and actual farm yield. Currently, it is averagely 16 quintiles per hectare, from expected over 50 quintiles per hectares (EPAR, 2010). This assumed productivity gap is a clear indication for the existence of problems in the production system and process. In this regard, finding the underlying causes for a given challenge can be seen as a good start for setting relevant interventions for a given community. What stakeholders do or do not do depends on their perceived belief, needs and ability, and perceived effectiveness of social environment and pressures from social world.

Thus, the causes for disagreements in promoted IWTs should be explored to bring desired changes in the study area. This study therefore seeks to investigate the perception of district stakeholders' towards these IWTs in Chencha district.

CHAPTER TWO: CONCEPTUAL FRAMEWORK AND LITRATURE REVIEW

As mentioned in the introduction section, the main concern of this study is to investigate the direct and indirect stakeholders' perception towards improved wheat technologies in the district and villages, which are delivered to smallholder farmers by research centres, GGZDA and SNNPRAB. The research focus comes from the problematic setting of improved wheat technology and innovation context in the study area. In this research, "smallholder farmer" is defined as a farmer who is cultivating very small and fragmented farms i.e. less than 25.2 hectares in Ethiopian case, as well as mostly that who is growing for his/her own consumption rather than for the market (IFPRI, 2011). Direct and indirect stakeholders are those groups who are vital to the survival and success of the organization and/or any group or individual who affect or is affected by the achievement of the projected objectives directly or indirectly. In this regard, in the study area, smallholder farmers are direct (primary) stakeholders for IWTs. Other district offices, NGOs, and DAs in the village are considered to be indirect (secondary) stakeholders, while zonal, regional bodies and research centres involved in IWTs are regarded as indirect (tertiary) stakeholders, these are GGZDA, SNNPRAB and research (Karim, 2007). As defined by scholars, productivity is "the ratio of a measure of total output quantity to a measure of the quantity of total input." Nevertheless, in this study, it is seen as the ratio of the total yield gained to the total farm area covered by the crop (IFPRI, 2011).

In order to provide broad understanding about the conceptual framework, some related concepts are briefly described. Those are reviewed as follows:

2.1 Farming practice

Wheat is one of the most important cereal cultivated in Ethiopia (Hossainet.al. 2004). Wheat, growing practice is one of the major practices of crop production. Practices are activities that people do or not do; they are patterns of human action; they may or may not be easily recognised in physical terms; and also they may or may not result from a conscious decision to do something, in fact, many practices can be seen as routines that they are not deliberated on as they take place. Moreover, they may be reasoned about only after they have emerged and they are connected to each other in a complex way. They have multi-dimensional phenomena. They can be seen from various hierarchical levels and domains at different point of time. Hierarchical levels entail production objects of individual, aggregate, farming system and the farm in its environment (Leeuwis 2004; Giddens, 1984).

This research focuses on the individual farming entities such as improved seeds, fertiliser, tilling, sowing, spacing, and farm management practices concerning the wheat technologies delivered. Domains of farming practice involve aspects of the technical and economical farming issues as well as social-organisational relationships of farmers. For instance, when farmers have decided to produce certain kind of crop with technologies, they usually see these aspects of practices. These conditions can determine their decision making process on practices. Alternatively, farmers to be successful in their practices, the level of production constituents should be co-ordinated carefully, because the occurrence of changes or innovations in one level can affect the function of other levels. It requires careful co-ordination of all levels (Leeuwis, 2004).

2.2 Technology and social change

Many historians suggest that technology is the driving force for the development of human society. It separates human beings from other creatures in the earth. It also allows certain groups of people to lead a better life. We cannot see human life without technology or separately. They are interlinked. Thus, someone to understand human condition, she/he should be able to explain how human technology has become increasingly complex, and increasingly central to modern life. In this sense, technology is defined as a body of knowledge used to create tools, develop skills, and extract or collect materials. Because of its nature, technology has different definitions. In relation to improving human capacity, technology can be seen in the form of a tool, technique, product, process, physical equipment or method (Schon, 1967). It can be also seen as a technical knowledge that organisations apply to enhance their ability to provide products and services (Bohn, 1994). Other authors categorise technology as techno ware or tools, "human ware" or talents, "info ware" or facts, and "orgaware" or methods (Drejer, 2000; Heffner and Sharif, 2008). According to Stock and Tatikonda (2000), technology takes the definition in the form of "a machine, an electrical or mechanical component or assembly, a chemical process, software code, a manual, blueprints, documentation, operating procedures, a patent, a technique or even a person".

Kaplan and Tripsas (2008) have linked the definition of technology to its physical manifestation in products. However, Taylor (2012) used the word technology as applied in a particular product context and as embodied in a physical artefact. Which means technology is not just the knowledge from which products are elaborated, but also includes the physical manifestation of that knowledge within a product.

It is difficult to define technology directly, but its types and dimensions can understand it more clearly. The types of technology are alternative, disruptive innovation, high tech, industrial, low technology, micro-technology, nonmanufacturing, and open-source-appropriate technology. Each of them has their own broad concepts. Nevertheless, it is not the main concern of this study. They can be generally categorized under types of artefact, function, production process, or context of use (Aunger, 2010).

According to DiGironimo (2011), the dimensions of technology are technology as artefacts, technology as a creation process, and technology as a human practice. These three dimensions make the structure of the technology. One cannot exist without the other. They have a strong linkage.

Furthermore, Leeuwis (2004, P.143) explained the concept 'innovation or technology' in terms of farmers' decision-making. Thus, the first type of innovations are regular innovation, and that are, innovations that do not challenge fundamentally the main technological and social-organisational characteristics of the farming system. For example, the farmer may optimise his or her farming system by making slight adjustments in the application of chemical fertiliser. The second type of innovation is "architectural innovations," which are those require and incorporate a fundamental reorganisation of social relationships, technical principles and rules. They can be seen as overthrowing the existing regime and breaking out of the path dependence created by it. Which means similar to that of a move of the farmer from the use of chemical fertiliser to biological farming. So that, strategic decisions are more likely to involve architectural innovation than

operational and tactical issues; the same is true for changes that take place at the higher hierarchical levels of the farm."

Agricultural technologies are categorized under a type of low technology. They are utilizing relatively unsophisticated equipment's and production techniques compare to high technology.

In the history of agricultural development, agricultural technology has brought a significant change in the socio-economic development of the people. Especially, the 1960's Green revolution of India and China is the known instances for how agricultural technology can contribute a vital role in the development process (Rosegrant, Hazell, and ADB, 2000). While, it is difficult, but not impossible to identify and promote technologies that will substantially improve the livelihoods of poor people in less-favoured areas. The approach had only promoted a few rich farmers. So that, effective organizations that are accountable to poor farmers, effective institutions, a strong actors' network, a stable and supportive policy environment are also essential to improve the livelihood of the poor people (Feed, 2002; Pender, 2008; NATESC, 2012).

2.3 The changing perceptive on 'the adoption and diffusion of innovation' tradition

The importance of innovation for farming practices is not an arguable issue. The socio-economic improvements that have been observed in 1960s and 1970s in south Asia were undeniable resulting from new technologies (Hazell, 2008). While, the main question is that to what extent these technologies are an appropriate with the interest of rural poor. As cited in research work of Oladele and Fawole (2007), ''to improve the agricultural production, some form of appropriate technology is necessary. Appropriate technologies are the latest scientific and technological developments that have been adjusted to suit the local conditions to the highest possible degree. Technologies are viable only when farmers use them. There is need to develop a new way of making these technologies acceptable to farmers to increase farmer perception and adoption levels''.

Studies showed that people did not use many technologies developed by researchers as lack of integration of the people, extension, and research and educational institutions. Innovations do not contain only technical devices, but also of new social and organisational arrangements, such as new rules, perceptions, and social relationships. These are the main issues that can determine farmers' practices and decision in adoption processes (Leeuwis and Aarts, 2011).

In line with Engel (1995) and Leeuwis (2004), the one-way approach is argued as that researchers have overlooked farmers in designing processes of innovation. They ignore their activeness and knowledgeabliliy in farming activities, and while innovation requires close co-operation in a network of actors, thereby farmers are not laggard, instead we can use the term "non-innovator" for those who were not adopt the given technology.

2.4 A critique in adoption and diffusion of innovations processes

The purpose of conventional research is to accelerate the adoption and diffusion of innovations based on the findings. As mentioned earlier the perspective of the adoption and diffusion of innovation has been criticised by many scholars due to its shortcomings. These shortcomings described by Leeuwis (2004, p.134-140) as follows.

a. Pro-innovation bias**:**

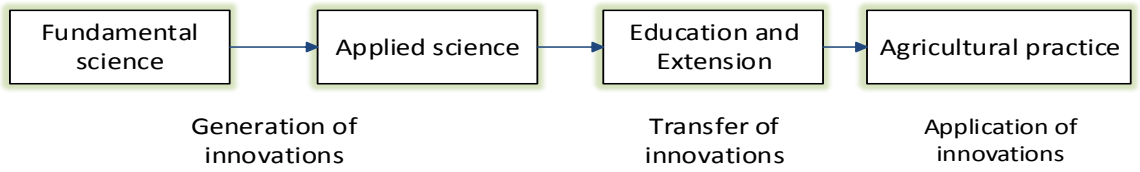
Researchers mainly assume that the innovations released by research centres are useful for farmers, and will be adopted by farmers as recommended. This assumption is called pro-innovation bias. In the adoption and diffusion theory, this assumption directly gave space for the researchers and change agents to classify non-adopting people into laggards. Non-adoption has been taken as a fault by researchers and change agents. Researchers and change agents got the chance to blame the farmers for non-adoption (Leeuwis, 2004).

b. A linear and top-down model of innovation**:**

In this model, usually the researchers propose, design and transfer innovations to farmers through agricultural communication workers. Researchers are considered as the origin of the innovations and farmers are supposed to receive and apply the innovation. Extension organisations are regarded as intermediaries as well. The thinking of this model is called 'the linear model of innovation' as it draws one way or line between science and practice, here, researchers are supposed to specialise in the generation of innovation, extension and education focus on transfer, whereas the farmers are expected to utilise the innovations as shown in figure 1.

In this model, stakeholders do not clearly understand the transferred messages from researchers as the occurrence of noise in the media. The researchers do not consider the farmers' everyday life world, and their active and creative role. Farmers often exist outside the innovation. Researchers can engineer, predict and plan change rationally, and diffusion is occurred after innovation is made. While in latter models, all scientist, researchers, intermediaries, and farmers are considered to be the origin of innovation; adoption is a collective process of interdependent stakeholders rather than an individual process; change is unpredictable, messy and emergent process; innovation is not only a new technical device, but also combination of technical device, modes of thinking and social organisations, such as new rules, perceptions, agreements, identities and social relationships, or innovation is a successful combination of 'hardware' (i.e. new technical devices and practices), software (i.e. new knowledge and modes of thinking) and orgware (i.e. new social institutions and forms of organisation) (Leeuwis, 2004 and Aarts, 2011).

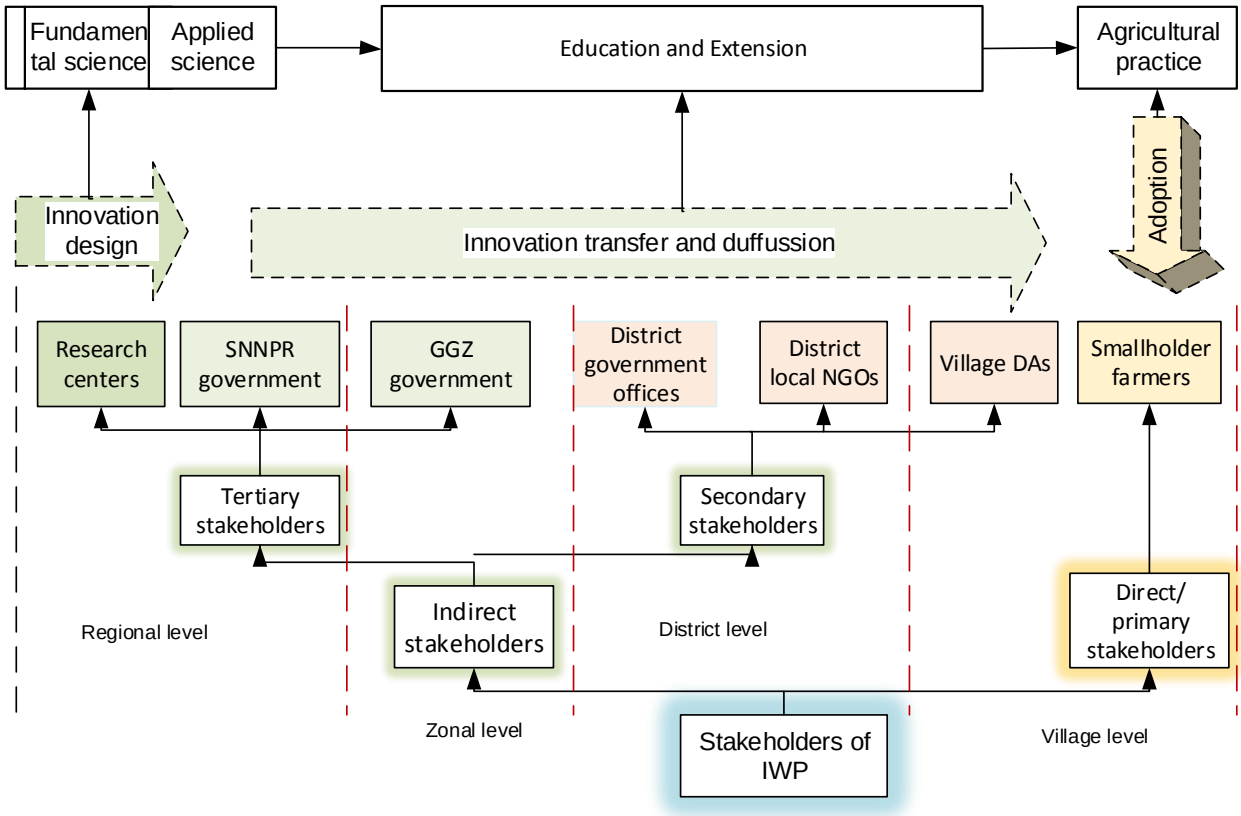
Figure 1: The linear model of innovation



Source: Leeuwis (2004, p.135)

In the case of IWTs in Chencha district we could make a detailed interpretation of linear model of innovation as presented in figure 2. In the figure, all interlinked stakeholder embodies element of linear model of innovation. Research centres represents both 'fundamental and applied science' since they design and generate innovations; SNNPR, GGZ and Chencha district government organisations, and village DAs illustrates 'education and extension' as they transfer innovations from research centres to smallholder farmers; and smallholder farmers designates 'agricultural practices' because, they apply the innovations diffused from intermediaries.

Figure 2: Model of relationship between various stakeholders in IWTs in Chencha district



Source: Author (2013)

c. A uni-linear model of farm development

As suggested by researchers, in adoption and diffusion of innovation process the different patterns of the farms did not get consideration. Even within a homogenous farming pattern, there are several variables, which are able to determine the development of the farm. Specific styles of farms need specific approach of innovation rather than using a blanket recommendation for the diverse faming patterns (Van der Ploeg, 2003).

d. Blindness, biased perception of innovativeness and stigmatisation

In relation to the farm development concept, as described by Leeuwis (2004, P.136), change agents and their organisations preferred and favoured particular types and patterns of innovations. Farmers who were able to adopt these preferred innovations are considered as innovators while others who followed their own option innovations are judged as the laggard. It is impossible to categorise farmers as laggards without knowing the causes for non-adoption. The adoption rate clearly reflects that the change agents have this blindness. Because, the sources of innovations are often hidden and invisible (Leeuwis, 2004 p.144). Individuals often differ in their situations, even within a homogenous category.

e. Progressive farmer bias

In linear model, the progressive farmers (opinion leaders) are the dominant actors. They are relatively wealthier than the other farmers are. Usually change agents pays a great attention for them, because of their capacity to adopt the bulk amount of favoured innovation and to diffuse for the follower farmers. The poor farmers have been ignored in this linear model (Leeuwis, 2004 p.137), which implies that social change can never come out without the involvement of the mass.

f. The selectiveness and non-neutrality of technology

As cited by Leeuwis (2004, 138), “in linear model, innovations were only applicable for, and often also communicated to, a specific segment of the farming community, while little service was provided for more vulnerable or less influential groups. The fact that technologies are selective is something that cannot be avoided but which can be a positive characteristic. In order to be of use, technologies need to be adapted to specific agro-ecology and social environments. The more adapted they are, the more selective they become. That makes it potentially applicable to a limited group. Thus knowledge and technologies are never politically neutral, but in adoption and diffusion research, it recognised as neutral and beneficial to all.” A single remedy cannot be a remedy for multiple challenges of the diverse agro-ecological and social settings.

g. Innovation as a collective rather than an individual phenomenon

In many adoption and diffusion of innovation researches, adoption of innovation has been reflected as relating to an individual. A greater emphasis has been given for individual farmers. For instance, the calculated rate of adoption is one indicator for this issue. However, all innovations require changing patterns of co-ordination between interdependent actors as well as simultaneous and co-ordinated changes by variety of actors while conventional adoption and

diffusion research does not pay attention to co-ordination between interdependent actors. Innovation is not a single entity (Leeuwis, 2004).

2.5 Human perception

Farmers' perception of technology is a decisive factor for whether a given technology is adopted or not. Researchers do not criticise farmers if their views diverge from them as farmers have their own meaning about technologies (i.e. perception of farmers).

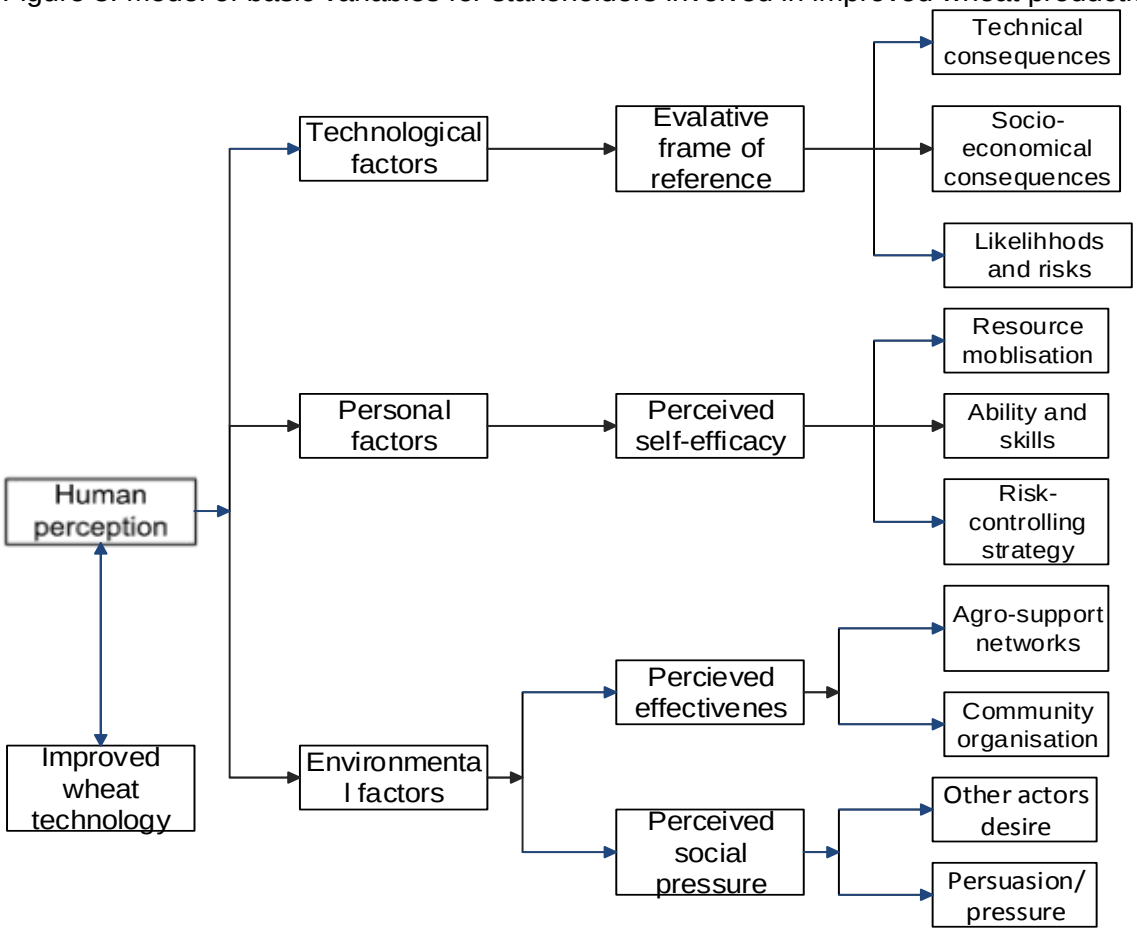
Quick and Nelson (1997) defined perception in terms of social perception, i.e., “the process of interpreting information about another person.” It has a direct link to the individuals' ability to understand a given situation. The assumption is that people mostly draw different conclusion on a given precept. Secondly, Michener, DeLamater, and Myers (2004) also defined perception in terms of social perception: *“Social perception refers to constructing an understanding of the social world from the data we get through our senses.”*

Thirdly, as suggested by Leeuwis (2004), *''perceptions inform us about a particular state of affairs, and thus they are closely intertwined with information, and establish the meaning.''*

The above definitions clearly show that the environment influences our attention, feelings, and the way individuals act. Perception helps individuals to gather data from their surroundings, process the data, and make sense out of it; it is a process of gaining mental understanding; and perception guides the perceiver in connecting and processing relevant information towards satisfying the perceiver’s requirements.

According Quick and Nelson (1997), the characteristics of perceivers, perceived issues, and the social context affect perception of individuals. In the perceptual process, the quality of perceived issues determines the quality of output that the process gives out. In this process, the perceiver first receives and then processes the perceptual issues and the resultant output becomes expressed as behaviour, attitudes, beliefs, action, feelings, etc. in perceiver). Nevertheless, the perceptual process is not public or directly observable, except for the perceiver, the validity of perceptual theories can only be checked indirectly by appropriate empirical data (Burge, 2003).
Different forms of perceptions can play a vital role in shaping human practice. This implies that innovation and development i.e. modification of human practice often require changes in perception. Perception relates to the functioning of the biological and social world. This will be explained in detail below under the four core variables of the conceptual framework. Which is the scope of this study, it can yield an entry points for change in wheat production.

Figure 3: Model of basic variables for stakeholders involved in improved wheat production



Source: Adapted from Leeuwis (2004, p.66).

The reason for selecting this model is that the theories expressed in the model are powerful and suitable ideas to investigate stakeholders' perception of IWTs in the study area. Thus, the core concept of this research is human perception. Three dimensions, which are technological, personal, and social factors, are derived from this core concept. Aspects of dimensions such as evaluative frame of reference, perceived self-efficacy, perceived social environment effectiveness, and perceived social pressure are used as the variables to investigate district stakeholders' perception of IWTs delivered to smallholder farmers. Each of them will be explained as follow: the variables are dynamic and interrelated each other, since in everyday life we are dealing with dynamic situations.

These variables have the ability to shape individuals practices during processes. They do not only shape practices directly, but also indirectly. For instance, perceived social pressure does not have a direct bearing on farming practices, but also tends to have an influence on the evaluative frame of reference or/and vice versa , thus, it has indirect consequences as well. In the same manner, the evaluative frame of reference can shape farmers' perceived self-efficacy or perceived environmental effectiveness (Leeuwis, 2004). The interrelation is not simple to understand. Illustrations can be understood well. For instance, the farmers' perceptions of technical consequences of adopting improved wheat variety (i.e., part of evaluative frame of reference) may

can create tension between the farmers and DAs (I.e., social pressure). Since the communication worker may use different incentive mechanisms to motivate the farmer to increase the adoption rate. In this context, the farmer may decide to adopt the new variety. This decision of the farmer may ask him/her for additional resources mobilisation (i.e., perceived self-efficacy). For the financial needs of purchasing the new seed, this farmer may look for the credit institutions (perceived effectiveness of social environment). These variables are linked together directly or indirectly in a given practice. From this example, we can understand how these variables can influence individuals' decision-making on practices in a given period. Thus, knowing individuals working condition on practices through using these variables can promote the way that different actors are going to adjust their intervention strategies and policies. Here the description is brief, but the detail explanation of each variable has provided in the following sections.

Evaluative frame of reference

The individual's evaluative frame of reference usually originates from their knowledgeability on practices. Individuals own knowledge is called tacit knowledge. In many studies, it is defined as a dynamic and complex body of expertise, practices, and skills that are developed and sustained by peoples with shared histories and experiences. In relation to farming, it underpins the choice of farming techniques, allowing farmers to manage farming practices, and this knowledge leads farmers to give meaning about the natural, economic, and social world as well as the consequences of practices and likelihoods. Depending on this meaning farmers again valuate such consequences in relation to a set of aspirations (Leeuwis, 2004; Beckford and Barker, 2007). Which means farmers often see the relative advantage and compatibility of any innovation before adoption. The research work of Adesiji, Akinsorotan, and Omokore (2010) has clearly shown that how farmers' were able to evaluate the effectiveness of extension services given to them using their indigenous knowledge.

In this evaluative frame of reference, farmers often recognise aspects such as technical and socio-economic consequences, and likelihoods and risky events of the farming practices. The technical effects comprise yield expectation, required input and its quality, etc., while socio-economic effects comprise required labour organisation, income effect and its impact on social relations. 'Likelihoods and risks' are understood as the probability of an event or situation taking place in the processes of performing practices. Thus, the assumption is that people's risk perception can often hinder the adoption rate of technologies, while likelihood perceptions can often boost people's involvement in technology adoption.

Perceived self-efficacy

The term "perceived self-efficacy" refers to "people's beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives." Consistent with this definition, it also defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainments." In these definitions, the concern is clearly control over the behaviour itself, not with control over outcomes or events (Ajzen, 2002). Under this, variable three aspects are discussed as follows:

a. Ability to mobilize resources:

It refers to an individual's capacity to organize and use resources available for the activities, which are expected to sustain life. In relation to farmers, these resources mainly related to cash, labour, land, a seed, animals, forests, grasses, etc. Farmers with more access to these resources have more opportunity to mobilize than those who are less accessible (Leeuwis, 2004).

b. Availability of skills and competence:

In European Community article (2007), the word competence has been referred as a combination of knowledge, skills, and attitudes appropriate to the context, but it is difficult to find coherent definition, since different authors defined it differently in different dimensions through different times. In the journal of Westera (2001), it has been seen from two distinct prospective. These are theoretical and operational perspectives. In the theoretical perspective, competence is perceived as a cognitive structure that facilitates a specified behaviour. In the operational perspective, competence appears to cover a broad range of higher order skills and behaviours that represent the ability cope with a complex and unpredictable behaviours. The operational definition includes knowledge, skills, attitudes, metacognition, and strategic thinking. This operational definition has a congruence with the definition of European community article stated above. According to Leeuwis (2004), competence is seen as individual ability in which it is needed to perform specific activities in a given development processes. This conceptual view of competence is the desired idea of this research. Skills are also one component of competence.

c. Ability to control risks:

As mentioned earlier, farmers do not avoid all risks due to that they are working with living things and climate changes. Farming is a risk-taking activity. Farmers can accept certain risks. However, the acceptance level of risks can depend on the number of a negative consequence that would happen, the perceived balance between potential gains and losses, and perceived ability to control risks. To certain extent, risks can be manageable. Based on their relatively severity level, risks can interpreted in three stages. These might be higher probability of an adverse outcome or a potential loss, medium loss occurrence and modest losses. The risks that farmers face result from numerous sources of change. Some of these are related directly to the farm. Others are related to external involvement in a farm. These risks generally classified as a production risk, price risk, casualty risk, technological risk. (Leeuwis, 2004). These risks need various coping mechanism by farmers. Farmers' risk controlling options are prevention, diversification, compensation, accommodation, and migration (Ellis, 2000; Leeuwis, 2004).

Perceived effectiveness of the social environment

a. Agro-support networks:

Agro-support network is as stated by Leeuwis(2004, p.72), ''Farmers' perception of the availability, quality, reliability of physical and organisational infrastructures are bound to shape their practices, as farmers are likely to opt only for those practices that they expect to be adequately supported by infrastructures''.

b. Community organisation:

It is seen as that different actors have their own interconnection with other actors when they are undertaking their activity. It is impossible to stay alone in a neutral environment. Everyone has relationship when operating his/her activities. The relationship can be direct or indirect, or strong or weak. Thus, individual's decision of performing the activity is relied on this relationship, as other actors can have various aspirations that may originates from the wish to maintain power positions or a desire to achieve organisation target Leeuwis, 2004). Individuals can keep on touch when others' aspirations coincide with them.

Perceived social pressure

As suggested by Leeuwise (2004), individuals' practices are shaped also by pressures that others experience from other people with whom they relate. This influence is partly direct and but also indirect the sense that social pressures can influence the mentioned three variables above. These social pressures also divided in to three dimensions: These are perceived desire and expectations from other actors; resources that others are perceived to mobilise in order to persuade; and validation of expectations, resources, and relationships. Some of pressures imposed on individuals are clear. Other pressures remain hidden.

2.6 The research objective and questions

The research obective and questions are provided as follows:

Research objective

The objective of this research is to investigate stakeholders 'relationship and perception towards improved wheat technologies in Chencha district, which are promoted by research centres through GGZDA, and SNNPR.

If there will be profound information and knowledge about both direct and indirect stakeholders' perception of improved wheat technologies, which can enable researchers, policy makers, and practitioners to regulate service delivery strategies and to improve the quality of services.

Research questions

- What is the model of innovation currently practiced in Chencha district for improved wheat technologies?
  - What kind of communication relationships are exist among actors in the innovation processes of IWP?
  - What roles do stakeholders contribute for the innovation process of improved wheat technologies?
- What factors affect the effectiveness of improved wheat growing smallholder farmers in Chencha district?
  - How do stakeholders (direct and indirect) evaluate the effectiveness of IWTs promoted from research centres to farmers in terms of technical and socio-economic consequences?

- What are the attitudes or beliefs that are influencing the effectiveness of IWTs?
- What is the extent of perceived self-efficacy of the stakeholders on IWTs in the processes of IWP?
- What is the capacity of support networks in providing various services for the improvement of IWTs?
- What social factors are influencing the innovation processes of IWTs?
- What type of strategies do stakeholders use to develop IWTs?

CHAPTER THREE: RESEARCH STRATEGY

This chapter presents a description of the study area, the research strategy used and tools employed for data collection. In addition, methods used for data analysis, validation meeting, ethical guidelines, limitations, and critical epistemology were discussed under this topic.

3.1 Chencha district

This study is carried out in Chencha district in Gamo Gofa Zone, SNNPR in Ethiopia. The capital town of the district is Chencha. Chencha is located at about 37 kilometres north of Arba Minch, and 500 kilometres from the capital city of Addis Ababa. Chencha district has a longitude and altitude of $6^0$15'N $37^0$34'E and it is situated between 1300 and 3250masl (Abera, 2006).

The district is divided into two agro-ecological zones, namely, 'Dega' and 'Woina Dega', which account for about 82 and 18% of the total area respectively. Mostly mountainous and rugged land features characterize the district with altitude ranging from 1800masl up to 4200masl. The minimum temperature of the district varies from 11 to 13 degree centigrade, while the maximum temperature is in the range between18 to 23 degree centigrade (Abera, 2006).

The average annual rainfall of the district is 1150 mm. The annual rainfall distribution in the district varies between 900 mm to 1200mm.The pattern of the rainfall is bimodal (Jemal, 2010). There are two known rainy seasons: the short rainy season 'winter' lasts from mid-February to April, whereas the long rainy season 'summer' lasts from June to September. The rainfall is erratic and uneven; onset is unpredictable, its distribution and amount are also quite irregular. Frequently most villages face shortage of rain; hence moisture stress is one of major production constraint in the district (Abera, 2006).

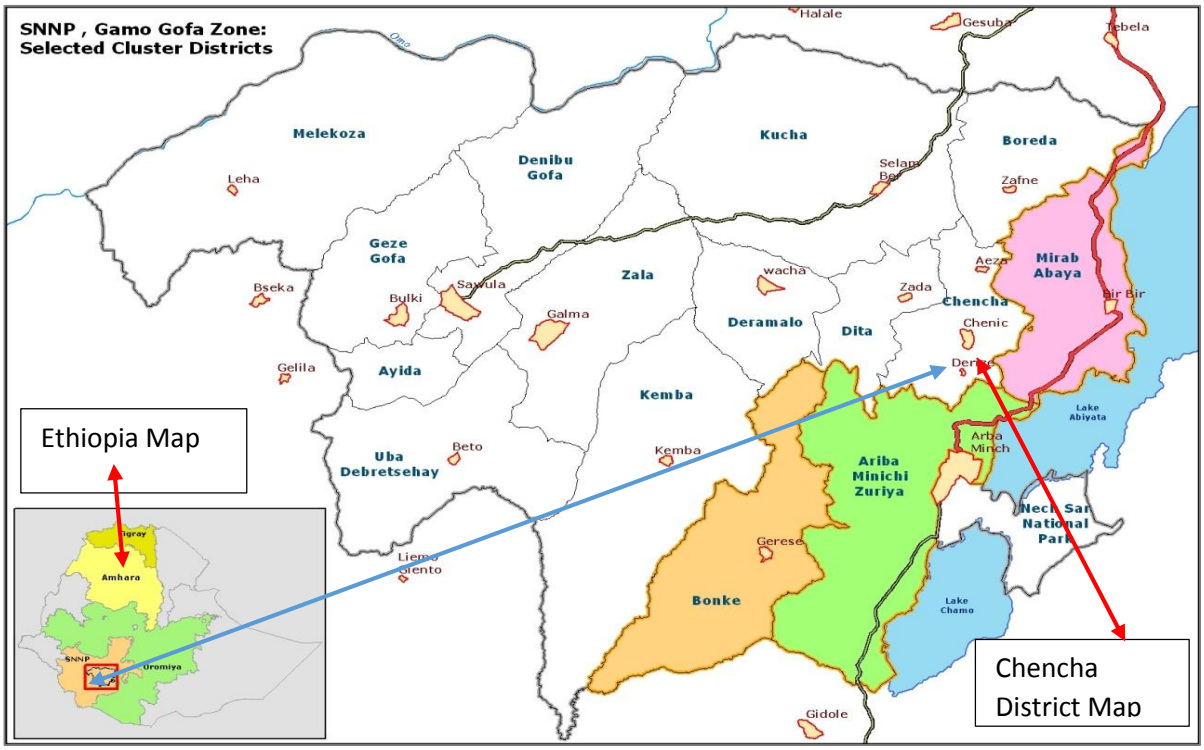
According to CTA (2007), Chencha district has a total population of 111,686, of whom 51,310 are males and 60,376 females; of the total population, 13,304 (11.91%) are urban residents. The majority of the residents, while 470376 (88.09) are rural dwellers. The majority of the residents were Orthodox Christians (62.19%) and the rest 36.82% were Protestants as cited by Abera, (2006).

Crop production in the district

The current land use pattern in the district consists of annual crops, perennial crops, forest, and shrubs. Out of the 45,000 ha of the districts total area 24,420 is covered by annual crops, 3102 by perennial crops, 3446 by grazing land, 6185 by natural and artificial forest and the rest 7847 by other crops, fallow land and marginal land. Livelihood of the people in the district highly depends on the crop production and animal husbandry. The farming mode of the smallholder farmers is mixed farming, while crop production is more dominant economic activity than animal husbandry. The major crops grown in the district are wheat, barely, maize, sorghum, teff, Irish potato, inset, peas, beans, lentil, apple, sweet potato and harry coat bean. Among these, including wheat cereals have a large land size than other crops, i.e. approximately 13,255 hectares (48%) (Abera, 2006). Currently, the district and zonal governments in their scaling up (intensification strategy) have given priority for wheat, potato, and apple production in the area. Based on this strategy, the district agricultural office has delivered some improved varieties of wheat and potato

for the smallholder farmers. As a result, a few smallholder farmers have shown an economic development in their wellbeing, while most farmers still exist in a subsistence mode of life.

Figure 4: Map of the study area



Source: LIVES-Ethiopia (2013)

3.2 Research strategy

The research has a qualitative approach and is based on literature and empirical data. A case study is used to collect data from direct and indirect stakeholders in the district and villages. The case study contributes to gain a deep and full insight on the aspects of Chencha district stakeholder's perceptions toward improved wheat technologies in the process of production. (Oliver, 2008; Verschuren and Doorewaard, 2010). This case study could provide an appropriate opportunity for these stakeholders to explain or speak out their challenges. Generally, the strategy could enable the researcher to find so far unknown difficulties in the improved wheat production processes in the area.

Based on the conceptual framework, both primary and secondary data sources were used for this case study. The primary method employed for data collection was individual-in-depth interviews, participant observation, and focus group discussion, which are elaborated below. Secondary data were also collected from both the district and the village.

In-depth interviews

Combinations of open-ended and pre-structured interview checklist were used in order to explore information about the subjects of the study. Sequentially, three categories of direct and indirect stakeholders (actors) were interviewed. These were Chencha district agriculture and Chencha district cooperative office experts, and both Chencha district development agents and Wheat producer smallholder farmers at village level. The first category of interview was carried out with one of the indirect-secondary stakeholders of the district those are Chencha district agricultural and Chencha district cooperative technical staffs. This technical staff category provided detail information about the technical aspects of improved wheat production (IWP) how they were involved in and contributed for the wheat production and productivity. The second category of the interview was carried out with the indirect-secondary stakeholders of the village those are the development agents (DAs) in the village. DAs had a daily contact with smallholder farmers and the practices of wheat production, they could also provide detail and actual information about perceived effectiveness of wheat technology, social environment, and social pressure in the production processes. The third category of the interview was undertaken with direct-primary stakeholders (smallholder farmers) at village level since they are the main actor of the IWP practices.

Participant observation

In this method, the working condition of the primary and indirect-secondary stakeholders was observed in the district and villages in order to experience and understand the daily concerns, value, beliefs, challenges, likelihoods, risks, etc. of the community. The observation was systematically recorded as a field note and analysed for contents. A digital camera was used as a tool for recording photo data. In this approach, conditions such as the direct stakeholders' farm, their farming methods, farm management and labour mobilisation mechanisms, and the kind of inputs used were seen. Besides, the demonstration sites and the input stores and utilisation; the relationship between the research and indirect-secondary stakeholders; the trainings practicability and risk coping strategies of direct stakeholders of wheat were observed. The detail checklist prepared was used during observation. In this observation, the stakeholders' evaluative framework and perceived self-efficacy, the perceived effectiveness of the social environment, the perceived social pressure was checked by visiting the mentioned aspects in the district and three villages.

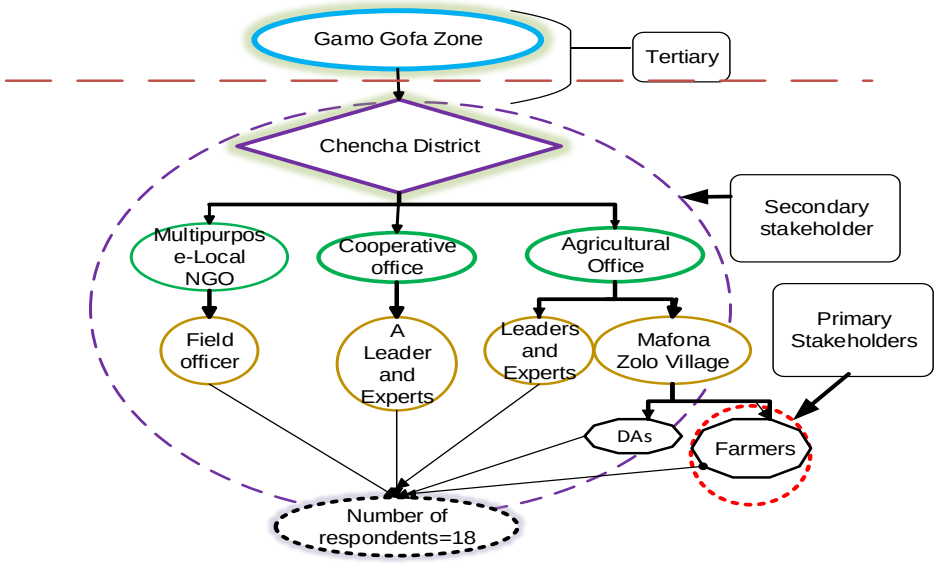
Focus Group Discussion (FGD)

The focus group discussion was carried out with the indirect-secondary stakeholders who are district agricultural office leaders, district cooperative office leader and an officer of a local NGO (Multipurpose). Totally five individuals participated in the focus group discussion. The focus group discussion was undertaken after in-depth interviews and participant observation. The preliminary findings of the respondents' interview and participant observation were combined with the checklist of the FGD. During the beginning of the focus group discussion, the researcher presented the initial findings of in-depth interviews and participant observation. The participants actively responded on the points of presentation since they feel that they are a responsible bodies for all issues discussed in the interviews. In this discussion, surprising issues were focused in order to acquire concrete or reliable study results.

Overview of research respondent

All respondents in this research were selected purposely to explore detail information for the study. In the selection processes, Chencha district was selected from 15 districts of Gamo Gofa zone due to its high wheat growing potential. Accordingly, in Chencha district, the district agricultural office and cooperative office were also selected since they are closest to the IWTs than other stakeholders concerning their relationship of service delivery. Respectively, Mafona Zollo village was selected from 18 potential wheat-growing villages due to its relative highest wheat growing potential than others. A multipurpose-local NGO was selected purposively due to its current involvement in wheat growing process in the district. In addition, in Mafona Zollo village, primary (farmers) and indirect-secondary stakeholders (DAs) were selected as well. Finally, primary stakeholders were selected based on their growing potential too, and also, women's participation had been given a consideration.

Figure 5: the selected stakeholders for interview and focus group discussion

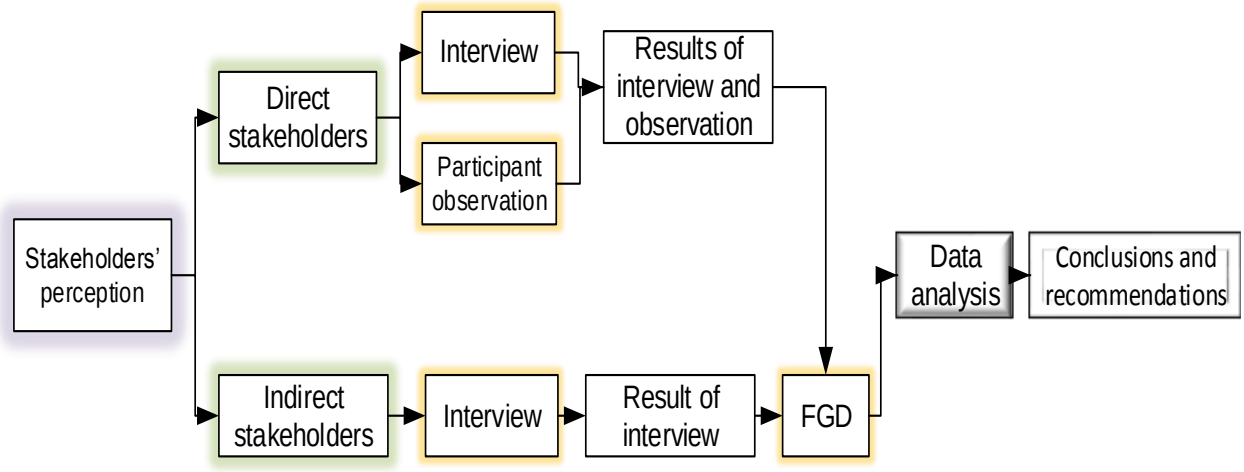


Source: Author

The sample size of the research units was 18, which comprised of 4, 5 and 1 leaders, and technical staffs, and NGO officer respectively from indirect-secondary stakeholders of the district, and 6 smallholder farmers from direct-primary stakeholders and 2 DAs from indirect-secondary stakeholders.

The following figure 6 shows the overall research methodology and analysis used for the study.

Figure 6: Research methodology



Source: Author

Validation meeting

A draft of this research report was presented to the Chencha district agricultural office experts and leaders. The feedback and comments were incorporated to improve the quality of the research. Because of the time shortage, draft of the research report was not presented to and commented by stakeholders in the village.

Research limitations

All direct and indirect stakeholders were so busy in their sowing practices and campaign tasks respectively. Because, the season was the peak period of grains planting practice. Thus, the time pressure had affected the chance of gathering profound data as required to certain extent.

Critical epistemology

As expected by the researcher that leaders in the FGD were not confident to discuss ideas deeply since they felt fear due to their political position and the researcher's job position one-step higher than their level. Even though the researcher had encouraged and initiated them as facilitator by giving some key illustrations (hints), (e.g. stakeholders' complain on effectiveness of improved inputs, support delivery systems, high priority on chemical fertilizer etc.) from interviews and observation.

Ethical issues

All stakeholders were informed about the objective of the study and methods used in the study processes, based on the consent made, they delivered their ideas in the study. Confidentiality and privacy of respondents' data were respected.

CHAPTER FOUR: FINDINGS AND DISCUSSION

This chapter reports the empirical findings and discussion of the study that was carried out with the direct and indirect stakeholders using the model illustrated in figure 3. In the model, aspects of four-basic variables such as evaluative frame of reference, perceived self-efficacy, perceived effectiveness of the social environment and perceived social pressure were used to explore the dimensions of improved wheat technologies.

4.1 Technical consequences of improved wheat technologies (IWTs)

The actual improved wheat production acreage

According to the results of the interview with direct and indirect stakeholders, the land size of farmers found to be very low. On top of that, the participation of farmers in IWP is also very low.

The information from indirect stakeholder at the district level (Table 4.1) suggested that, in the past two years, the cultivable land comprised by improved wheat production (IWP) was almost 16%. Consequently, the participation of farmers was nearly 27% of the wheat growing potential of the district.

Table 4:1 Land size and farmers' participation in improved wheat technologies in the district

Cropping year	Planned land of wheat in hectares'	Land covered by IWP		Planned farmers	Farmers Participated in IWTs or IWP	
		In hectares	In percentage		number	percentage
2011/12	5343	1460	27	16029	7300	45.5
2012/13	5624	350	6	17250	1867	11
Sub-total	10967	1810	16	33279	9167	27
2013/14	6003	186	3	18461	378	2

Source: Chancha district agriculture (2013)

Additionally, the data from indirect stakeholders of village level (Table 4:2) revealed that the average land covered by IWP and the participation of farmers in the village is 18% and 17 % respectively from the expectation.

Table 4:2 Land size and farmers' participation in improved wheat technology in Mafona Zollo village

Cropping year	Planned land of wheat in hectares'	Land covered by IWP		Planned farmers	Farmers Participated in IWTs or IWP	
		In hectares	In percent		In number	In percent
2011/12	70	28.5	40	128	16	12.5
2012/13	131	8	6	241	48	20
Total	201	36.5	18	369	64	17
2013/14	141	0	0	0	0	0

Source: Mafona Zollo village development station (2013)

The interviews with direct stakeholders (Table: 4.3), suggest that the total farm areas covered with IWP was 66% of their potential wheat farm. Furthermore, the remaining wheat farm was being used for the local wheat growing modes.

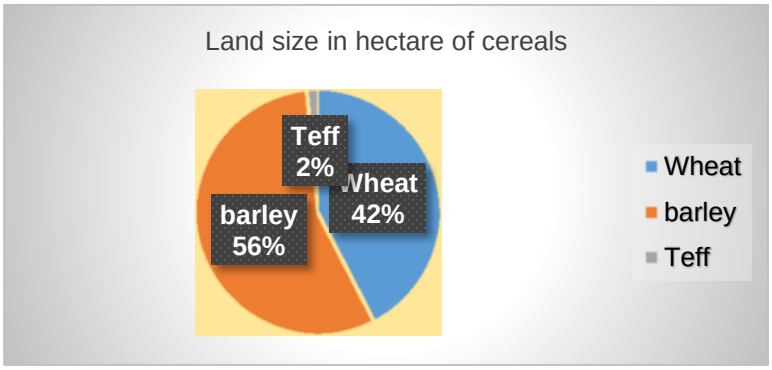
Table 4:3 Potential wheat land size versus improved production of the direct stakeholders

Direct stakeholders	Gender	Family size			Experience in IWP (Years)	Potential wheat farm (hectare)	Farm covered by IWTs size	% of IWP
		Male	Female	Total				
A	Female	6	2	8	4	0.2	0.1	50
B	Female	5	5	10	5	0.25	0.15	60
C	Female	4	3	7	3	0.33	0.25	75
D	Male	5	4	9	3	0.2	0.1	50
E	Male	4	3	7	20	0.33	0.2	60
F	Male	5	2	7	3	0.2	0.2	100
Total		29	19	48		1.51	1.0	66

Source: Direct stakeholders (2013)

FGD with indirect stakeholders suggested that, the district is the potential producer of wheat in the Gamo Gofa zone. The wheat ranks the second among other cereals produced in the district (Figure 7). The stakeholders revealed that, they have a strong belief on the ways and processes that they were promoting IWTs.

Figure 7: Proportion of wheat land from cereals land size in the district



Source: Indirect stakeholders in FGD (2013)

The interview from stakeholders showed that the land coverage of IWTs was very low in the district, likewise, the participation of farmers was also very low compared to the expectation of the indirect stakeholders. These low performances indicted that most farmers were not involved in IWP since they were growing wheat with their own farming system or local knowledge (Beckford and Barker, 2007). The perceived issues of farmers determined them to participate in IWTs, which is congruent with the idea stated by Quick and Nelson (1997), i.e. "*the quality of perceived issues determines the quality of output that the process gives out*". Moreover, the stakeholders' evaluative behaviour of the effectiveness determined their involvement in IWTs (Adesiji, Akinsorotan and Omokore, 2010). The reason for these low land size and farmers' limited participation of IWTs were discussed under the following sections briefly.

The sources, supply, application, and compatibility of inputs of improved wheat technologies

Both individual and group interviews with stakeholders have showed that inputs such as improved seeds, chemical fertilizers, chemicals and limes were supplied as kinds of technologies for farmers to develop IWP and were recognized as the key component of IWT by most stakeholders in the area.

The interview with indirect stakeholders suggested the types, amounts and attributes of inputs grown in the district. The interview (Figure 8) further showed that, within three years, five types of improved wheat seeds and two types of chemical fertilizers were introduced to and employed by farmers.

The indirect stakeholders in the district indicated that regarding improved wheat seeds, the DAO usually procures and transports seeds yearly from SNNPRSME; primarily these seeds were released from the research centres for multiplication. Furthermore, the multiplication is carried out through the SNNPRSME. When the multiplication process had completed, it was mandatory for the district to transport the seeds allocated for them whether they were compatible with the district agro-ecology or not. The information labelled on the seed bugs were the only source of information for experts to know the seeds quality during the moment of procurement and transporting the seeds. The experts did not have any opportunity to involve in the processes of seed technology design and multiplication. The quality and potential of seeds is known after that they were implemented by the farmers on farms. Thus, experts and DAs could not be confident with the potential effectiveness of the seeds they had distributed. Two district indirect stakeholders exemplify this as follows:

> *"The effectiveness of a given technology is often known by stakeholder after it has been implemented by the farmers. The research tasks such as the adaptation trials and agronomic practices are not carried out in the district. Maybe in the future, we can get an opportunity to be involved in the design practices of the research, because of the existence of newly emerging research center in the Zone (Arba Minch Research Center)".*

> "*We do not have any opportunity to know the quality and potential of improved wheat seeds before they are being transported to our district; We do not know whether they are effective or ineffective; We usually listen their good quality and productiveness in meetings and training sessions ideally; we do not have any function rather than transferring the seeds designed and multiplied by the research centers and seed multipliers; and we usually enforce our farmers to grow through trial and error, but we are not allowed to talk about our need and our farmers need."*

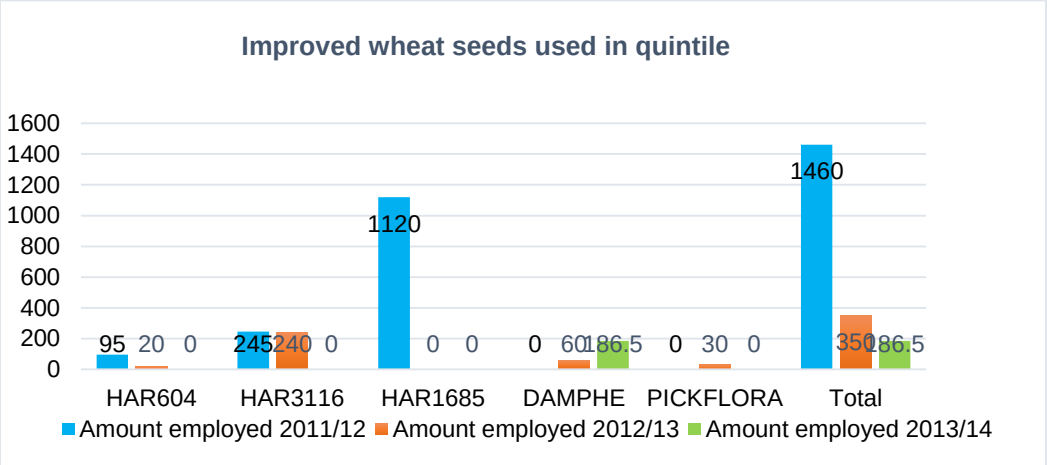
Regarding the quality and effectiveness of the seed, all stakeholders preferred the wheat variety 'HAR 3116' among other varieties adopted since that variety had an ability to be more tolerant disease than other varieties. On the other hand, the variety called: 'HAR 604' and "HAR 1685" were not preferred due to the fact that the varieties were susceptible to rust diseases.

This shows to what extent the stakeholders could evaluate the effectiveness of the wheat varieties by observing the technical consequences based on their wealth of knowledge.

It follows that, in this evaluation the knowledge gained in the growing processes have played a great role to perceive the consequences of the seeds. Consequently, Leeuwis (2004) suggested the concept that justify individuals who tend to do activities depending on their belief on technical consequences that they were experienced. Additionally, due to these beliefs and associated consequences the adoption rate of improved wheat seeds is very low (Fig 10).

The interview further revealed that, this low adoption rate is greatly caused by risk avoidance due to rust disease infestation and misuse of seed out of agro-ecology; for instance, varieties like HAR1685 and HAR 604, and pick flora were used inappropriately in areas above an altitude of 2600masl and 2200masl respectively (Annex 6.5). Thus, lack of information on varieties, provision of limited seed types, absence of required seeds, lack of adaptation and agronomic trials of seeds in the district before bringing into use, late provision of seeds and farmers' lack of purchasing power were among the limitations contributing to low productivity.

Figure 8: Application of improved wheat seed varieties in the district



Source: Chancha district agriculture (2013) (2013)

It follows from above that, one of the village indirect stakeholder said as follows:

> *"In the past two years, the village had used 42 quintiles of HAR 604 and 12 quintiles of HAR 3116 wheat seed varieties. We were relatively effective on the variety-HAR 3116 due to its good disease resistivity. In this year (2013/14), we had requested this variety (HAR 3116), but we couldn't acquire it, instead, we enforced to receive the variety that we do not know (i.e. DAMPHE)".*

From the interview of direct stakeholders, it resulted that among other improved wheat varieties of wheat, the variety HAR 3116 was preferred in the village due to its disease tolerance, easy for threshing, color, by product and marketability than other varieties adopted. Furthermore, the researcher observed that the wheat seed supplied this year was "Damphe" variety. In the district,

lack of quality was the challenge for the year as well. The problems observed in the district store were: the presence of the broken and shirked seeds in the bags. More than 2 quintiles of seeds were transported to villages having such problems and were returned back to the store after the appeal was submitted by farmers. On top of this, due to the absence of preventive mechanisms for pests, the seeds were being affected with pests. Consequently, this incidence was a serious problem for the seed quality in the district as shown by the input distribution expert during the research (Figure 9).

Figure 9: Storage mechanism and the quality of wheat seed in the district store

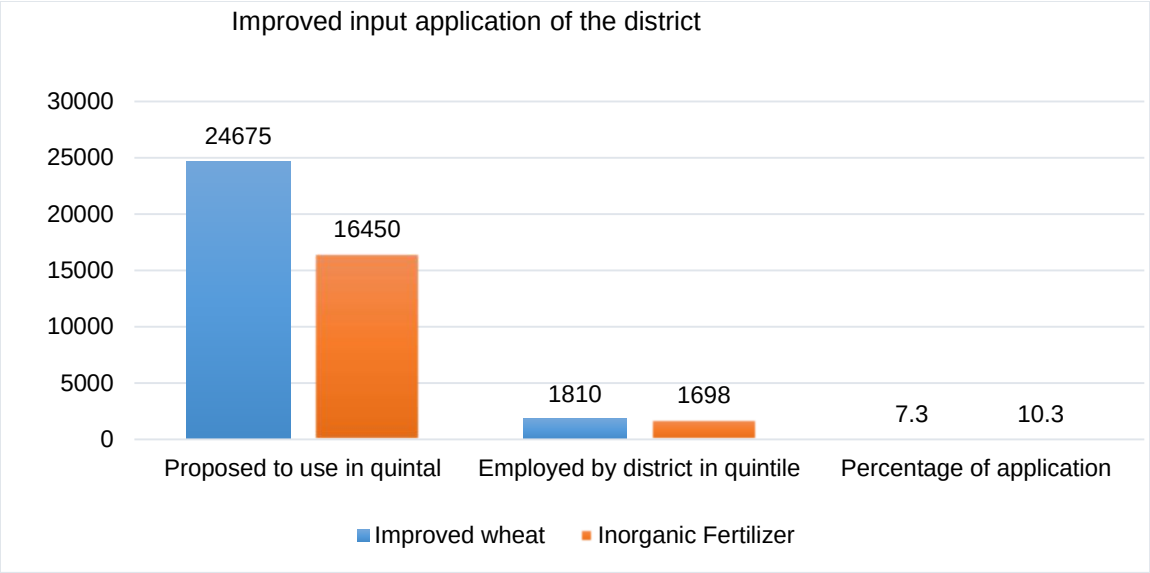
Source: Author from the field (2013)

Both group and individual interviews showed that, the district government often provides DAP and Urea fertilizers for farmers since it is considered as a key production function for high productivity more than other technologies. Over two decades, farmers are receiving the same type of fertilizers from the indirect stakeholders based on the blanket recommendations made above 20 years ago (Van der Ploeg, 2003). It follows that, even currently, the government has a strategy on increased use of fertilizer as a new development option through the scaling up process.

Most stakeholders in the district devoted their time and energy on this practice and often use campaign approach as a main tool to increase the adoption rate; while the accomplishment is very low. For instance, the current average two years rate of application is 10.3% (Figure 10). Interview results of indirect stakeholders suggested the reasons for this low adoption were: the increased price of fertilizers, the acidic effect of fertilizers on the soil because of repeated application for years, the actors' risk avoidance due to absence of insurance linked to loans and use of traditional fertilizers (manures).

Additionally, interviews with indirect stakeholders in the village showed that last year it was difficult to offer DAP and Urea fertilizers to farmers whilst this year farmers' interest has sown slightest progress as they have accessed loans up to 100%.

Figure 10: Input application rate in cropping year 2011/12 and 2012/13



Source: Chancha district agriculture (2013)

All interviews result suggested that the acidity of the soil is a serious challenge. The acidity of the soil is caused by the recurrent cultivation of farmland, the soil erosion and the repeated use of chemical fertilizers.

This soil acidity further hindered the crop intake of the available nutrients from the soil and reduced the yield dramatically. Interview participants further added that both Sodo soil laboratory and SNNPRAB did not deliver 'the soil test results' and 'the lime on time' to the district as per their mandate; and the lime was not adequate for the soil tested. It follows that, the district itself had a serious problem in transportation facility to distribute lime for the villages. Due to these limitations, the villages could not use the lime on required time and frequency. The requirement is that the lime should be applied before two months of a planting date and done at least three times for the three consecutive years to reclaim the soil. In contrary, farmers mainly apply once a year from a week to two weeks before the planting time. The gap between the actual application and the requirement was very high; for instance, in the district from the tested acidic soil, only 11% of soil was treated for first time. From which, only 9% soil was treated by lime for the second time and the supply and application was also only 11% (see Table 4). On top of this, in Mafona Zollo village, only 6 hectares (4%) of soil is tested out of 141 hectares of acidic wheat soil. One indirect village stakeholder stated that:

> *"Most farms become unproductive and wasted, because of this many farmers are resisting our teachings of adoption of chemical fertilizers, and they are worrying for inheriting the waste lands for their decedents."*

The FGD participants further substantiated the idea revealed by individual interviews. According to all interview participants, the acidity has affected approximately 28 villages' farmland in the district. One of the FGD participant suggested the following idea:

"*Almost all soil samples we sent for the soil laboratory had the problem of acidity, only a few samples were failed due to the gaps in the sampling techniques of the experts and DAs. The samples taken per year did not match with the acidic coverage of the soil, they were a few, and with this speed it is difficult to diminish the problem. Regarding to the provision of lime we have seen improvement than earlier while it is not sufficient even for the acidic soil tested*".

It has been argued that, absence of stakeholders' involvement in seed designing and multiplication process, seeds lack of quality, late delivery and lack of access of inputs (seeds and lime), incidence of rust disease, the acidity effect on production due to use of chemical fertiliser, low performance soil laboratories of testing soil acidity and weak seed storage facilities were a serious bottlenecks for IWP in the district. The bottlenecks had constrained the actors from adopting IWTs (lime) as required by researchers since actors' technology adoption depends upon perceived ability to perform and mobilise resource for practices, which also can affect their attitude on technology adoption negatively (Leeuwis, 2004). The context is not conducive to promote the needs of stakeholders on IWTs.

Table 4:4 Soil test, lime supply and application data in the district

Year	Soil tested in hectare	Lime required (quintile	Lime supplied (quintal)	Lime used (quintile)		
				1st turn	2nd turn	3rd turn
2008	8	150	50	50	0	0
2009	52	894	0	0	0	0
2010	125	2145	600	600	0	0
2011	158	2700	1465	1465	0	0
2012	899	15321	200	0	200	0
Total	1242	21210	2315	2115	200	0

Source: Chancha district agriculture (2013)

Regarding to the need assessment of inputs, interviews with indirect stakeholders showed that the district often presents its input demand to GGZDA during the planning phase. However, the supply was mostly undertaken by the interest of indirect-tertiary stakeholders; for instance, in this year, the district had requested the seed variety called HAR 3116. To the contrary, the GGZDA and SNNPRSME had supplied another variety i.e. 'DAMPHE' in limited quantity for 22 villages whilst the remaining 23 villages did not received the seed. One of the stakeholders raised the following opinion in the interview: "*Our seed demand was not recognized by GGZDA. We just received the seed variety we do not know*''.

The input supply processes obviously shows that input provision is carried out without considering stakeholders' demand in the district and village level. It was obvious that lack of consideration has a great impact on decision-making process of stakeholders. It was highlighted by indirect village stakeholders stating that "*we usually received inputs distributed from district stakeholders through a quota system, and we will assign these inputs into the development teams called: 1 to 5 networks as well as individual farmers in the same manner…; the distribution process was not undertaken voluntarily, but this year, the village had got a capability to refuse the allotted seed since the seed did not match with the agro-ecology of the village (2640 to 2810masl) while the altitude of the DAMPHE is below 2600masl.*"

Interview with direct stakeholders revealed that farmers received the inputs allocated by DAs and village leaders and group interview participants further strengthened the idea. Consequently, results appears to suggest that the approach has been top to down and it did not acknowledge the actors need, and all indirect stakeholders involved in the process were acted as a channel for the transfer of technologies, the approach seems the idea suggested in linear and 'top-down model' of innovation by Leeuwis (2004).

Performance of agronomic practices of improved wheat technologies

All interview participants have a concern on the technical aspect such as the land preparation, planting techniques and weeding and harvesting.

Pertaining to land preparation, as it was confirmed by all stakeholders, improper land preparation was a big challenge for the district. More than 90% farmers never cultivated their farms more than twice with hoe and three times with oxen.

Commonly the IWP was conducted on such improperly cultivated farms. Consequently, land preparation has a great impact on yield.

In line with this condition, the data obtained from the participant observation (Figure 11) shows the challenges of land preparation and reasons. The wheat farm had been cultivated only twice with oxen. On top of that, the farm was planted with wheat seed through the broadcasting technique and was not well prepared. The proper land preparation requires more than three times with hoe and four times with oxen according to the indirect stakeholders' information.

It was observed that this direct stakeholder had got skill training on the land preparation and the row planting techniques for the last two years. However, he did not want to apply this technique in his farm because of the labor scarcity in the family, the perceived time consuming character of the technology and the small land holding size. Additionally, the inputs used in planting were the DAP fertilizer and wheat seed (second generation). The farmer could not find the certified seed this year due to absence of accessibility of improved seeds.

Regarding the information of the seeding rate, the farmer was not willing to tell the input size he used while the farm size is nearly 0.25 hectares. The view reflected by the visited farmer has been the common feature of most farmers' in land preparation and row planting in the district as it was highlighted by stakeholders in the interview and FGD.

Figure 11: Wheat land preparation and planting mechanisms of farmers in Mafona Zollo village

Source: Author from the field (2013)

It was further highlighted by district indirect stakeholders in the interview that the technology was adopted only by a few model farmers. The wheat row planting demonstration trial observed in Mafona Zollo' village is clear instance for this condition.

As it was observed in the field, the DAs established and were undertaking a row planting demonstration in the farmers' training center (FTC). Figure 12 shows a plot size of the trial of 0.25 hectare which was cultivated three times by hoe. It was planted in rows according to the required dimension i.e. two centimeter between seeds and twenty the between rows. Inputs used for planting were 25 kgs of seed, 25 kgs of DAP and 12.5 kgs of Urea.

The DAs used seed variety HAR 3116-second generation. During field observation, the first turn weeding was conducted by farmers, and top dressing with urea fertilizer will occur after a week.

According to the DAs, the technology can save about 33% of seed quantity used for planting. It can give a safe space for weeds and disease management, aeration, and can increase production over 25% quintiles per hectare of broadcast planting. However, most farmers did not apply it as they have their own perception on the technology. The farmers' perception was that the technology takes more space, and requires more labor and time.

Therefore, for the technology to be applied and effective, the belief of the farmers is a decisive factor and the technology employed should be adjusted with the farmers' beliefs to the highest possible degree (Oladele and Fawole, 2007).

Figure 12: Wheat row planting technology at demonstration site

Source: Author from the field (2013)

All stakeholders of the district and village suggested that the weeding was not carried out more than once in the farm since even if farmers understood the disadvantage of weeds because of the lack of animal feeds they were using weeds for animals' feed, but one direct stakeholder had linked it with labor scarcity in the family. Additionally, it was elaborated by the stakeholders, the yield loss due to weeding was above 30% per annum. Another aspect, brought up by the stakeholders is 'rust disease' as serious challenge for the IWP in the district. It was reported that because of this disease, before last year the yield loss was above 50%.

According to all stakeholders in the district, the technical consequences of IWTs discussed above, seriously affected the productivity of wheat. For instance, the production and productivity of the last two years were averagely below 50% the expectation. Almost all stakeholders were not satisfied by the productivity gained by improved varieties as the yield difference was far away from farmers' potential yield. Thus, as it was indicated in the findings, technical limitations were the main causes for the low adoption and productivity of IWTs among other factors.

4.2 Socio-economical consequences

Socio-economic benefits of improved wheat technologies

Concerning to the socio-economic benefit, the district indirect stakeholders indicated that the yield increased due to IWTs had caused the improvement of the consumption, seed accessibility, income and purchasing power of the farmers. Additionally, it was showed that farmers adopted IWP were able to gain better income and had improved their livelihoods to certain extent.

Accordingly, the village indirect stakeholders showed that farmers participating in IWP usually produce 4 quintals from their farm per year, and they sell half of the yield in the market. From this

sale, they earn nearly 80 € per year. As it was substantiated by them, the income obtained was very low compared to the expected income due to limitation in productivity.

The direct stakeholders showed that the average production and productivity for the last two was averagely 27% (13.5 quintile/hectare) from the expected 50 quintile per a hectare of land. They strongly underlined that the productivity was very low as compared to the expected one. The yield loss occurred in a year 2011/12 that was 50% of the expected yield and it was mainly caused by the infestation of rust disease (Annex 6.2). Besides, the direct stakeholders revealed that they earned low amount of cash from the yield sale of last year even if the yield did not have the disease infestation. The maximum and minimum cash earned was 60€ and 0€ respectively. Except one participant the five direct stakeholders further indicated that they used the income earned for various utilities such as students' school fees, labor wages, loans payment, and treatment expenses (Table 4: 5). While, the one stakeholder used all produces for consumption due to limited other food options for consumption. In addition to this, that the stakeholders in FGD confirmed that farmers involved in IWTs obtained additional source of food, seed and income to their livelihoods more than farmers did not participated, even if there were some limitations on the production process and yield achieved.

All stakeholders of the study confirmed that the socio-economic benefits achieved were not satisfactory and could not respond their needs as required. But, limited benefits were acquired due to the IWTs adopted, this is the inherent nature of improved technology as appeared during the development phase of 'Green Revolution' of China and India (1960's and 1970's). At that, few farmers had brought socio-economic change in their livelihoods since they were more favored by resource than the poor (Hazell, 2008), however, most poor farmers had not been in change due to similar technical, ecological and social factors discussed above and in the following sections (Pender, 2008). With regard to this, the features observed in socio-economic benefits of the district had similarity with the characteristics appeared in development process of 'Green Revolution' (1960's and 1970's).

Table 4:5 Benefit gained from the production of improved wheat yield of the direct stakeholders

Direct stakeholders	Yield gained in quintile	Yield sold in quintile	Yield remained for consumption in quintile	Yield remained for seed in quintile	Income gained in €
A	1.5	0.75	0.5	0.25	30
B	2.25	1	0.75	0.5	40
C	3.5	0	3.5	0	0
D	1.5	0.5	0.75	0.25	20
E	3	1.5	1	0.5	60
F	3	1	1.5	0.25	40
Total	14.5	14.5	8	1.75	190

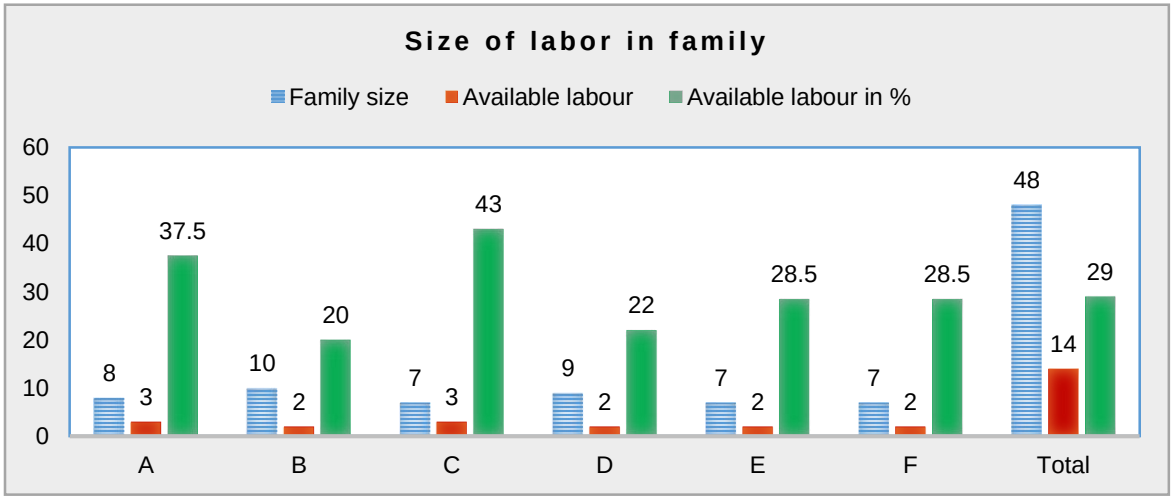
Source: Direct stakeholders in Mafona Zollo village (2013)

4.3 Resource mobilization ability of actors for improved wheat technologies

With respect to the resource mobilization, all stakeholders revealed that the farmers' accomplishment of agronomic practices were greatly affected by factors such as low income, land and labour scarcity. Concerning to financial constraints, for instance, last year, farmers' participated in fertilizers adoption were a few since they did not have credit access. As it was suggested lack of cash greatly hindered their procuring potential of inputs, and also all stakeholders emphasized that they had very small land size (i.e. almost less than 0.5 hectare per a household) (Table 4:3). Accordingly, the direct stakeholders strongly indicated that labor scarcity in the family was a critical factor that was affecting their capacity to undertake IWP. In line with this idea, mostly parents were the available labor source for farm families; mainly household heads and sons were migrating to cities for searching for jobs, and the rest sons and daughters went to school. Based on this suggestion, the direct stakeholders underlined that it was difficult for them to accomplish all practices required from IWTs. Because, the available labor force was not above 29% of the family members as indicated by each participant in Figure 13.

The information given by stakeholders indicated that the resource accessible or resource mobilizing ability could have determined farmers' capacity to undertake IWTs in the district as stated by Leeuwis (2004).

Figure 13: The available labor force for the selected farm households



Source: Direct stakeholders in Mafona Zollo village (2013)

4.4 Ability and skills of stakeholders to undertake improved wheat technologies

All stakeholders in interviews and FGD suggest that stakeholder' professional competences (ability), job experiences and training quality were crucial issues for the improvement of IWTs. Regarding to the competences and work experience, for the researcher, actually it was difficult to measure the ability of stakeholders with the chosen data gathering techniques, but it was possible to predict based on their background and expressions on the offered trainings as well as practicality of training ideas.

The interviews indirect stakeholders showed that three had a bachelor degree in agriculture and had 5 years' job experience in crop production and marketing, four interviewees had a diploma in general agriculture and they had more than 15 years' job experience in crop production and natural resource, and similarly, three male farmers attained a primary level education and were able to read and write, while the remaining three women had not any school education, but all of them had more than two years' IWP experience.

It was revealed that the educational background and job experiences of stakeholders were relatively satisfactory to provide preliminary support for and to undertake the production process, although, these were not adequate to perform practices effectively as the existence of newly introduced technologies. Because of this, various seasonal trainings were delivered for respondents accordingly, eleven stakeholders participated in the skill trainings of IWTs except one stakeholder; however, they were not satisfied with the trainings due to existence of constraints. The training constraints indicated were: the attendance of large number of trainees in a given training period, insufficient material preparation, inadequate time allocation, scarcity of budget, absence of skilled trainers, communicating several contents at once, absence of continuity for trainings, low capacity of training centers (FTCs), absence of need assessment of training. Stakeholders from FGD indicated the same ideas to others. On training quality one of the district stakeholder stated the following:

> *"The quality of the trainings at region are relatively good, but its quality become low at district and village level since we do not have sufficient amount of financial and material resources to provide qualified trainings for DAs and farmers."*

It was underlined that the training constraints were the main factors that were inhibiting the performance of technical aspects such as land preparation plant spacing, etc. discussed above. The information given from all stakeholders showed that the practical (operational) ability of IWTs was very important to put theory in practice (Westera, 2001). The weaknesses of trainings in the district strongly affected the performance of stakeholders in IWTs. If the stakeholders were equipped with the required competences (knowledge and skills), they could undertake practices in the district; however, they could not implement several training knowledge and skills of IWTs. This condition is congruent with the ideas suggested in studies of Schneide, Anderson and Diao (2010).

4.5 Risk controlling strategies of stakeholders in improved wheat production

All stakeholders in interview and FGD highlighted that the risk events because of rust disease infestation and disturbance of rain onset were common features in the IWP; the rust disease mostly affected the crop at growing and flowering stage; for managing, chemicals such as 'Tilt' and 'Vampher' were delivered by zone and region government according to their mandate. Nevertheless, they were not accessible and affordable for the farmers on time. Especially, during the last two years it caused a loss of over 50% yield from the yield expected.

Furthermore the direct stakeholders indicated that the risks due to heavy rain at harvesting period were also a serious problem for IWP. It damaged the matured seeds before harvesting. They estimated that the yield loss was approximately 25% of expected yield. Because of the disease and heavy rain damage, they were not able to pay loan of input from the income which was coming

from the yield. To recover these costs, they used a cash from the sale of other crops and animal out puts. Additionally, as it was observed in the field, most farmers were using manures instead of chemical fertilizers as a strategy to protect the impact of risks in IWP (Ellis, 2000; Leeuwis, 2004) (Figure 14).

Figure 14: Direct stakeholders' risk coping strategy through use of manure instead of chemical fertilizers in Boyena Tupa village

Source: Women in Boyena Tupa village (2013)

As it is shown in figure 14, in 'Boyena Tupa' village, two women were carrying manure fertilizer to wheat farm. The women's indicated that most direct stakeholders were using manures instead of chemical fertilizers for IWP since they were not happy with the increased cost, the acidic effect of chemical fertilizers, and the risks encountered in the production process, because, in the past five years, they lost large amount of yield. Correspondingly, for this loss, they hadn't got any insurance, instead they had enforced by indirect stakeholders to pay the loans. This condition forced most direct stakeholders into manure utilization.

It was revealed by the women in the picture that manure fertilizer was better than chemical fertilizers, because, it could maintain soil fertility for more than a cropping season, but not the chemical fertilizers. As it was observed in the farm that most farmers were employing manure more than chemical fertilizer in the village. As depicted in the figure 14, it was mainly transported to farm by women's back and sometimes by horses, it was a tiresome task.

Regarding the farmers' shift to manure use denoted that how the risk perception of stakeholders could determine the adoption decision of IWTs promoted by researchers (Leeuwis, 2004). While, farmers change from chemical fertilizer to manure has an implication for women. It increased the workload for women in the family. For women, the use of fertilizers is a better option to reduce the workloads. Two compromising conditions were observed in farm families, the risk coping

strategy and the workload of women. Because of the existence of gender imbalance in the area, the women's workload did not get recognition from men. So that, gender inequality can be also another factor for shaping the decision-making process of farmers on adoption of IWTs in the district. On the other hand it is expected to be happened complexity in the community during the adoption of innovation as stated by Leeuwis (2004, P.139).

4.6 Effectiveness of agro-support networks

Effectiveness of input supply networks

Stakeholders in the interviews explained that the seed delivery system had many gaps, as it was explained under 'technical consequences of IWTs" sub-title above; they were not supplied according to the needs of the district and village actors. However, in this year the accessibility of fertilizers was relatively better than last years, except the appearance of complaints on the price. Generally, the input supply networks were not reliable and strong to promote the productivity as required.

Effectiveness of credit supply networks

According to all stakeholders, last year, farmers did not have a credit accessibility. However, this year, it was facilitated for chemical fertilizers through a microfinance institution. The direct stakeholders had been given an opportunity to participate between ranges of 25% to 100% with 9.5% interest rate loans per year. For instance in this year, in Mafona Zollo village, out of 186 eligible farmers 182 farmers and 4 farmers were participated in 100% and 50% loan respectively. According to the view of both village stakeholders, the loan delivery system was not active to serve efficiently. Even if most farmers had not come into utilisation of chemical fertilizer voluntarily as required in the village.

Effectiveness of technical support delivery networks

All stakeholders indicated that the technical support networks were linked to each other to provide input, advice, training, information, monitoring, and evaluation service for their corresponding stakeholders. All stakeholders indicated during the interviews that they were not satisfied with the support delivered by their support links. The direct stakeholders were not happy on DAs, experts and political leaders; similarly, DAs were not happy on district stakeholders; and the district experts were not happy on zone stakeholders and district political leaders. The experts and DAs commented that the support system was not participatory, the system undertook activities through a commanding approach, and it did not offer priority for professional issues. For instance, political leaders used more time for their own agendas in many meetings or platforms of IWTs, while experts and DAs had limited time to transfer their messages audience. Mainly, leaders did not consider the written rights of employees during implementation of practices. Almost all practices were undertaken by the order of command post. The political leaders in both administrative levels led practices through the 'command post approach', and it focused on errors and fines. Because of this relationship, in the interview, one of the district stakeholders stated the following:

> *"The performance of the experts and DAs hasn't been evaluated based on the continuous follow up of results achieved. Our results do not fit with our performances. It often relies*

on the interest and view of one of our boss, we supervised by many bosses, inefficient employees were nominated for rewards and promotions, these condition demotivated us to perform effectively."

According to their expression, another factor for poor adoption of IWTs was the creation of unfavourable job environment in the district. In the interview, one village stakeholder suggested the following idea:

"The district experts are not confident in providing advice as a responsible or professional body for practices. They do not provide the technical support consistent with their expertise. They usually give great focus on increasing the number of inputs."

The direct stakeholders also supported this idea by saying that a great consideration had been given for input distribution rather than agronomic practices and farmers' actual needs. But, stakeholders in the FGD indicated that the networks were delivering services with commitment currently except financial shortages and gaps in market information system. Whereas, the data from the stakeholders in the interviews showed that the networks had given priority to technical devices (hardware) rather than involving new knowledge (software) and new social institutions as stated by Leeuwis and Aarts (2011), thus, for these reasons, the support networks did not become effective in performing practices according to their mandate.

Effectiveness of research-extension-farmer networks

All stakeholders in the interviews and FGD indicated that all stakeholders were happy with the establishment of new research center called "Arba Minch research center" (AMRC) in the zone since they sought to be involved in design processes of IWTs. However, as the researcher in the field observed it, the AMRC and the Chencha DAO had not had a common ground to undertake practices together.

During the time of observing the wheat trial in the 'Otte' village (FTC), the newly established 'AMRC researchers' and the Chencha DAO vice leader had been in a quarrel. The reason for this quarrel was that the researchers did not inform their tasks to the DAO leader, likewise, the DAO vice leader did not get information about the research task in the village. It was the responsibility for the DAO vice leader to manage agronomic practices in the district. The created conflict led both bodies into a joint discussion. In the discussion, many issues were raised besides the main issue occurred in the field. Issues discussed in the negotiation process were: the roles and responsibilities of the DAO and AMRC; and the duties of the DAO and AMRC in the district. After a long discussion, they agreed only on continuing the started research trial in the field, while each actor had taken an assignment to investigate the working framework in their line organization since they did not have a guideline at that moment. The case explained that there is a big problem in the network between the DAO and AMRC to provide an integrated result for farmers (see figure 15).

The case presented a real evidence that the link between the three actors is very weak. They had not had a common framework to undertake IWTs in the field as indicated in the studies of Gebreselassie (2006) and Feyissa (2006).

Figure 15: The wheat agronomic trial undertaken by a model farmer and the researchers'

Source: Author from the field (2013)

4.7 Relationships, desires, and persuasion from other stakeholders

All stakeholders explained that some actors with whom they are related in service delivery shaped their improved wheat practices, and they had a relationship with these actors. These actors were: village leaders, DAs, zone and district experts and leaders, and local NGOs. These actors influenced them directly or indirectly. The stakeholders indicated also that for the last five years, improved wheat practices had implemented through a campaign. This campaign became a cause for the exertion of pressure on actors during the implementation process. The overall purpose of this campaign was to maximize production and productivity. The campaign involved the political leaders, experts, and DAs. When the wheat-growing season came, these actors jointly went to farmers to provide support. Their focus was increasing the amount of input distribution. As it was mentioned in the interviews, there was always tension between farmers and indirect stakeholders during input distribution process. Because farmers were influenced by village development teams and '1 to 5' networks. On top of this, they were also promoted by the team of experts and leaders from district and DAs from village which was called a "command post". It was a working tool or an approach to provide support for farmers. Also stakeholders in the interviews suggested that the command posts of the district, zone experts, and leaders often influenced the district leaders and experts strongly.

With this working system, four of the district stakeholders in the interview, were not happy. One stakeholder reserved to give his response. The reason for unhappiness was that they did not have belief on the effectiveness of input distribution through pressure, and priority greatly offered for the quantity of adoption. Promotion systems and disciplinal measures shaped them to work

along with politicians in the campaigns of input distribution. This implies that to a certain extent they were influenced with the political pressure coming from leaders, the context is clearly fit with the concept suggested by Leeuwis (2004, pp76-78).

The indirect stakeholders of the village reflected that farmers who adopted more than 50 kilograms of chemical fertilizer, were considered as model farmers. Others who adopted below this number of kgs, were regarded as follower farmers, but farmers who did not adopt any input were viewed as laggards (10%), and laggards are usually exposed to stigmatization (exclusion from social benefits). Because of this influence, most farmers are enforced to utilize inputs allotted to them. This condition was true for the DAs as well, the village indirect stakeholders showed that the DAs mainly devoted their time and energy to increase the quantity of input distribution, if they had a high achievement in input distribution, the would have a great opportunity to get better incentives, while the reverse led them to demotion. These conditions greatly shaped all actors to give concentration on input distribution in the district as indicated by Leeuwis (2004, pp76-79).

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

This chapter presents conclusion based on the empirical findings and draw recommendation, and furthermore highlights the relevance of the research issue by considering the research objective and research question.

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5.1 Conclusions

The conclussion presents the idea of stakeholders perception towards improved wheat technologies(IWTs) based on the models used in the study, i.e. “model of innovation” and “model of basic variables”.

The stakeholders’ preception based on model of innovation

*(*To understand the ideas under this sub-title, refer to the model on page 9).

As it was indicated throughout the discussion of findings, all direct and indirect stakeholders work in a manner that fits with a linear and ‘top-down’ approach of innovation as a key tool to undertake IWTs in the district. In the innovation process, the approach applied did not create appropriate space for experiential learning of stakeholders and negotiation among stakeholders, it positioned researchers as technology generators, extension organizations as intermediary channels, and farmers as receivers of the technology in a top-down relationship. The approach did not acknowledge the importance of all actors’ involvement in technology designing processes. Stakeholders expressed concrete ideas about the importance of all actors’ involvement in the innovation process in their practices that they perceived, but no one could bring these ideas into action in the district.

The tertiary stakeholders, in an attempt to scale up the strategy, imposed on direct stakeholders to adopt the proposed technologies (IWTs). In line with this, they categorized direct stakeholders according to the adoption rate of technology; they did not acknowledge differences among direct stakeholders. They gave priority to rich farmers who were capable of implementing the technologies, paving way for stigmatization.

Researchers had promoted designed IWTs for adoption to different agro-ecological zones without considering their appropriateness to specific contexts. They ignored the selectiveness and the non- universal nature of technologies.

The IWTs adopted in the district mainly were not an effective innovation as they were not compatible with the social arrangements of existing system.

The stakeholders’ perception based model of basic variables

(To understand the ideas under this sub-title, refer to the model on page 12).

Findings showed that the current production of improved wheat (IWTs) was very low considering the land coverage and farmers participation in the district and village level (i.e. below 30% of the expectation). These low performances are attributed to the existence of challenges in production process. They could also be explained by: the top-down design processes of research centers, the limited compatibility of IWTs with existing agro-ecology and farmers need, the lack of

accessibility of inputs and credits, the limited stakeholders' acceptance and applicability of IWTs, difficulties in resource mobilization and limited risk coping ability, the weak capacity of training programs, the intervention inappropriateness, the unsatisfactory socio-economic benefits, the ineffectiveness of support networks, and the influence from other actors.

The district stakeholders were often obligated by tertiary stakeholders to transport the seeds allocated for them, whether the seeds were compatible with their agro-ecologies or not. They would know the effectiveness of the seeds only after it produced by farmers since they did not have an opportunity to participate in the design and multiplication processes. This had a great influence on stakeholders' confidence.

Some seed varieties were preferable than others due to disease tolerance, but they were not accessible to farmers (e.g. Variety HAR 3116).

The adoption rate of inputs (chemical fertilizer and the seeds) was not as high as the priority given by tertiary stakeholders. The current performance was 11% below expectation. This low performance of inputs could have been caused by the influence of increased price; the soil acidity; the actors' risk-avoidance in relation to loans and absence of insurance for damages; the availability of local fertilizers (manures); the occurrence of rust disease infestation; the yield failures (due to misuse out of agro-ecology); the actors' doubt (due to lack of information and trials), late provision of required seeds and actors' lack of resources.

The productivity of improved wheat was low compared to the expected farmers' potential yield, it was averagely 24.5 quintiles per hectare from the expected 50 quintiles per hectare. This low productivity could have been caused by the following factors:

With respect to agronomic practices, above 90% farmers did not prepare their land as required and they were planting through a broadcasting technique; row planting technology was not adopted by almost all farmers; the fertilizer application rate was below the required size (60%); and the weeding practice was also undertaken only one times by most farmers. These weak performances were linked to farmers' perception on practices. The practices were perceived as laborious, time consuming and expensive. Weeds were considered as animal forage.

The training knowledge and skills of IWTs did not change practices by farmers because of absence of a need assessment before a training and the weak performance of training programs. Despite the seriousness of the rust diseases infestation, timely preparation for protection remained very weak in the district for the past five years. Chemical delivery was undertaken after the occurrence of disease symptoms in the farm, and this discouraged most farmers from adoption of IWTs.

Soil tests indicated a high incidence of acidity in most farms in the district, and the quantity of lime supplied and applied were very small. For the past five years the district had applied only 11% lime of the tested soil. The late delivery of the results of soil test and the lime and lack of transportation facility were the main problems for the low performance in the district.

Regarding the socio-economic benefits of IWTs, the yield gained provided additional consumption, seed and income source. The income gained assisted in the expenses such as a farm labor, the school fees and a medication.

Subsequently, the support networks were not strong in the district as according to their mandate in delivering services such as input and credit supply, technical support, transfer of information and so on. They were not satisfied with their respective body. All complained on the links above their level. The possible reasons were: presence of high pressure from networks through campaigns; low accessibility of inputs and loans; lack of recognition for professional issues; lack of motivation of employees; lack of insurance for damages; the high priority mainly given for input distribution and absence of research activities. The newly established research center in the zone is anticipated to improve the district's future processes of IWTs. This indicated that the support networks had given a great consideration for the hardware, rather than software and orgware, and they were greatly involved in the generation and transfer of technology (Leeuwis, 2013).

The working systems such as educational and salary promotion, and disciplinary measures shaped the indirect stakeholders in the IWP processes, while the direct stakeholders were controlled by the village networks. In this network, stakeholders had not used allotted inputs were not allowed to some social benefits.

Thus, the issues raised above greatly affected the effectiveness of IWTs and determined the stakeholders' practices in IWP in the district. All explanations reflected the perceptions of the stakeholders on IWTs and production processes employed in the district.

Generally, on the basis of findings, this research confirms that the innovation process of IWTs undertaken in the district is a classic instance of misplaced adoption and diffusion thinking. The concerned actors realized that the thinking was not appropriate for the existing context; however, they had not brought their realization into action.

5.2 Recommendations

Depending on the analysis of the empirical findings and the discussions the following key recommendations were drafted with the ambition to offer an idea to various actors involved in innovation processes for improvement and adjustment of policy (strategy) and implementation capacity of innovation in relation to IWTs.

The recommendations may be considered by policy makers, agricultural researchers and extension organizations in the policy formulation and implementation of innovation of improved technologies.

Extension organizations (policy makers):

- In the study area, the special focus that has been given for rich farmers who were favoured by resources. The government appointed them as leader at different administrative and development structures of villages because of the existence of its "rich farmers' strategy". This allowed them to get information earlier, and adopt new technologies better than the poor farmers did, but they were few in number. The poor were bulk in number. In this

approach, it is difficult to bring development and to eradicate poverty without offering priority for and encompassing the mass (the poor). The policy makers might revise their rich farmers' strategy to provide priority for the less favoured farmers. It may be useful to learn from the failures of Green Revolution approaches. Because, the 'Green Revolution approach' did not address areas where there was no irrigation access and resource poor rural people.

- Before three years, in the strategy, the government had put the idea of strengthening the research-extension-farmers councils at different structural levels to promote the technology adaptation, multiplication, distribution and use system, but this idea had not been implemented in the district and villages at all. Thus, to solve the technology problems and to promote co-ordinated solution, it might be better for the government to re-establish and strengthen the framework of research-extension-farmers linkage.

- The scaling up strategy of the government usually seeks and enforces all farmers to employ technologies tested, released, and promoted by the researchers. Within the strategy, the government did not give consideration for differences among farmers. Therefore, the policy makers might review the approach by considering the realities that even the homogenous farmers' categories can require a different kind of services in a given development.

- A capacity building is mentioned as a fundamental way to improve the skills, knowledge and implementation performance in the strategy , while with respect to IWTs, the quality of trainings were poor compared to the required level. Thus, they might be improved by enhancing the capacity of trainers, and material, financial and time allocation, and extension teaching methods and systems to promote practicality of the technologies.

- In improved wheat production process some practices, for instance agronomic practices, acidic soil, etc., had not been given priority for them as input distribution, they are equally important for high productivity, so that, the policy needs to give due consideration for them.

- The current Ethiopian policy approach is dominated by linear top-down technology transfer approach. But, innovations do not only consists of new technical devices but also new social and organisational arrangements such as new rules, perceptions, agreements and social relationships in which different stakeholders involved. Thus, the policy needs to give additional attention to institutional innovations, which take into knowledge of processes consultancy, facilitation, and accommodating resources.

Research centers:

- In the district, the stakeholders do not have information about the designing processes of improved technologies. In addition, most promoted technologies did not fit with the needs of the stakeholders. So that, the research centres needs to start their research activities from the needs of the stakeholders as well as to involve them in the research activities by considering differences in agro-ecology of specific area.

REFERENCES:

Abera, O., 2006. Studies *Indigenous common Grazing Land Management in Chencha Wereda*, South Ethiopia. Addis Ababa University School of Graduate. PHD thesis: Addis Ababa University. [Pdf] Available at: <http://etd.aau.edu.et/dspace/bitstream/123456789/724/1/Abera%20ogato.pdf> [Accessed on 10 July 2013].

Adams, R. S., Turns, J., and Atman, C., 2003. *Educating effective engineering designers: The role of reflective practice*. Design Studies, 24(3), 275–294.

Asian Development Bank (ADB), 2000. *Rural Asia: Beyond the Green Revolution*. Manila: ADB.

Adesiji, G. B., Akinsorotan, A. O. and Omokore, D. F., 2010. *Farmers' Assessment of Extension Services in Ogun State*, Nigeria, Journal of Agricultural and Food Information, 11:2, 143-156.

Ajzen, I., 2002. *Perceived Behavioural Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behaviour*. Journal of Applied Social Psychology, 32: 665–683.

Aunger, R., 2010. *Types of technology* Technological Forecasting and Social Change, Volume 77, Issue 5, June 2010, Pages 762–782 http://dx.doi.org/10.1016/j.techfore.2010.01.008.

Beckford, C., and Barker, D., 2007. *The role and value of local knowledge in Jamaican agriculture: adaptation and change in small-scale farming*. Department of Geography and Geology, University of the West Indies, Kingston, Jamaica. The Geographical Journal, Vol. 173, No. 2, pp. 118–128. [Pdf] Available at: <http://www.willamette.edu/cla/debate/pdf/youth_forum/mtt%20research/technological%20advances/Dea_Local%20Knowledge_Farming.pdf> [Accessed 13 May 2013].

Burge, T., 2003.*Perception*. The International Journal of Psychoanalysis, 84: 157–167. [Online] Available at: <http://www.britannica.com/EBchecked/topic/451015/perception> [accessed 10 May 2013].

Bohn, R.E., 1994. *Measuring and managing technological knowledge*. Sloan Management Review 36, 61–73. (Fall).

Chanyalew, D., Adenew, B., and Mellor, J., 2010. *Ethiopia's Agricultural Sector Policy and Investment Framework (PIF) 2010-2020*. Consultant Draft Final Report 15 September 2. [Pdf] Available at**:** <http://www.caadp.net/pdf/Ethiopia%20Post-Compact%20Investment%20Plan.pdf> [Accessed 6 July 2013].

Devereux, S., and Guenther, B., 2009. *Agriculture and Social Protection in Ethiopia* .FAC Working Paper No. SP03 January 2009. [Pdf] Available at: <http://www.futureagricultures.org/pdf%20files/Social_Protection/Working%20Paper%20No%20SP03%20-%20Agriculture%20&%20Social%20Protection%20in%20Ethiopia.pdf> [Accessed on 6 July 2013].

Diao X., 2010. *Economic Importance of Agriculture for Sustainable Development and Poverty Reduction*: The Case Study of Ethiopia. Global Forum on Agriculture29-30 November 2010 Policies for Agricultural Development, Poverty Reduction and Food Security OECD Headquarters, Paris. [Pdf] Available at: <http://www.oecd.org/tad/agricultural-policies/46378942.pdf> [Accessed 25 May 2013].

Drejer, A., 2000. *Integrating product and technology development* European Journal of Innovation Management, 3 (3) pp. 125–136.

DiGironimo, N., 2011. *What is Technology? Investigating Student Conceptions about the Nature of Technology*, International Journal of Science Education, 33:10, 1337-1352**.**

Ellis, F., 2000. *Rural Livelihoods and Diversity in Developing Countries*. Oxford University Press, London.
Engle, P.G.H., 1995. *Facilitating Innovation*. AN Action-oriented and Participatory Methodology to Improve Innovative Social Practice in Agriculture. Published doctoral dissertation. Wageningen Agricultural University, wageningen.
Ethiopian Development Research Institute (EDRI), 2012. *Seed, Fertilizer, and Agricultural Extension in Ethiopia*. Ethiopia strategy support program (ESSP II), working paper 20. [Pdf] Available at:
< http://www.ifpri.org/sites/default/files/publications/essprn12.pdf > Accessed 02 September 2013
Evans School Policy Analysis and Research (EPAR), 2010. *Yield Gap and Productivity Potential in Ethiopian Agriculture: Staple Grains & Pulses, EPAR Brief No. 98*.University of Washington. [Pdf] Available at:
<http://evans.washington.edu/files/Evans_UW_Request_98_Productivity_of_Ethiopian_Ag_October-12-2010.pdf> [Accessed 04 April 2013].
Feyissa, R., 2006. *Farmers' Right in Ethiopia*. A Case Study. The Fridtjof Nansen Institute: GTZ. [Pdf] Available at:
<http://www.fni.no/doc&pdf/FNI-R0706.pdf> [Accessed 01July 2013].
Freed, A.S. and Feed, S.R., 2002. *Green Revolution: agricultural and social change in a north India village*. Anthropological paper of the AMNH:no. 85 [Pdf] Available at:
<http://digitallibrary.amnh.org/dspace/bitstream/handle/2246/311/A085a00.pdf?sequence=1> [accessed 3 July 2013].
Gebreselassie S., 2006**.** *Intensification of Smallholder Agriculture in Ethiopia: Options and Scenarios*. Paper prepared for the Future Agricultures Consortium Meeting at the Institute of Development Studies 20-22 March 2006. [Pdf] Available at:
<http://www.future-agricultures.org/pdf%20files/SG_paper_3.pdf> [Accessed on 6 July 2013].
Giddens, A., 1984. *The Construction of Society*: Outline of the Theory of Structuration. Polity Press, Cambridge.
Hazell P.B.R., 2008. *An Assessment of the Impact of Agricultural Research in South Asia since the Green Revolution*. Science Council Secretariat: Rome, Italy. [Pdf] Available at:
<http://www.sciencecouncil.cgiar.org/fileadmin/user_upload/sciencecouncil/Impact_Assessment/SC_south_asia_final_low-res_for_web.pdf> [Accessed on 12 June 2013].
Heffner, M. and Sharif, N., 2008. *Knowledge fusion for technological innovation in organizations*. Journal of Knowledge Management, 12 (2) pp. 79–93.
Hossain, I. Epplin M. F., Horn W. G., and Krenzer, J. G. E., 2004. *Wheat Production and Management Practices used by Oklahoma Grain and Livestock Produce*. Oklahoma State University. [Pdf] Available at:
<http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1806/B-818.pdf> [Accessed 25 May 2013].
International Food Policy Research Institute (IFRI), 2010. *Fertilizer and Soil Fertility Potential in Ethiopia*. Constraints and Opportunities for Enhancing the System: Working Paper [Pdf]. Available at: <http://www.ifpri.org/sites/default/files/publications/ethiopianagsectorwp_soil.pdf> [Accessed on 7 July 2013].
Kaplan, S. and Tripsas, M., 2008. *Thinking about technology: applying a cognitive lens to technical change* Research Policy, 37 pp. 790–805.

Karim, A.S. B., 2007. *A review of issues and strategies of stakeholders' management in the construction industry*. Faculty of the Built E*nvironment, University of Malaya, Malaysia.* [Pdf] Available at: <http://www.academia.edu/172847/Issues_and_Strategies_in_Stakeholder_Management> [Accessed, 23 June 2013].
Leeuwis, C. and Aarts, N., 2011. *Rethinking Communication in innovation Processes: Creating Space for Change in Complex Systems*, The Journal of Agricultural Education and Extension, 17:1, 21-36.
Leeuwis, C., 2004. *Communication for Rural Innovation: rethinking agricultural extension*. Third ed. Contribution by A. van de Ban. Oxford, UK: Wiley-Backwell.
Leeuwis, C., 2013. *Coupled Performance and Change in the Making*. Inaugural lecture upon taking up the Post of Professor of Knowledge, Technology and Innovation at Wageningen University on 6 June 2013: Wageningen University, Netherlands.
McGinn, R. E., 1991. *Science, technology, and society.* Englewood Cliffs, NJ: Prentice Hall.
Mellor, W. J. and Dorosh P., 2010. *Agriculture and the Economic Transformation of Ethiopia***.** Ethiopia Strategy Support Program 2 (ESSP2) Working Paper No. ESSP2 010 April 2010. Development Strategy and Governance Division, International Food Policy Research Institute – Ethiopia Strategy Support Program 2, Ethiopia. **.** [Pdf] Available at: <http://www.ifpri.org/sites/default/files/publications/esspwp010.pdf> [Accessed 7 July 2013].
Michener, H. A., DeLamater, J. D. and Myers, D. J., 2004. *Social Psychology Australia*: Thompson Wads worth, Fifth Edition, p. 106.
Ministry of Finance and Economic Development (MoFED), 2010. *Federal Democratic Republic of Ethiopia Growth and Transformation Plan (GTP) 2010/11-2014/15 Draft*. [Pdf] Available at**:** <http://www.vliruos.be/media/1829405/growth_and_transformation_plan.pdf> [Accessed on 6 July 2013].
Mojoa, D., Todob, Y., and Matous, P., 2010. *Perception of Farmers and Agricultural Professionals on Changes in Productivity and Water Resources in Ethiopia*. World Academy of Science, Engineering, and Technology 42. [Pdf] Available at: < http://www.waset.org/journals/waset/v42/v42-145.pdf> [Accessed 20 May 2013].
National Agricultural Technology Extension and Service Center (NATESC), 2012. *Overview of The Development of Agricultural Technology Extension in China*, China Background Paper prepared for the Roundtable Consultation on Agricultural Extension. [Pdf] Available at: <http://www.syngentafoundation.org/__temp/Natesc_Overview_of_AG_TECH_EXTN_CHINA.pdf> [accessed 4 July 2013].
Oladele, O.I., and Fawole, O. P**.,** 2007, *Farmers' Perception of Relevance of Agriculture Technologies in South Western Nigeria*: Journal of Human Ecology*:* Vol. 21 No. 3, 191-194.
OLIver, P., 2008. *Writing your Thesis*. 2ed**.** London: SAGE Publications Asia-Pacific Pte Ltd.
Pender, J., 2008. *Agricultural technology choices for poor farmers in less-favoured Areas of South and East Asia* Environment and Production Technology Division: International Food Policy Research Institute Washington, D.C. [Pdf] Available at: <http://www.ifad.org/operations/projects/regions/pi/paper/5.pdf> [accessed 4 July 2013].
Ploeg JD, V. d, 2003. *The virtual farmer: Past, present and future of the Dutch peasantry. Assen*, The Netherlands: Royal van Gorcum.
Quick, D.L., and Nelson, J.C., 1997. *Organisational Behaviour: Foundations, Realities, and Challenges*, New York: West Publishing Company, pp. 83-84.
Rosegrant, M. and Hazell, P., 2000. *Transforming the Rural Asian Economy*: The Unfinished Revolution. Oxford: Oxford University Press.

Schneider, K. and Anderson, L., 2010. *Yield Gap and Productivity Potential in Ethiopian Agriculture:* Staple Grains and Pulses. EPAR Brief No. 98. Evans School Policy Analysis and Research (EPAR): University of Washington. [Pdf] Available at: <http://evans.washington.edu/files/Evans_UW_Request_98_Productivity_of_Ethiopian_Ag_October-12-2010.pdf> [Accessed on 6 July 2013].
Schon, D. 1967**.** *Technology and Change**.*** Pergamon, London.
Spielman, J.D., Kelemwork, D. and Alemu, D., 2011. *Seed, Fertilizer, and Agricultural Extension in Ethiopia*. Development Strategy and Governance Division, International Food Policy Research
Institute. [Pdf] Available at: <http://www.ifpri.org/sites/default/files/publications/esspwp20.pdf> [Accessed 01July 2013].
Stock, G.N. and Tatikonda, M.V., 2000. *A Typology of Project-level Technology Transfer Processes.* Journal of Operations Management, 18, pp.719-737.
Taffesse, A., Dorosh, P., and Asrat S., 2010. *Crop Production in Ethiopia: Regional Patterns and Trends*: Development Strategy and Governance Division, International Food Policy Research Institute, Ethiopia Strategy Support Program II, Ethiopia. [Pdf] Available at**:** <http://www.ifpri.org/sites/default/files/publications/esspwp16.pdf> [Accessed on 6 July 2013].
Taylor M., Taylor A., 2012. *The technology life cycle: Conceptualization and managerial implications***:** International Journal of Production Economics, Volume 140, Issue 1, Pages 541–553 http://dx.doi.org/10.1016/j.ijpe.2012.07.006.
Tefera, A., 2012.*Ethiopia Grain and Feed Annual*: Annual Report. [Pdf] Available at: <http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual_Addis%20Ababa_Ethiopia_4-17-2012.pdf> [Accessed on 6 July 2013].
Verschuren, P., and Doorewaard, H., 2010. *Designing a Research Project*. Second ed. Eleven International publishing: The Hague.
Westera, W. 2001. *Competences in Education: A Confusion of Tongues*: Journal of Curriculum Studies, 33(1), 75-88.Center of Open University of Netherlands. [Pdf] Available at: <http://www.open.ou.nl/WIM/publicationspdf/CompetencesWW.pd> [Accessed, 23 June 2013].
Zuga, K. F., 1996. *STS promotes the re-joining of technology and science*. In R. E. Yager (Ed.), Science/technology/society as reform in science education (pp. 227–238). Albany, NY: SUNY Press.

ANNEXES

Annex 1: Checklist for interview

Section 1: Checklist for district indirect stakeholders
General information
Respondent name:
Respondent organization:
Gender:
Date of the interview: DD/MM/YY
Name of interviewer:

Part 1: Evaluative frame of reference

1) What is the total land size of wheat crop of the district (hectares)?
2) What is the land size of improved wheat from the total land size of the wheat in the district (in hectares)?
3) What type of improved wheat varieties have you grown in this district?
4) How do you acquire this/these improved wheat varieties?
5) How do you know the quality of the seed varieties before transporting to your district?
6) How do you identify the needs of the villages & smallholder farmers in relation to improved wheat technologies (IWTs)?
7) How do you feel about the compatibility of the wheat technologies introduced with the needs of the smallholder farmers?
8) What is the attitude of smallholder farmers and DAs in adoption of improved wheat seeds and fertilisers, planting space, seed rate & weeding?
9) Which type of improved wheat variety do you like most? Why?
10) Which type of improved wheat variety do you dislike more? Why?
11) What is the involvement level of smallholder farmers in improved wheat production (IWP) in the district?
12) How do you evaluate the effectiveness of IWTs used by smallholder farmers?

- Technologies about:
    - Seed varieties
    - Fertilisers (DAP &UREA)
    - Agronomic practices
    - Chemical utilisations for disease infestation so on.

13) Based on question No. 12 maybe, according to your evaluation, if they are not effective, what would be the possible cause(s) for this infectiveness of a specific technology?
14) What is the average productivity of the improved seed varieties that the smallholder farmers employed in the district (quintiles per a hectare)?
15) How do you compare the average farmers' actual yield with the farmers 'potential yield (the expected yield) in the district?
16) What do you and other actors feel in relation to the wheat yield gained?
17) What risky events have you faced in the process of IWP in the district?
18) What benefits do the smallholder farmers obtained from growing wheat with IWT?

Part 2: Perceived self-efficacy**:**

1) What trainings have you trained from actors in IWTs?
2) How was the quality of the trainings you participated in the IWTs?
3) How was the preparation of facilities /materials for trainings of smallholder farmers & DAs in the IWTs in the village and district respectively?
4) What was your belief in the practicability of the trainings of IWTs?
5) Which training type does you like and/or dislike of IWTs? Why?
6) How many smallholder farmers & DAs have trained in IWTs?
7) What are the topics of the trainings for IWTs?
8) How do you evaluate the practicability of the skills & knowledge gained from the training by smallholder farmers?
9) How do you visit and give an advice for DAs?
10) How do you see the smallholder farmers' ability to mobilise resources on IWTs?
11) How do you see the cost of improved wheat inputs?
12) How is your role in risky events in the processes of IWP?

Part 3: Perceived effectiveness of social environment**:**

1) What is your strategy to provide services to DAs & smallholder farmers in IWP?
2) How do you see the effectiveness of technical support that different actors might promote your job in relation to IWP?
3) What is your participation level in design processes of IWTs?
4) How do you observe the accessibility of various types of improved wheat seeds, fertilisers, and chemicals to your district based on the needs of villages?
5) What do you think about the accessibility of loans for growing wheat?
6) How do you know the quality of and potential of improved wheat varieties coming from seed enterprises or research centres or cooperative union?
7) How do you evaluate the effectiveness of support networks and community organisation in wheat production process?

Part 4: Social pressure**:**

1) What is the involvement of actors in your service delivery of IWP processes?
2) How have you influenced or persuaded by these actors whether to grow wheat or not? On which issue?
3) How do you feel the influence of these actors in your service delivery tasks IWP?
4) What were these actors expect from you in wheat growing?
5) What were your responses for the expectation of actors in the processes of wheat growing?
6) How do other actors assess you in your service provision for IWP? What is your perception on this assessment?

Section 2: Checklist for village indirect stakeholders

General information
Respondent name:
Respondent organization:

Gender:
Date of the interview: DD/MM/YY
Name of interviewer:

Part 1: Evaluative frame of reference:

1) What is the total land size covered by wheat crop of the village (hectare)?
2) What is the land size of improved wheat from the total land size of the wheat in the village (hectare)?
3) What type of improved wheat varieties have you grown in this village?
4) How do you acquire this/these improved wheat varieties?
5) How do you know the qualities of the seed varieties before transporting to your village?
6) How do you identify the needs of the smallholder farmers in relation to IWTs?
7) How do you feel about the compatibility of the IWTs introduced with the needs of the smallholder farmers?
8) What is the attitude of smallholder farmers in adoption of improved seeds and fertilisers, planting space, seed rate & weeding?
9) Which type of improved wheat variety do you like most? Why?
10) Which type of improved wheat variety do you dislike? Why?
11) What is the involvement level of smallholder farmers in IWP in the village?
12) How do you evaluate the effectiveness of IWTs introduced to smallholder farmers?

- Technologies such as:
    - Seed varieties
    - Fertilisers (DAP and Urea)
    - Agronomic practices
    - Chemical utilisations for disease infestation so on.

13) Based on question No. 12 maybe, according to your evaluation, if they are not effective, what would be the possible cause(s) for this infectiveness of a specific technology?
14) What is the average productivity of the improved wheat varieties you have employed in your village (quintiles per a hectare)?
15) How do you evaluate the average farmers' actual yield with the farmers 'potential yield (the expected yield) in your village?
16) What is your feeling and farmers feeling of the wheat yield gained?
17) What risky events have you faced in the process of IWP in your village?
18) What benefits do the smallholder farmers obtained from growing wheat with IWTs?

Part 2: Perceived self-efficacy:

1) What trainings have you trained from actors in IWTs?
2) How was the quality of the trainings you participated in IWTs?
3) How was the preparation of facilities /materials for trainings of smallholder farmers in improved wheat technology in the village?
4) What was your belief in the practicability of the given training of IWTs?
5) Which skill training of IWTs do you like? Why?
6) How many smallholder farmers were trained in IWTs?
7) What are the topics of the trainings for IWTs?

8) How do you evaluate the practicability of the skills and knowledge gained from the trainings by smallholder farmers?
9) How do you visit and give an advice for smallholder farmers?
10) How do you see the smallholder farmers' ability to mobilise resources on IWTs?
11) How do you perceive the cost of the improved wheat inputs provide?
12) How is your role in risky events in the processes of IWP?

Part 3: Perceived effectiveness of social environment:

1) What is your strategy to provide services to smallholder farmers in IWP?
2) How do you see the effectiveness of technical support that different actors might give from in the IWP processes?
3) What is your participation level in design processes of wheat technology?
4) How do you observe the accessibility of various types of improved wheat seeds, fertilisers, and chemicals to your village based on smallholder farmers' interest and needs?
5) How do you think the accessibility of loans for growing wheat?
6) How do you know the quality of and potential of improved wheat varieties coming from seed enterprises or research centres or cooperative union?
7) How do you evaluate the effectiveness of support networks and community organisation in IWP process?

Part 4: Social pressure:

1) What is the involvement of actors in your service delivery processes of IWP processes?
2) How have you influenced or persuaded by other actors whether to grow improved wheat or no to grow? On which issue?
3) How do you feel the influence of these actors in your service delivery jobs of IWP?
4) What were these actors expect from you in wheat growing?
5) What were your responses for expectation of actors in the processes of wheat growing?
6) How do other actors assess you in your service provision for IWP? In addition, what is your perception on this assessment?

Section 3: Checklist for direct stakeholders

General information
Respondent name:
Gender:
Village:
Date of the interview: DD/MM/YY
Name of interviewer:

Part 1: Evaluative frame of reference:

1) For how long have you grown wheat?
2) Which wheat variety are you growing?
3) What is your land size for wheat growing (in hectares)?
4) How many hectare of land have you used for growing improved seed?
5) How often do you cultivate your land for planting a wheat seed?

6) What is source of a seed and fertiliser for IWP?
7) What types of wheat variety have grown?
8) Do you have a choice on the variety to plant? Yes...No... If your answer is “NO” Why?
9) Do you like the wheat variety have you grown? Yes...No... If your answer is “NO” Why?
10) If your answer is “Yes” to question NO. Nine (above), which specific characteristics do you want about the variety you have grown.
11) How do you plant the seed and fertiliser in your wheat farm?
12) How many quintiles of yield have you harvested from IWP?
13) How do you evaluate the productivity and effectiveness of the improved wheat variety?
14) How often do you do weeding?
15) What benefits have you gained from growing improved wheat?
16) How do you evaluate the acidic effect on your IWP process?
17) Perhaps, what risky events have you faced in IWP?
18) What strategies have you employed to control the risky events in IWP?
19) How do you evaluate the loss of the yield and its impact on your wellbeing?
20) Additionally do you grow local wheat? If you answer could be “Yes,” how do you evaluate the productivity of local seed compared to improved seeds?
21) What opportunities (likelihoods) do you have for your future wheat growing?

Part 2: Perceived self-efficacy:

1) How do you mobilise money for purchasing improved wheat seed and fertilisers?
2) How do you perceive the current cost of both improved wheat seed and fertilisers?
3) How do you employ your labour force in the IWP processes?
4) How do you pay loans of inputs in wheat growing?
5) Have you participated in the trainings of IWP? If you answer, is “NO” why you have trained?
6) If your answer for No. 5 is “Yes,” on which issues have you trained? who was/were your trainer(s)?
7) Based on No.6, which agronomic activities have you carried out in your yet? If you have not carried out, why?
8) How do you evaluate the importance of the trainings and its effectiveness in relation to practicability among smallholder farmers?
9) How do you evaluate your ability (skills) to carry out IWP practices mentioned in No. 7?
10) How do you feel the size of your land for IWP?

Part 3: Perceived effectiveness of social environment:

1) How do you see the effectiveness of technical support given from different actors?.
2) What is your participation level in design process of wheat technology?
3) How do you observe the accessibility of various types of improved wheat seeds, fertilisers, and chemicals to according to your interest?
4) How do you think about the accessibility of loans for growing wheat?
5) How do you know the quality of and potential of improved wheat varieties coming from DOA or research centres?

6) How do you evaluate the effectiveness of support networks and community organisations in IWP?

Part 4: Social pressure:

1) What is the involvement of different actors in your IWP processes?
2) How have you influenced or persuaded by these actors in your IWP practices? On which issue?
3) What was the expectation of these actors from you in the growing process of improved wheat?
4) What were your responses for the actors' expectation in the processes of wheat growing?
5) What was your category in adoption of IWTs based on DAs or others' assessment?

Annex 2: Checklist for focus group discussion

General information
Name of facilitator:
Facilitator organization:
Gender:
Date of the focus group discussion: DD/MM/YY

Part 1: Evaluative frame of reference: Belief of actors/stakeholders

The technical consequences

- The district total wheat land coverage and improved wheat land size (in hectares)
- Type of improved wheat varieties grown in the district and the sources of wheat varieties
- Identification of smallholder farmers need
- Evaluation of:
  - The quality of the seed varieties
  - The quality of fertilisers
  - The seeds' ability to resist a disease
  - Agronomic practices
  - The yield change in relation to average actual farmers' yield to average farmers' potential yield (the expectation)
  - Marketability of the yield
- Risk occurrence on the production process

Socio-economic consequences:

- Required labour organisation
- Income effect (change in family wellbeing)
- Impact on social relation (Government, NGO, Household members, community members, etc.)

Part 2: Perceived self-efficacy: Ability of stakeholders

- Perceived availability of 'skills' and 'knowledge' (for IWP)
- Perceived 'ability' to mobilise resources: labour, land, cash for seeds, fertilisers, chemicals and practices

- Perceived 'ability' to control risks (risk coping strategies): presentation from happening, share risks with others, accommodation (accepting) of risks, Perdition and preparation for risks

Part 3: Perceived effectiveness of social environment: Ability of social environment

- Perceived effectiveness of agro-support networks: for technical support, input and loans delivery and accessibility, transportation and market facilities
- Perceived effectiveness of community organisation: Collaboration and trust among community on the production process of improved wheat

Part 4: Social pressure: Expectation from other stakeholders/actors

- Perceived desire and expectation: from other actors on improved wheat production
- Resources that others are perceived to mobilise in order to persuade: Incentives or motivation or sanctions

Annex 3: Checklist for participant observation

Variables will be observed and captured	Tools used
- Note book guided by participant observation - Reflection of daily observation	Farmers belief (knowledge), attitude, interest, ability, social environment, personal judgments, self-efficacy, risk & risk coping mechanisms, and social pressure on IWTs
Camera	Smallholder farmers wheat farms, wheat demonstrations sites (farmers training center or on-farm), input distribution centres, farmers meetings on technology adoption, farmers' seed storage places

Annex 4: Sample Informed Consent Form

You are invited to participate in a study of investigating stakeholders' perception on IWTs in Chencha District, Gamo Gofa Zone, Ethiopia.

We hope to learn (factors affecting innovation process of improved wheat production among stakeholder/actors, which helps us to establish and design appropriate future intervention strategy that might contribute for improving the production and productivity of wheat crop). You were selected as a possible participant in this study because (you are selected purposively/randomly by research subject as potential and experienced respondent of wheat production expert/development agent//farmer.

If you decide to participate, we will continue the discussion for 2:00 hrs. . In case any discomforts and inconveniences encountered we will try to complete the interview time in less than two hours.

Your appropriate responses and input for this study will benefit the organization engaged in the agriculture sector to design future appropriate strategy in the district besides confirming my studies.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission.

Your decision whether or not to participate will not prejudice your future relation with the *Van hall Lareinstein University, part of Wageningen UR Group*. 57

If you have any additional questions later, please contact (Tegegn Daniel Molla*)* at *(tegegndaniel.molla@wur.nl).* I will be happy to answer them.

You will be offered a copy of this form to keep.

_____

You are making a decision whether or not to participate. Your signature indicates that you have read the information provided above and have decided to participate. You may withdraw at any time without penalty or loss of benefits to which you may be entitled after signing this form should you choose to discontinue participation in this study.

_____ _____

Signature Date

_____ _____

Signature of Parent/Legal Guardian (If necessary) Date

_____ _____

Signature of Witness (If appropriate) Signature of Investigator

Annex 5: Planning

Date	Activity
Early May to mid-June 2013	Presentation of first draft proposal and drawing of conceptual framework on what researcher have to study or not
2 - 13 July 2013	Desk study and preparation for data collation
13 - 18 July 2013	Flight and logistic arrangement with using organization for data collection
19 July 2013 to 17 August 2013	Data collection and starting of data analysis
19 August 2013 to 21 August 2013	Back to Netherlands
22 August to 12 September 2013	Working on data analysis and finalizing the report
13 September	Submission of the thesis

Annex 6: Field data

6.1 Expected and achieved production and productivity of wheat variety HAR 3116 (2012/13)

Respondents	Land sowed in hectare	Expected Productivity in quintiles per hectares	Achieved productivity in quintiles per hectares	Percentage of the productivity achieved	Expected Production in quintiles	Achieved production in quintiles	Percentage of the yield achieved in quintiles
A	0.10	40	15	37.5	4	1.5	37.5
B	0.15	40	15	37.5	6	2.25	37.5
C	0.25	40	14	35	10	3.5	35
D	0.10	40	15	37.5	4	1.5	37.5
E	0.20	40	15	37.5	8	3	37.5
F	0.20	40	15	37.5	8	3	37.5
Total	1.00	40	14.5	36.25	40	14.5	36.25

Source: Direct stakeholders (2013)

6.2 Expected and achieved production and productivity of wheat variety HAR 604 (2011/12)

Respondents	Land sowed in hectare	Expected Productivity in quintiles per hectares	Achieved productivity in quintiles per hectares	Percentage of the yield achieved	Expected Production in quintiles	Yield lost in % due to rust disease	Achieved production in quintiles	Percentage of the yield achieved in quintiles
A	0.10	60	11.3	25	6	50	1.13	18.83
B	0.15	60	12	33.33	9	50	1.8	2o
C	0.25	60	10.4	10	15	50	2.6	17.33
D	0.10	60	10	25	6	50	1.13	18.83
E	0.20	60	11.25	25	12	50	2.25	18.75
F	0.20	60	11.25	12.5	12	50	2.25	18.75
Total	1.00	60	11.16	20	60	50	11.16	18.16

Source: Direct stakeholders (2013)

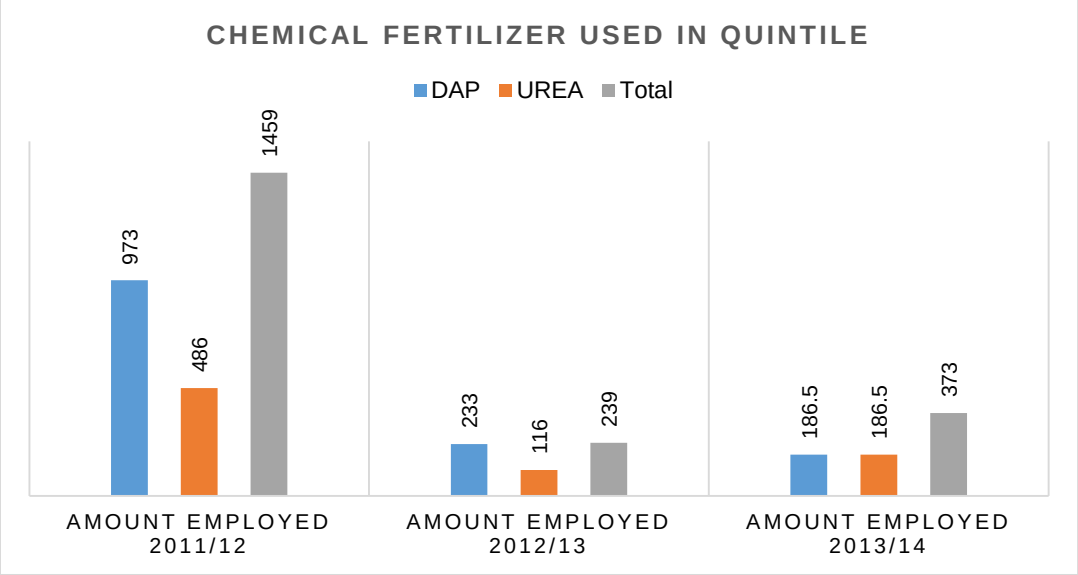
- There has been a 50% yield loss due to yellow rust infestation

6.3 Performance of agronomic practices of direct stakeholders data in mafona Zollo village

Respondent	Frequency of land preparation	Planning techniques	Input use ration	Weeding frequency	Acidic factor	Soil test and liming
A	Three times with oxen	Row planting only for trial once	Less than required	Once at growing time	Chemical fertilizer and recurrent tilling	Soil test and used lime once lately
B	Two times with oxen	Broadcasting	Less than required	Once at growing time	Chemical fertilizer and recurrent tilling	No soil test, no liming
C	Three times with oxen	Broadcasting	Less than required	Once at growing time	Erosion	Soil tested, no lime
D	Three times with oxen	Broadcasting	Less than required	Once at growing time	Erosion and repeated tilling	Soil tested, no lime
E	Three times with oxen	Broadcasting	Less than required	Once at growing time	Chemical fertilizer	No soil test, no liming
F	Two time with hoe	Broadcasting	Less than required	Once at growing time	Erosion	No soil test, no liming

Source: Direct stakeholders (2013)

6.4 Input utilization data of the district



Source: Chencha DAO (2013)

6.5 Altitude data of improved wheat varieties' from district extension department

Wheat Varieties	Altitude in masl
HAR 1685	2000-2600
HAR 3116	2000-2900
HAR 604	2200-2600
DAMPHE	2000-2600
PICKFLORA	1500-2200

Source: Chencha DAO (2013)

Annex 7: Documentation

7.1 Sample photo of the interview with district indirect stakeholders

7.2 Interview with Mafona Zollo village indirect stakeholders

7.3 Interview with female in Mafona Zollo village with direct stakeholders

7.4 Focus group discussion with district indirect stakeholders