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ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
INSTITUTE OF REGIONAL AND LOCAL DEVELOPMENT STUDIES
(IRLDS)

**RICE VALUE CHAIN IN METEMA DISTRICT, NORTH GONDAR,
ETHIOPIA: CHALLENGES AND OPPORTUNITIES FOR INNOVATION**

A Thesis Submitted to the School of Graduate Studies of Addis Ababa University
in Partial Fulfillment of the Requirements for the Degree of MASTER OF ARTS
IN REGIONAL AND LOCAL DEVELOPMENT STUDIES

By

Biruhalem Kassa Gebremeskel

October, 2010

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ACRONYMS AND ABBREVIATIONS

AARC	Adet Agricultural Research Center
ACSI	Amhara Credit and Saving Institute
AKIS	Agricultural Knowledge and Information System
ARARI	Amhara Regional Agricultural Research Institute
BDS	Business Development Services
BPR	Business Processing Re-engineering
CBO	Community Based Organizations
CSA	Central Statistical Authority
DAs	Development Agents
DAP	Die Ammonium Phosphate
EIAR	Ethiopian Institute of Agricultural Research
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
FREG	Farmers Research and Extension Group
FTC	Farmers Training Center
IPMS	Improving Productivity and Market Success
IRRI	International Rice Research Institute
NARS	National Agricultural Research System
NERICA	New Rice for Africa
PA	Peasant Association
PLW	Pilot Learning District
REFLAC	Research-Extension-Farmer Linkage Advisory Council
SMSs	Subject Matter Specialists
SNRMP	Sustainable Natural Resource Management Project
SWOT	Strength, Weakness, Opportunity and Threat
SPSS	Statistical Package for Social Science
ToT	Transfer of Technology/ Trainer of Trainee
VCA	Value Chain Analysis
DoARD	District office of Agricultural and Rural Development

TABLE OF CONTENTS

ACKNOWLEDGMENTS	iii
ACRONYMS AND ABBREVIATIONS	iv
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF APPENDICES	ix
ABSTRACT.....	x
1. INTRODUCTION	1
1.1 Background.....	1
1.2 Statement of the Problem.....	3
1.3 Objectives of the Study.....	5
1.4 Research Questions.....	5
1.5 Significance of the Study	6
1.6 Scope and Limitation of the Study.....	6
1.7 Organization of the Thesis	6
2. LITERATURE REVIEW	7
2.1 Definitions and Concepts.....	7
2.2 Literature Review.....	9
2.2.1 Why innovation?.....	9
2.2.2 Types of Innovation	12
2.2.3 Drivers of Innovation in a Value Chain	13
2.2.4 Basic Concepts of Agricultural Value Chains and Value Chain Analysis.....	15
2.2.5. The Agricultural Value Chain Analysis Approach and Purpose.....	19
2.2.6 Innovation System Perspective in Value Chain Development.....	21
2.2.7 Conceptual Framework	22
2.3 Review of Empirical Studies on Value Chain.....	25
3. RESEARCH METHODOLOGY.....	29
3.1 Description of the Study Area.....	29
3.2 Research Design.....	31
3.2.1 Sampling Procedure	32
3.2.2 Method of Data Collection.....	34

3.2.3 Method of Data Analysis	35
4. RESULTS AND DISCUSSION	36
4.1 Demographic Characteristics of Sample Households	36
4.2 Livestock Ownership	39
4.3 Overview of Rice Production in Metema.....	41
4.3.1 Land Holding and Area Allocated to Rice.....	42
4.3.2 Type and Source of Input Used for Rice Production	43
4.4 Rice Value Chain Mapping.....	47
4.5 Actors, their Role, Linkage, Attitudes, Habits and Practices in Rice Value Chain	48
4.5.1 Actors and their Role	48
4.5.2 Actors' interaction	59
4.5.3 Missing Actors and/or Role in Rice Value Chain.....	62
4.5.4 Attitude, Habit and Practices of Value Chain Actors	62
4.6 Institutional Arrangement and Enabling Environments Influencing Functioning of Rice Value Chain in Metema.....	66
4.6.1 Enabling Environment	66
4.6.2 Institutional Arrangement	69
4.7 Innovations in Rice Value Chain and Their Immediate Outcomes in Metema.....	70
4.8 Challenges, Opportunities and Entry Points for Innovation in Rice Value Chain in Metema.....	79
4.8.1 Challenges.....	79
4.8.2 Opportunities.....	89
5. CONCLUSION AND RECOMMENDATION.....	93
5.1 CONCLUSION.....	93
5.2 RECOMMENDATION	94
REFERENCE.....	97
APPENDICES	101

LIST OF TABLES

Table	Page
1. Attitudes and practices affecting key innovation processes and relationships.....	25
2. Land area and human population in the study area.....	29
3. Sample of respondents in rice value chain of Metema.....	31
4. Demographic characteristics of sample of respondents.....	36
5. Household family size and use of improved rice varieties.....	37
6. Source of livelihood (occupation) of sample farmers.....	37
7. Livestock ownership of sample farmers.....	38
8. Land ownership and amount of land allocated for rice production (2007-2009).....	41
9. Type and source of input used in rice production in Metema.....	42
10. Average amount of rice produced, consumed and sold at a household level.....	51
11. Buyers of rice in Metema	52
12. Status and source of rice consumption	54
13. Rice training by organization in Metema	55
14. Source of advisory service.....	56
15. Advisory and technical information dissemination method.....	56.
16. Credit availability to the sample farm households.....	57
17. Source and purpose of credit used by sample of respondents	57
18. Metema rice value chain actors linkage matrix.....	59
19. Amount of area covered by improved varieties of rice for seed multiplication across location.....	72
20. Mean grain yield of improved varieties in all seed multiplication sites of Metema, 2007.....	73
21. Actor time line of rice value chain development in Metema.....	76
22. Challenges faced by rice producer farmers.....	83
23. Challenges that hinder the use of rice varieties by non producer groups.....	84
24. List of upland rice varieties released to Metema and surrounding area as of 2009.....	86
25. Opportunities/reasons for farmers to produce rice in Metema.....	87

LIST OF FIGURES

Figure	Page
1. Typical agricultural value chain and associated business development services.....	16
2. Map of the study area (Amhara region and Metema District)	30
3. Sampling Procedure.....	33
4. Type of varieties used by the sample of respondents	43
5. Current rice value chain in Metema.....	45
6. Trends in the number of rice producing farmers, area allocated and production in Metema.....	50
7. Grain/flour mills in Metema.....	52
8. Animal pulled cart used for transportation in Metema.....	53
9. Storage bans to store rice.....	53
10. Map of the road structure of Metema.....	66

LIST OF APPENDICES

Appendixes	Page
1. Actors and their role in the rice value chain in Metema.....	96
2. Attitudes, habits and practices of value chain actors that influence interaction, knowledge and information sharing, inclusiveness, and risk taking.....	97
3. Sample farm households interview schedule	98
4. Interview check list	106

RICE VALUE CHAIN IN METEMA DISTRICT, NORTH GONDAR, ETHIOPIA:
CHALLENGES AND OPPORTUNITIES FOR INNOVATION

ABSTRACT

Rice is a new crop for the country in general and the study area, Metema, in particular. There is an immense potential rice production area and high consumer demand. However, the rice sector is not fully developed as compared to the potential. Many institutional, organizational and technological factors were attributed to existing inefficiencies in rice production and utilization. This study was undertaken in Metema District of North Gondar Zone, Amhara National Regional State and has been designed to throw light on the challenges, opportunities and entry points for infusing further innovation (technological institutional and organizational) for upgrading the rice value chain. Identification of actors, their role, linkage, attitudes, habits and practices in the value chain; analyzing the institutional arrangements and enabling environment that affect the functioning of the value chain; and identifying recent innovation activities and their immediate outcomes in the District were the focus of this study. Primary data was collected from 100 randomly selected farm households and other rice value chain actors including input suppliers, marketing agents, consumers and support services. Data was collected using both qualitative and quantitative methods which incorporated semi-structured interview schedule, focus group discussions, key informant interview and personal observation. The main findings of the research revealed that, there are multiple public and non-public actors involved along the rice value chain, upstream from input supply to downstream consumers, playing different role. However, there is no mechanism to coordinate multiple actors together for effective and efficient functioning of the value chain. There is public sector actors' domination with limited private sector involvement in the value chain. A long tradition of limited responsiveness, top-down, hierarchical, non participatory/ exclusiveness and less risk taking type of organizational culture and, habits and practices lead DoARD to have weak interaction, knowledge and information sharing with the various actors along the value chain. As to the linkage, weak and informal linkage between chain actors characterizes the rice value chain. Lack of post harvest processing technology(rice polisher), limited access to and supply of inputs, severe termite attack, non availability of well developed rice market, high labor demand for crop management, absence of responsible body who works on actors interaction were some of the challenges identified for innovation at various stages of rice value chain. Absence of rice polisher machine was the most critical problem that affects the whole value chain. On the contrary, increased farmer's awareness about and availability of improved rice varieties, existence of favorable land and climatic condition, presence of high consumer demand, and increased institutional support from different GOs and NGOs were mentioned as opportunities for innovation. In order to address the existing problems and to increase competitive advantage of the rice production, plat forms and partnerships have to be created between value chain actors to create an enabling environment for sharing of information, knowledge and solve existing problems of shortage of rice polisher machine and input supply services. The existing extension service should also be strengthened in a way that enables working in harmony with relevant actors to bring about change for efficient and effective delivery of agricultural inputs/services.

1. INTRODUCTION

1.1 Background

Rice is a staple food for more than half of the world's population. In Asia alone, more than 2,000 million people obtain 60-70 percent their calories from rice and its products. It is also the most rapidly growing source of food in Africa, and is of significant importance to food security and food self-sufficiency in an increasing number of low-income food deficit countries. Therefore, improving the productivity of rice systems would contribute to hunger eradication, poverty alleviation, national food security and economic development (FAO, 2004)

Ethiopia is one of the developing African countries with high population and food insecurity. The country has been implementing different strategies to achieve food security. Diversification of crops, increasing the availability of food through domestic production, and encouraging the production of early maturing and high yielding crops in different agro-ecologies of the country are some of such strategies. Rice is considered to be a highly productive crop next to maize in the country (CSA, 2003). The introduction and expansion of rice production in suitable agro-ecologies, therefore, could be an option to achieve food security and self-sufficiency.

Rice is among the most important cereals and root crops grown in different parts of Ethiopia as food crop. It is reported that the potential rice production area in Ethiopia is estimated to be about thirty million hectares (MoARD, 2010). According to FAO (2009), four rice ecosystems were identified in the country. These are; *upland rice*, which is grown on naturally drained soils and where the water table always remains below the roots and is entirely rain fed ; *Hydromorphic (rain fed lowland) rice*, which is grown on soils where the roots are periodically saturated by fluctuating water table in addition to the rainfall; *Irrigated lowland ecosystem*, whereby crop water requirement is entirely satisfied from irrigation, and rainfall is not a limiting factor, and *Paddy rice (with or without irrigation)* which is grown under water-logged or submerged conditions.

According to Tareke (2003), even though rice is not a traditional staple food in Ethiopia, it is a high potential emergency and food security crop for the country. Rice production is expanding

rapidly and farmers are growing it in many places and over large areas and also have developed many Ethiopian recipes using rice including: *Injera*, bread (*Dabo*), porridge (*Genfo*), breakfast cereal (*Mook*), Soup, Salad, Couscous (*Kinche*), and local drinks (*Tella* and *Kati-Kalla*). The area under rice grew from 6000 ha in 2005 to 91,000 ha in 2008. A total of 713,987 quintals of rice was produced in the country and out of this 569,500.34 (79.8%) and 4151 (0.6%) quintals of production was produced in Amhara National Regional state and North Gondar zone respectively (CSA 2008). However, the amount of area under rice cultivation is low as compared to the potential. For instance, as computed from the above data for the year 2008, only 0.3% (91,000ha) of the total potential was covered with rice.

Rice is introduced in Ethiopia during 1970s and has since been cultivated in small pockets of the country. Ever growing demand due to population growth and urbanization, Consumer preference and diet changes especially from city dwellers, increased consumption of food away from home, increased participation of women in labor force, convenience and ease of storage and cooking, are forcing the government to spend large amounts of money on importing rice. For the year 2008 and 2009, the government of Ethiopia imported 25,667 and 30,082 tons of milled rice respectively (Ethiopian customs and revenue agency for imports cited in MoARD, 2010). The recent surge in demand combined with the skyrocketing import price, and availability of potential agro-ecologies for rice production, challenged the country's policy makers to seriously consider the country's potential to grow the grain for itself. Subsequently, successful lobbying has pushed rice to be classified as a fourth "National Food Security Crop" after wheat, maize, and the country's traditional staple cereal crop, tef. This move favors rice research and promotion on a larger scale (Nigussie et al., 2008).

The western lowlands of the country particularly of *Metema* and its surrounding areas in North *Gondar* have potential to grow rice since the area is characterized by its low altitude (about 800m above sea level) and high temperature with sufficient rainfall. Cognizant of the stated importance of rice and existing potential for its production, Amhara Reginal Agricultural Research Institute (ARARI) in collaboration with different Federal and Regional research centers, and NGOs has tried to conduct multi-location adaptation trials in selected potential rice growing areas to release locally adapted varieties. *Metema District* is one of the study areas where adaptation trial is conducted.

1.2 Statement of the Problem

Even though the country has thirty million hectares of potential rice production area, the amount of arable land under rice cultivation during 2009 (185,000ha) is very small as compared to the potential (MoARD, 2010). Beside, inefficient utilization of rice production area, the same author illustrated that input supply, agronomic practices, pre and post harvest handling, marketing, utilization and overall investment are some of research and development gaps and priorities under the current situation of rice production in Ethiopia. Organizations that are working on rice development, however, mainly focus on adaptation and release of locally adapted varieties. They do not give importance to the other activities (input supply, post harvest processing, marketing and utilization) across the value chain. Nigussie et al. (2008) argued that the rice production system in the country has focused mainly on the introduction of improved varieties from a range of different sources, including the International Rice Research Institute (IRRI), the Africa Rice Center (WARDA), Guinea, and Madagascar. Federal and Regional research centers are also concentrating on the evaluation and release of new varieties for local producers.

However, to increase production and productivity and to get competitive advantage from the development of rice sector, there should be innovation at every stage of the value chain. Bammann (2007) illustrated that the value chain concept helps to trace product flows; show value addition at different stages; identify key actors and their relationships in the chain; identify enterprises that contribute to production, services and required institutional support; identify bottlenecks preventing progress; provide a framework for sector-specific action; identifies strategy to help local enterprises to compete and to improve earning opportunities and identify relevant stakeholders for program planning.

Recently, the demand for production and consumption of rice varieties is increasing tremendously by farmers in the study area (*Metema*) as well as neighboring Districts' like; *Quara*, *Liy Armachiho* and *West Armachiho*. The main factors for the existing demand are availability of land with conducive soil characteristics for rice production and climatic condition, search for alternative cereal crop for consumption, crop rotation and diversification, and need of crop residue for livestock fodder.

According to IPMS (2005), soils in the area where about a quarter of the size of the District is Haplic Luvisols soils and about 22% are Vertisols or soils with vertic properties. Many of the areas are also flat. Hence, seasonal water logging, especially during the heavy rainfall months, is so high and it is the main production problem in the study area. Such a condition is not conducive for the dominant commercial crops (sesame and cotton) production in the area. Household income and food security of rural farmers could be affected by the decline in the production of such crops due to the water logging problem. Besides, such a problem also lead to natural resources degradation especially of forests. This is because farmers' clear forest areas in search of farm land to compensate the amount of land abandoned due to water logging. On the contrary, rice has potential to grow in water logging conditions. There is also need for alternative cereal crop in Metema. Sorghum is the only cereal that can be used for household consumption and crop rotation. Productivity of sorghum is very low due to severe striga infestation, it has low market demand and price, and has problem of storability.

Considering such huge demand and potential agro-ecology; various research, development and none governmental organizations put some effort to introduce and raise rice production in the area. Yet, farmers are still facing different problems like, input supply (improved seed and fertilizer), post harvest handling (particularly of shortage of rice polisher and thresher), and lack of market information for the seed as well as grain, and its utilization. Therefore, this entails a need for more comprehensive study which rigorously examine the rice value chain in the study area.

Rice is a new and only recently introduced crop and lacks in-depth studies. Accordingly, very few studies have been done on rice (Getachew,2000; Biruhalem and Dessalegn, 2007 and MoARD, 2010). However, most of these studies have focused on production (adaptation trials) or they are simple informal surveys. Rather there is no comprehensive study made so far to understand the whole rice value chain in the study area, *Metema*. This is the first study of its kind which analyzes the entire value chain from input supplier to the consumer. This study has the benefit of an integrated/holistic approach that tries to analyze the dynamics of input supply, production, marketing, postharvest processing and consumption of rice in the study area. Through such an approach, potential areas or entry points can be identified for infusing further

innovation to upgrade the value chain. It also provides a holistic picture of existing challenges and opportunities in the rice value chain, allowing identifying and taking appropriate intervention measures for improvement.

To understand opportunities and constraints in addressing the existing problems and to increase competitive advantage of the rice production in the area, this study was designed to achieve the following specific objectives.

1.3 Objectives of the Study

Main Objective

- To identify challenges and opportunities for innovation along the rice value chain in Metema District, North Gondar, Ethiopia

Specific Objectives

- To identify the actors/stakeholders and assess their roles/ functions, linkages, attitude, habits and practices in the rice value chain
- To analyze the institutional arrangements and enabling environment that affect the functioning of the value chain
- To identify and analyze recent innovation activities related to development along the rice value chain and assess their immediate outcomes

1.4 Research Questions

- Who are the actors/stakeholders involved in the in the rice value chain? And what are their characteristics, functions/roles, linkages, attitude, habits and practices?
- What institutional arrangements and enabling environments are affecting the functioning of the value chain?
- What recent innovation activities are undertaken in development of the value chain and what outcomes are obtained?
- What challenges, opportunities and entry points are available for infusing further innovation (technological, institutional and organizational) for upgrading the value chain?
- What short-term actions/interventions should be taken to pursue opportunities and address constraints?

1.5 Significance of the Study

The study analyzes the entire rice value chain from input supplier to the consumer. It also provides a holistic picture of existing challenges, opportunities and entry points in the rice value chain. Therefore, it can shed light on required efforts to enhance the production and utilization of the crop at larger scale to ensure food security and self-sufficiency and bring about economic development in the area. The information generated will also help a number of organizations; research and development organizations, traders, producers, policy makers, extension service providers, NGOs, to assess their activities and redesign their mode of operations and ultimately influence the design and implementation of policies and strategies. It can also help such actors and others to identify and analyze new ways of stimulating innovation.

1.6 Scope and Limitation of the Study

This study aimed at identifying challenges and opportunities for innovation along the rice value chain in *Metema* District, North Gondar, Ethiopia. Due to time and financial resource unavailability, the study is limited in its depth and coverage to fully address the aforementioned objectives of the study. Furthermore, Since Ethiopia has wide range of diverse agro-ecologies, institutional capacities, organizations and environmental conditions, the result of the study may have limitations to make generalizations and make them applicable to overall country. However, it may be useful for areas with similar context with the study area.

1.7 Organization of the Thesis

This thesis consists of five chapters. Chapter one deals with the background, problem statement, objectives, scope and limitation, and significance of the study. Chapter two reviews related literature appropriate for the research topic. Methodological issues including the study area description are presented in chapter three. The fourth chapter presents and discusses the results of the study. The final chapter includes conclusion and recommendations.

2. LITERATURE REVIEW

This chapter tries to present relevant definitions and concept, related literature including conceptual issues regarding innovation, agricultural innovation system, value chain, value chain development and upgrading, and various relevant theories and models. It also attempts to explore results of relevant empirical studies which were conducted in different parts of the world which are pertinent and directly linked with the topic of the research..

2.1 Definitions and Concepts

To enhance understanding of the innovation and value chain concepts, key terms and conceptual issues are described as follows.

First, innovation is defined by many scholars in various ways as “*Innovation is the profitable implementation of ideas*” or “*Innovation is implementing new ideas that create value*” (Jjang, 2009). Mytelka (2000) defines it as the process by which organizations “master and implement the design and production of goods and services that are new to them, irrespective of whether they are new to their competitors, their country, or the world”. Kahsay et.al (2008) and OECD (1999) also pointed out that innovation is a new idea, practice, or product that is successfully introduced into and utilized in an economic and social process, which positively affects the competence, productivity, competitiveness, and livelihood of agents in the value chain. They could be technological, organizational, institutional and policy innovations.

Second, innovation system is defined as the network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect the system’s behavior and performance. Innovation systems help to create knowledge, provide access to knowledge, share knowledge, and foster learning. The innovation systems concept embraces not only the science suppliers but also the totality and interaction of actors involved in innovation. In other words, the concept extends beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in novel and useful ways (World Bank, 2006b).

Third, a value chain is the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final customers, and final disposal after use, and it incorporates a range of activities within each phase, including both input supply and output marketing systems (Kaplinsky and Morris, 2000). A product moves in the value chain from one chain actor to another and in the process add some value; for example, flow of seed to farmers and grain to the market occurs along chains from producer to intermediary to consumer.

Fourth, actors can be defined from both innovation system perspective and value chain aspect. From value chain point of view, KIT et al. (2006) and Hellin and Meijer (2006) mentioned chain actors as those involved in producing, processing, trading or consuming a particular agricultural product. They include actors which are directly and commercially involved in the chain (input (e.g. seed suppliers), producers, traders, processors, transporters, wholesalers, retailers and final consumers) and indirect actors which provide financial or non-financial support services, such as bankers and credit agencies, business service providers, government, researchers and extensionists.

On the other hand, from an innovation system perspective, actors are agents, individuals and firms as well as public institutions and non-state actors constitute the principle operating components of the system. Again, when we apply innovation system perspective to developing-country agriculture; agents/ actors are those who are engaged in the generation, dissemination, or use of knowledge or technology. The primary focal agent in the literature is often the public sector research system: national research organizations, extension systems, state marketing agencies, institutes of higher learning, and international research centers are mentioned as primary actors. However, private firms are also increasingly important focal agents, and may include multinational and national agribusiness firms; small and medium enterprises engaged in agro industrial processing, marketing, and distribution; industry associations; and individual entrepreneurs. Civil society organizations are also important focal agents and include producer/farmer associations, nongovernmental organizations, consumer groups, and other types of community or solidarity groups. And, finally, agrarian agents are also critical focal agents; these include farmers, agricultural laborers, farm households, and rural communities that are

engaged not only in the utilization of knowledge but in its production and diffusion as well (Spielman, 2005).

2.2 Literature Review

2.2.1 Why innovation?

Available literature illustrated the rationale for exploring the utility of concepts of innovation, systems of innovation and the innovation systems perspective in the agriculture sector particularly of developing countries agriculture. Innovation is becoming central to the ability of farmers, agro-enterprises and countries to cope, exploit and compete in rapidly evolving technical and economic conditions. Innovation plays crucial role in the development of agriculture through promoting interactive learning between actors along the value chain. There by it eliminates the drawbacks of NARS and AKIS perspectives like; ineffective technology transfer, incorrect research priorities and weak demand for research products. The main reason for the problem is such systems do not allow all actors to make a link to identify their problems or needs and develop a technology to solve their problems. Accordingly, the demand for the technology developed will decrease since it is developed without taking clients real circumstance in to consideration (Hall et al. 2006).

Rajalahti et al. (2008) pointed out six major changes in the context of agricultural development which heighten the need to incorporate innovation systems concepts in the agricultural sector:

1. Markets, not production, increasingly drive agricultural development.
2. The production, trade, and consumption environment for agriculture and agricultural products is growing more dynamic and evolving in unpredictable ways.
3. Knowledge, information, and technology increasingly are generated, diffused, and applied through the private sector.
4. Exponential growth in information and communications technology (ICT) has transformed the ability to take advantage of knowledge developed in other places or for other purposes.
5. The knowledge structure of the agricultural sector in many countries is changing markedly.

6. Agricultural development increasingly takes place in a globalized setting (in contrast to a setting characterized predominantly by national and local influences and interests).

In line with this, World Bank (2006a) also identified various important patterns in the agricultural sector of many developing countries which require the application of agricultural innovation system concept and framework. For instance;

- The delineation of new, dynamic, and very knowledge-intensive niche sectors, such as export horticulture and agro processing.
- Rapid evolution in production, consumption, and marketing conditions, driven by new technologies, globalization, and urbanization.
- Industrialization of the food chain.
- The importance of these new sectors as income sources for the poor—farmer-owners as well as laborers.
- An important role for organizations other than state organizations—particularly private organizations, but also cooperatives and civil society organizations.
- The need to compete in rapidly evolving international markets and the consequent importance of innovation as a source of competitive advantage.
- The importance of upgrading and innovating, not only in hi-tech sectors but also in sectors such as agriculture, which are considered more traditional and low-tech.

Besides, World Bank (2006b) also pointed out the following distinguishing characteristics of innovation and innovation process from invention;

- Innovations are new creations of social and economic significance. They may be brand new, but they are more often new combinations of existing elements.
- Innovation can comprise radical improvements, but it usually consists of many small improvements and a continuous process of upgrading.
- These improvements may be of a technical, managerial, institutional (that is, the way things are routinely done), or policy nature.
- Very often innovations involve a combination of technical, institutional, and other sorts of changes.

- Innovation can be triggered in many ways. Bottlenecks in production within a firm, changes in available technology, competitive conditions, international trade rules, domestic regulations, or environmental health concerns may all trigger innovation processes.

Innovation is a process in which knowledge and technology are generated, disseminated and utilized by agents, whose interaction both condition and are conditioned by social and economic institutions. In its broadest sense innovation covers the activities and processes associated with the generation, production, distribution, adaptation, and use of technical, institutional and organizational or managerial knowledge. It does not mean new technology alone, but also the institutional innovations, that emerge as new ways of developing, diffusing and using technology (Anandajayasekaram et al., 2006). Furthermore, innovation is neither research nor science and technology, but rather the application of knowledge (of all types) in the production to achieve desired social or economic out comes. The knowledge might be acquired through learning, research or experience, but until applied it cannot be considered innovation (Hall et al., 2006).

Innovation is an interactive process. Innovation involves the interaction of individuals and organizations possessing different types of knowledge within a particular social, political, policy, economic, and institutional context. Innovation systems concept recognizes the importance of these activities but gives more attention to (1) the interaction between research and related economic activity, (2) the attitudes and practices that promote interaction and the learning that accompanies it, and (3) the creation of an enabling environment that encourages interaction and helps to put knowledge into socially and economically productive use (ibid). Pellissier (2008) also described that innovation is to be understood as the result of cumulative dynamic interaction and learning processes involving many stakeholders. Here innovation is seen as a social, spatially embedded, interactive learning process that cannot be understood independently of its institutional and cultural context.

As we can easily understand from the concept of innovation, interaction/linkage between different actors or agents, who have diverse knowledge across the value chain, is vital for the development and delivery of agricultural innovation. However, the linkage may take different forms; formal or informal partnership or network. According to Waring (1997) cited in

Anandajaskaram et al. (2006), networking is process by which two or more organizations and/or individuals collaborate to achieve common goals. Networks potentially offer opportunities for taking advantage of economies of scale and for developing capabilities necessary to respond new challenges of change in context. Again, it provides opportunity to jointly address complex issues that cannot be effectively addressed by any one partner/institution; to improve the effectiveness and efficiency of resource use; and to avoid duplication of efforts, exploit complementarities and synergies. On the other hand, partnership is an alliance in which different individuals, groups, or organizations agree to a common goal; work together; share resources; share the risks as well as the benefits; review the relationships regularly; and revise their agreement as necessary.

Next, an innovation system includes those *institutions* that affect the process by which innovations are developed and delivered—the laws, regulations, conventions, traditions, routines, and norms of society that determine how different agents interact with and learn from each other, and how they produce, disseminate, and utilize knowledge. Institutions are also defined by Edquist (1997), are “sets of common habits, routines practices, rules or law that regulate the relations and interactions between individuals and groups”. These are the factors that determine the efficiency and stability of cooperation and competition, and whether agents in an innovation system are able to interact to generate, diffuse, and utilize knowledge. An institution may be no more explicit than a traditional tendency toward (or away from) informal entrepreneurial behavior in agrarian society, such as farmer exchanges of seed and other planting materials; or it may be more codified in the laws that govern how private, knowledge based firms are established, licensed, and taxed, and the extent to which such firms can appropriate the rents from innovation.

2.2.2 Types of Innovation

As many literatures illustrated that there are numerous types of innovations, broadly; Product, Process, Service, Business Model, Value, and Market. However, here our main focus is on agricultural innovations along the value chain. In this regard, innovation may take form of technological, institutional, organizational and technical (Pellissier, 2008; World Bank, 2006b; and OECD, 1999).

Traditionally, the focus in agricultural development has been on technological innovations such as varieties or breeds, type of equipment, or method of pest control. These can be growth increasing, cost reducing, quality enhancing, risk reducing, and shelf life enhancing. However, with the ever changing agricultural context; due to increased consumer demand and preference, globalization, quality, increased national/ international competitiveness, Conroy, (2008) recognized that social and institutional innovations can also be as important as technical ones. These include; innovations among producers and development of innovatory linkages/ networks between producers and service producers.

According to Pellissier (2008), *technological innovation* is the technology itself (this can include the product, method, process etc). It may include improved varieties, breeds, type of equipment, method of pest control, etc (Conroy, 2008). Similarly, they also described *technical innovation* as *use* or application of the technology (for example social networking as a technical innovation using the internet as a technology via cell phone as a technology).

Social and institutional innovation may take two forms (1) innovation among producers and (2) development of innovative linkages/ networks between producers and service producers. Social innovation among producers may be formal or informal and includes the development of cooperatives, farmer groups, and self help groups. The formation of groups of farmers can have a number of benefits, like; making the government research and extension service more client driven and efficient, strengthening farmers bargaining power with traders, reducing transaction costs for input suppliers and output buyers, economies of scale, facilitating saving and access to credit, and reducing public sector extension costs(Conroy, 2008). Furthermore, institutional innovation as suggested by Ruttan (2002) includes both innovation in the structure of economic units and in the routines, norms and decision rules followed by these units. He also argued that shifts in the demand for institutional innovation are induced by changes in related resource endowments and by technical changes. On the other hand, *Organizational innovation* includes processes, systems, strategies or organization design.

2.2.3 Drivers of Innovation in a Value Chain

Innovation does not occur randomly rather there are a number of factors or conditions that trigger innovation at particular point of time and space. Accordingly, a number of theories have

been developed that aim to explain what drives innovation. Conroy, (2008) described three of them as follows.

Science Push/ Transfer of Technology Model

The dominant view during the last few decades has been that scientific research is the main driver of innovation, creating new knowledge and technology that can be transferred to (and adapted to) different situations. The science push/TOT model of innovation mirrored the belief that "basic science leads to applied science, which causes innovation and wealth." The policy implications of the science push model were simply- if you want more economic development, you fund more science. The people who would reproduce and use the technology were not seen as sources of innovation or ideas in their own right. In this model technology change is exogenous to the economic system, originating outside the agricultural system that is expected to benefit from it. The adoption of innovation by farmers that were developed on the basis of this model has generally been disappointing, particularly in the case of resource-poor farmers.

Population Pressure Model

Work by Boserup(1965) and Binswanger and McIntire(1987) cited in Conroy(2008) identified increasing population density as the main drivers of the evolution of agricultural systems- from extensive hunter/gatherer system to slash-and-burn system to more intensive farming systems: population growth (and the consequent scarcity of land) provides the impetus for endogenous technological change. As agricultural land becomes scarcer, traditional practices like long fallow periods are abandoned, and intensification technologies (often labor intensive) tend to be applied on a large scale, resulting in average increased output per hectare. Boserup also saw population growth as ultimately leading to cheaper transport, easier marketing, and more specialization, which in turn would lead to the growth of local towns and more profitable agriculture- provide there were no cheap imports of domestically produced agricultural goods. This model only addresses part of the process driving agricultural innovation and is not relevant to situations in which labor is the scarcest factor of agricultural production- situation that are in some ways more relevant today with the spread of HIV/AIDS and labor migration to urban centers.

Market Pull Model

With increased market integration and globalization, it has become more and more obvious that markets and output price can exert a major influence on agricultural innovation. Good product prices may provide an incentive to farmers to improve their production practices or their marketing arrangements, and the cash needed to do so. Models that assume that the primary drivers of innovation is access to markets for agricultural and livestock products can be described as “ market pull” models of innovation. There has been a trend in recent decades towards economic globalization; i.e., increased economic integration between countries and a higher share of gross domestic product(GDP) being traded. This has provided opportunities for farmers to export their products to the international markets, and “changing patterns of production”.

2.2.4 Basic Concepts of Agricultural Value Chains and Value Chain Analysis

Although the value chain approach in general has a long tradition especially in industrial production and organization, its application in international development and agriculture, has gained popularity only in the last decade (Anandajayasekeram and Berhanu , 2009). The value chain concept has proven particularly useful for the identification and formulation of projects as well as in the development of strategies for improved agricultural and rural development. According to Anandajayasekeram and Berhanu (2009) in agricultural value chain, there are four major basic concepts: value chain, stages of production, vertical coordination and business development services.

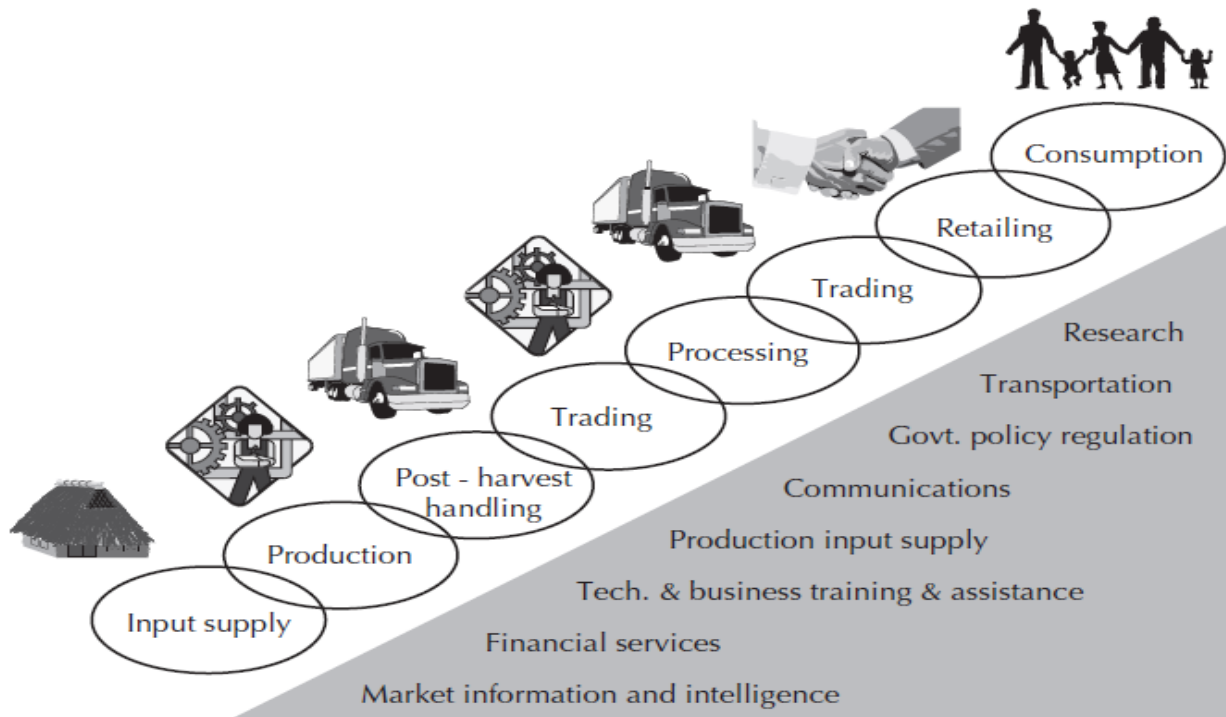
2.2.4.1 Value Chain

A value chain is the full range of activities required to bring a product from conception, through the different phases of production and transformation. A value chain is made up of a series of actors (or stakeholders) from input suppliers, producers and processors, to exporters and buyers engaged in the activities required to bring agricultural product from its conception to its end use (Kaplinsky and Morris, 2001). Bammann, (2007) has identified three important levels of value chain.

- *Value chain actors*: The chain of actors who directly deal with the products, i.e. produce, process, trade and own them.

- *Value chain supporters*: The services provided by various actors who never directly deal with the product, but whose services add value to the product.
- *Value chain influencers*: The regulatory framework, policies, infrastructures, etc.

The value chain concept entails the addition of value as the product progresses from input suppliers to producers to consumers. A value chain, therefore, incorporates productive transformation and value addition at each stage of the value chain. At each stage in the value chain, the product changes hands through chain actors, transaction costs are incurred, and generally, some form of value is added. Value addition results from diverse activities including bulking, cleaning, grading, packaging, transporting, storing and processing (Anandajayasekaram and Berhanu , 2009). See Figure 1 for a typical agricultural value chain.



Source: Adopted from Anandajayasekaram and Berhanu , 2009.

Figure 1. Typical agricultural value chain and associated business development services.

Value chains encompass a set of interdependent organizations, and associated institutions, resources, actors and activities involved in input supply, production, processing, and distribution of a commodity. In other words, a value chain can be viewed as a set of actors and activities, and organizations and the rules governing those activities. Value chains are also the conduits through

which finance (revenues, credit, and working capital) move from consumers to producers; technologies are disseminated among producers, traders, processors and transporters; and information on customer demand preferences are transmitted from consumers to producers and processors and other service providers (ibid).

Value chains can be classified into two based on the governance structures: buyer-driven value chains, and producer-driven value chains (Kaplinisky and Morris 2001). Buyer-driven chains are usually labour intensive industries, and so more important in international development and agriculture, which is our focus in this paper. In such industries, buyers undertake the lead coordination activities and influence product specifications. In producer-driven value chains which are more capital intensive, key producers in the chain, usually controlling key technologies, influence product specifications and play the lead role in coordinating the various links. Some chains may involve both producer- and buyer-driven governance (Kaplinisky and Morris 2001).

2.2.4.2 Stage of Production

In agricultural value chain analysis, a stage of production can be referred to as any operating stage capable of producing a saleable product serving as an input to the next stage in the chain or for final consumption or use. Typical value chain linkages include input supply, production, assembly, transport, storage, processing, wholesaling, retailing, and utilization, with exportation included as a major stage for products destined for international markets. A stage of production in a value chain performs a function that makes significant contribution to the effective operation of the value chain and in the process adds value (Anandajayasekeram and Berhanu , 2009).

2.2.4.3 Vertical Coordination

The performance of an agricultural value chain depends on how well the actors in the value chain are organized and coordinated, and on how well the chain is supported by business development services (BDS). Verticality in value chains implies that conditions at one stage in the value chain are likely to be strongly influenced by conditions in other stages in the vertical chain, in direct and indirect ways, and in expected and unexpected ways. It should be noted that intra-chain linkages are mostly of a two-way nature. A particular stage in a value chain may affect and be affected by the stage before or after it.

Coordination refers to the harmonization of the functions of a value chain—its conduct. The result of good coordination between the stages of a value chain may be reflected in a good match between buyer preferences and seller supplies. That is, better coordination in a value chain results in better matching of demand and supply between the chain stages, resulting in efficient and low-cost exchange, quality maintenance, and value addition. It should be noted that the coordination of activities by various actors within a value chain is not necessarily the same as chain governance. Coordination usually involves managing required parameters as exhibited in the bundles of activities undertaken by various actors performing specific roles in the chain. Coordination of value chains takes place at different places in the linkages to ensure consequences of interactions are as required. Coordination also requires monitoring of the outcomes, linking the discrete activities between different actors, establishing and managing the relationships between the various actors comprising the links, and organizing logistics to maintain networks (Anandajayasekeram and Berhanu , 2009).

Coordinating mechanisms are the set of institutions and arrangements used to accomplish harmonization of adjacent stages of the chain. Coordination can be done in various ways. Firms at specific key stages of a value chain (e.g. wholesalers and processors) can be coordinating agents, by handling or processing large volumes of commodity, thereby coordinating assembly, transformation and distribution. Government and nongovernment agencies that provide needed services, and associations of producers and processors and traders may also act as coordinating organizations. Various forms of contractual arrangements, different forms of markets (spot, futures, auction), various forms of information exchanges and vertical integration are other types of coordinating mechanisms. Uncertainty and risk, perishable nature of agricultural commodities, and increasingly stringent quality and safety standards by consumers provide strong incentives to develop effective coordinating institutions and arrangements (ibid).

2.2.4. 4 Business Development Services (BDS)

Closely related to the concept of value chains is the concept of business development services. These are services that play supporting role to enhance the operation of the different stages of the value chain and the chain as a whole. In order for farmers to engage effectively in markets, they need to develop marketing skills and receive support from service providers who have better

understanding of the markets, whether domestic or international. Local business support services are, therefore, essential for the development and efficient performance of value chains.

Business development services can be grouped into infrastructural services; production and storage services; marketing and business services; financial services; and policies and regulations. Basic infrastructural services include market place development, roads and transportation, communications, energy supply, and water supply. Production and storage services include input supply, genetic and production hardware from research, farm machinery services and supply, extension services, weather forecast and storage infrastructure. Marketing and business support services include market information services, market intelligence, technical and business training services, facilitation of linkages of producers with buyers, organization and support for collective marketing. Financial services include credit and saving services, banking services, risk insurance services, and futures markets. Policy and regulatory services include land tenure security, market and trade regulations, investment incentives, legal services, and taxation. The roles of the business development services have hitherto been neglected. The neglect was a result of the mistaken assumption that profitable business development services will emerge as value chains develop or that the public will provide business development services where they are needed and when markets are insufficient to provide profitable niches for competitive services to develop (Anandajayasekaram and Berhanu , 2009).

2.2.5. The Agricultural Value Chain Analysis Approach and Purpose

2.2.5.1 What Is The Agricultural Value Chain Analysis Approach?

Agricultural value chain analysis can be viewed as a heuristic device or analytical tool (Kaplinisky and Morris 2001). The research can be descriptive, prescriptive and designed to provide operational guidelines to improve efficiency of vertical coordination. Agricultural value chain analysis systematically maps chain actors and their functions in production, processing, transporting and distribution and sales of a product or products. Through this mapping exercise, structural aspects of the value chain such as characteristics of actors, profit and cost structures, product flows and their destinations, and entry and exit conditions are assessed (Kaplinisky and Morris, 2001 and KIT et al., 2006).

Agricultural value chain analysis is a dynamic approach that examines how markets and industries respond to changes in the domestic and international demand and supply for a commodity, technological change in production and marketing, and developments in organizational models, institutional arrangements or management techniques. The analysis should look at the value chain as a set of institutions and rules; as a set of activities involved in producing, processing, and distributing commodities; and as a set of actors involved in performing the value adding activities. Value chain analysis focuses on changes over time in the structure, conduct and performance of value chains, particularly in response to changes in market conditions, technologies and policies (Kaplinisky and Morris, 2001).

Agricultural value chain analysis focuses on chain governance and the power relationships which determine how value is distributed at the different levels. Through the analysis of systems and power relations at different levels, value chain analysis enables a more comprehensive modelling of the effects of interventions at different levels. Such an approach can enable a better targeting of interventions aimed at poverty reduction. Hence, value chain aims at identifying how the productivity of chain activities can be improved, either through improved technologies, organizations or institutions to better coordinate the various stages of production and distribution, and meet consumer demand. The agricultural value chain approach accords due attention to the roles of business development services in enhancing the performance of value chains. Since final demand is the major driver of agricultural value chains, a strategy to improve the competitiveness of a value chain should consider the nature of products in relation to the type of markets where the product is sold for final usage (Kaplinisky and Morris, 2001 and Anandajayasekeram and Berhanu , 2009).

2.2.5.1 Purposes of Value Chain Analysis

Value chain analysis is conducted for a variety of purposes. The primary purpose of value chain analysis, however, is to understand the reasons for inefficiencies in the chain, and identify potential leverage points for improving the performance of the chain, using both qualitative and quantitative data. In general, agricultural value chain analysis can be used to:

- Understand how an agricultural value chain is organized (structure), operates (conduct) and performs (performance). Performance analysis should concern not only the current performance of the value chain, but also likely future performances, as well.
- identify leverage interventions to improve the performance of the value chain

- analyze agriculture–industry linkages
- analyze income distribution
- analyze employment issues
- assess economic and social impacts of interventions
- analyze environmental impacts of interventions
- guide collective action for marketing
- guide research priority setting
- conduct policy inventory and analysis

In sum, the concept of value chain provides a useful framework to understand the production, transformation and distribution of a commodity or group of commodities. With its emphasis on the coordination of the various stages of a value chain, value chain analysis attempts to unravel the organization and performance of a commodity system. The issues of coordination are especially important in agricultural value chains, where coordination is affected by several factors that may influence product characteristics, especially quality. The value chain framework also enables us to think about development from a systems perspective, similar to the innovation system perspective.

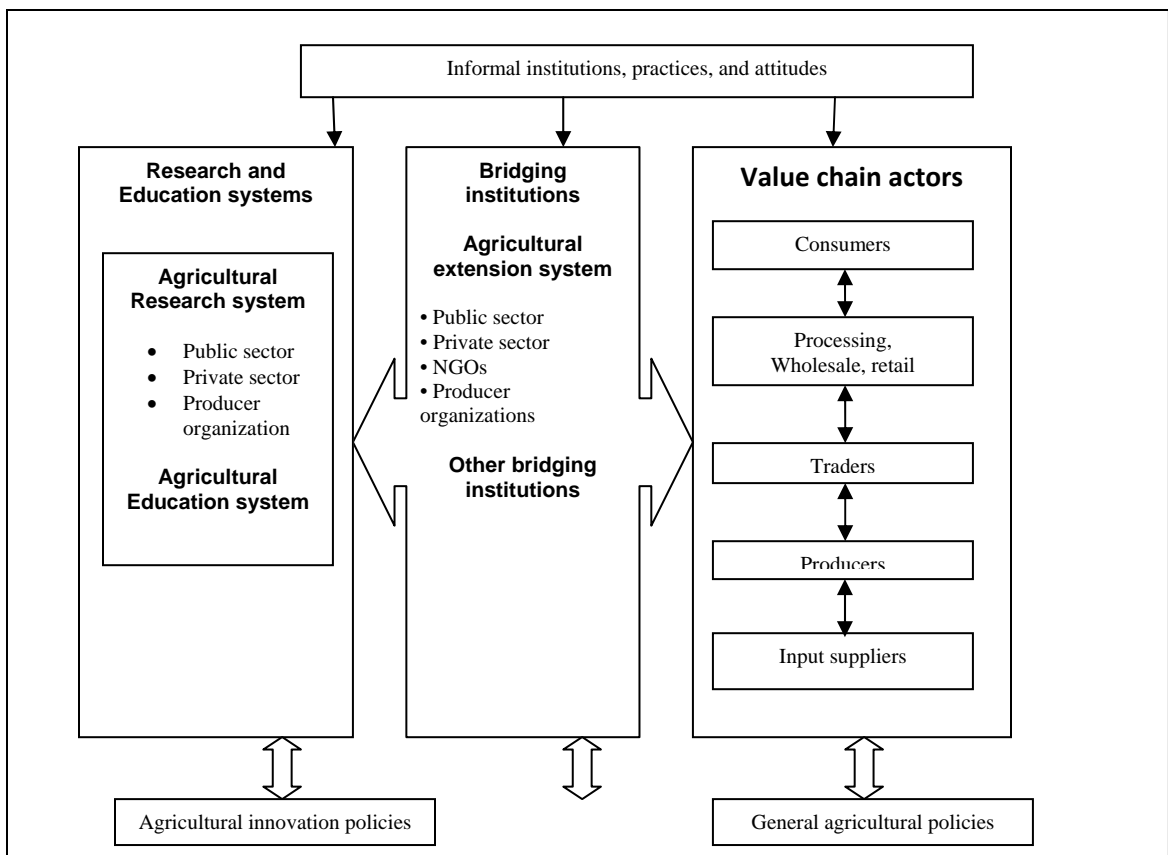
2.2.6 Innovation System Perspective in Value Chain Development

According to the World Bank (2006), Innovation systems and value chains often have many shared partners, and although they respond to different organizational principles, they are highly complementary and overlapping. From a value chain perspective, the key challenge is to link supply and demand in the most effective way, and information sharing is very important for enabling these producer-consumer linkages. Organizations that help to link producers, transporters, and distributors to consumer markets are vital if value chains are to function effectively. When participants in a value chain pass along information on demand characteristics, for example, or on standards and regulations affecting the market (such as sanitary and phytosanitary standards), at the same time they are providing important information to shape the direction of the innovation process. If, in addition to well functioning value chain, an effective innovation capacity exists, this market information will be combined with new and existing knowledge on technological opportunities and information, such as farming techniques, postharvest processes and marketing to innovate in response to these market signals. One of the innovation challenges with respect to sustainable agriculture is to expand opportunities and means for resource-poor farmers to become actors and stakeholders in these innovation systems.

In general, a value chain brings partners together in their desire to integrate production, marketing, and consumption issues in the most profitable way, both in the long and in the short run. For example, value chain partners may need to make organizational and technological changes, or they may need to agree on pricing practices or quality control systems. The innovation system perspective brings actors together in their desire to introduce or create novelty or innovation into the value chain, allowing it to respond in a dynamic way to an array of market, policy, and other signals. The innovation system perspective provides a way of planning how to create and apply new knowledge required for the development, adaptation, and future profitability of the value chain.

2.2.7 Conceptual Framework

In order to analyze innovation in agricultural value chain, innovation system framework is used. The conceptual framework comprises of the essential elements of a national agricultural innovation system, the linkages between its components, and the institutions and policies that constitute the enabling environment for innovation.



Source: World Bank 2009 , modified by the author with input from World Bank 2006 a and b.

The conceptual framework consists of different actors; their role, linkage and interaction; attitude, practices and habits of the different actors, enabling environment including policies, institutional arrangements and incentives that affect the capacity and efficiency of actors to innovate across the value chain.

Actors: The innovation systems concept recognizes that (1) there is an important role for a broad spectrum of actors outside government (2) the actors' relative importance changes during the innovation process; (3) as circumstances change and actors learn, roles can evolve; and (4) actors can play multiple roles (for example, at various times they can be sources of knowledge, seekers of knowledge, and coordinators of links between others (Hall, 2006). The chain actors who actually transact a particular product as it moves through the value chain include input (e.g. seed suppliers), farmers, traders, processors, transporters, wholesalers, retailers and final consumers(Kaplinsky and Morris, 2000).

Linkage: Linkage can be both partnership and network. Partnership is condition in which two or more organizations pool knowledge and resources and jointly develops a product, or they can be commercial transactions, in which an organization purchases technologies (in which knowledge is embedded) or knowledge services from another organization, in which case the relationship is defined by a contract or license. Whereas, network refers to networks, which provide an organization with market and other early-warning intelligence on changing consumer preferences or technology. These linkages and relationships govern the movement of commodities through value chains(ibid).

Attitude and practices: The common attitudes, routines, practices, rules, or laws that regulate the relationships and interactions between individuals and groups largely determine the propensity of actors and organizations to innovate. Some organizations have a tradition of interacting with other organizations; others tend to work in isolation. Some have a tradition of sharing information with collaborators and competitors, of learning and upgrading, whereas others are more conservative in this respect. Some resist risk-taking; others do not (World Bank, 2006b). Besides, it also illustrated that Attitudes and practices also determine how organizations respond to innovation triggers such as changing policies, markets, and technology. Because such attitudes vary across organizations and across countries and regions, actors in different sectors or countries may not respond in the same ways to the same set of innovation triggers.

Table 1. Attitudes and Practices Affecting Key Innovation Processes and Relationships

Attitudes and Practices Affecting Key Innovation Processes and Relationships		
Process	Restrictive attitudes and practices	Supportive attitudes and practices
Interaction, knowledge flows, learning organizations	<ul style="list-style-type: none"> -Mistrust of other - Closed to others' ideas - Secretiveness - Lack of confidence - Professional hierarchies between organizations and disciples - Internal hierarchies - Top-down cultures and approaches - Covering up of failures - Limited scope and intensity of interaction in sector networks 	<ul style="list-style-type: none"> - Trust - Openness - Transparency - Confidence - Mutual respect - Flat management structure - Reflection and learning from successes and failures - Proactive networking
Inclusiveness of poor stakeholders and the demand side	<ul style="list-style-type: none"> - Hierarchies - Top-down cultures and approaches 	<ul style="list-style-type: none"> -Consultative and participatory attitudes
Risk-taking and investment	<ul style="list-style-type: none"> - Conservative 	<ul style="list-style-type: none"> - Confidence - Professional incentives

Source: World Bank, 2006b

Furthermore, World Bank,2006b mentioned the desire to develop attitudes that encourage dynamic and rapid responses to changing circumstances; for instance, external shock, or changing trade rules and competitive pressure in international markets—by building self-confidence and trust, fostering preparedness for change, and stimulating creativity. This could also require creating partnership/linkage between actors or stakeholders to gain more competitive advantage.

Enabling Environment: it include infrastructure, effective governance of input and output markets, and a supportive policy and fiscal framework for science, technology, legal, advisory, and trade issues. Most developing countries lack an optimum enabling environment and must choose among the many options to improve it (Rajalahti, et.al, 2008).

Given that the enabling environment often influences how the actors in a sector can use their knowledge; the enabling environment is an important promoter of innovation capacity. Policies are integral to forming an enabling environment, but there is no single “innovation policy.” A set of policies is needed to work together to shape innovation. The evidence suggests that policy interventions to create an enabling environment for innovation may remain ineffective unless they are accompanied by efforts to change prevailing attitudes and practices (Ibid). World Bank 2006b also indicated that Policy supports of innovation is not the outcome of a single policy but of a set of policies that work together to shape innovative behavior. In evaluating the effectiveness of policies on innovative performance, investigators must therefore be sensitive to a wide range of policies that affect innovation and seek ways of coordinating them. Moreover, policies interact with attitudes and practices, and thus, effective policies must take account of existing behavioral patterns (Mytelka, 2000). For example, the introduction of more participatory approaches to research is often ineffective unless scientists’ attitudes (and incentives) are changed. Similarly, food safety regulations might be rendered ineffective if the agencies charged with enforcing them have a tradition of rent-seeking behavior. Policies to promote innovation must be attuned to specific contexts.

The evidence also indicates that the ability to agree on the innovation challenges within a sector is much greater when effective value chain coordination is in place. Improvements in the enabling environment will thus be more effective if they are combined with activities to strengthen other aspects of innovation capacity, particularly the patterns of interaction among the main actors, and if the efforts to improve the enabling environment focus on identified needs for innovation and address the need for sector coordination (Rajalahti, et.al, 2008)

2.3 Review of Empirical Studies on Value Chain

The literature that exists concerning the challenges and opportunities for innovation in agricultural value chain is too diversified to be exhaustively reviewed here. Therefore, only those studies that are directly or indirectly related to the variables or objectives of this study were reviewed.

The challenges and opportunities for innovation in a value chain are quite different depending on the nature of the sector or circumstance under which the sector operates. For instance, a study conducted on innovations in banana value chain in *Metema* (Kahsay, et.al, 2008) indicated that very limited sucker production and supply, low demand for locally available varieties, absence of improved varieties and limited knowledge of banana production in the area were some of the challenges for innovation in banana value chain to enhance its production and productivity. On the other hand, high market demand for improved banana varieties, production potential of the area, availability of irrigation water in the area, presence of enabling environment including policy support for irrigation agriculture, provision of technical advice from both government and nongovernmental organization to boost banana production and productivity in the area are also mentioned as opportunities for innovation in the value chain.

Other study conducted on whether public policies enhance or impede innovation in fish, banana and vegetable value chain in Uganda pointed out that policies have two dimensional influence on innovation in value chain irrespective of sectors; policies that constrain innovation and those that support innovation. The former include lack of favorable credit facilities and no subsidy policy, lack of infrastructure, lack of government support in value addition of local products, stringent and ever changing international market demands, and weak enforcement of existing laws and regulations. On the other hand, policies perceived to enhance agribusiness innovation include: non-taxation of agricultural exports, liberalization of trade and service delivery enabling pluralistic service providers (Kibwika, 2006).

In India, Bhutan district, the status of the rice commodity chain was evaluated using the functional, flow and economic analysis methods. More over the study utilized SWOT analysis to identify the challenges and opportunities and chain mapping to show the flow of rice along the chain. The study identified the various actors in the value chain, strengthen, weakens and opportunities of each actors. Currently, the different agents or stakeholders in the chain include farmers, commission agents, extension agents, researchers, millers, exporters and urban retailers. The rice production is largely subsistence farming and not directly linked with the market. The CAs supply inputs such as seeds, fertilizers and herbicides to the farmers on a commission basis which requires revision. The current coverage and number of CAs is inadequate for inputs distribution. There are several gaps and weaknesses in the production, processing and marketing

of rice. The low seed replacement ratio and use of modern varieties affects production. Farmers mostly rely on organic manures to supply nutrients to the rice crop, which is not sufficient for raising production. Irrigation water is a core input in rice cultivation, but the problem of inadequate water supply affects a large proportion of rice growers (Ghimiray, 2007).

Likewise, rice cultivation in Bhutan is labor intensive which due to the scarcity of labor adds to the cost of production. Farming tools and implements are still largely traditional with low use efficiency. Farm mechanization is limited, restricted by the availability of affordable machines and the inhospitable natural terrain. Ownership regulations also have a negative impact on productivity. Landowners often restrict the use of new crops and varieties, leading to low productivity and resource utilization. Crop loss due to wild animals is also substantial. The rice milling machines that are used at present are crude and damage the rice grain leading to breakage and low head and total rice recovery. Marketing of rice is quite limited with less than 15% of the harvest sold in the market (ibid).

Other rice value chain study conducted in Cambodia (Agrifood Consulting International, 2002) revealed that Rice plays an integral role in the economy of rural Cambodia. Over 80 percent of Cambodian farmers cultivate rice, primarily through traditional farming practices. For most of these farmers, rice is the major source of income and sustenance. Yet the rice sector faces a number of important constraints in Cambodia. Farmers lack consistent access to income-generating activities and credit for the purchase of inputs to rice production. Further downstream, the rice processing and distribution sector faces a number of key constraints. Milling technology is often outdated, resulting in high levels of broken rice. Furthermore, millers are fundamentally constrained by a lack of working capital that limits their ability to purchase paddy from farmers and update machinery. This contributes to the unofficial export of paddy to regional markets such as Viet Nam and Thailand and prevents Cambodia from capturing the value-adding from rice milling. The lack of capital also perpetuates the low levels of technology implicit in the sector.

Institutional and infrastructural constraints also impede the sector. High costs in the provision of credit dampen private investment by farmers and millers, forcing farmers to seek unofficial sources of credit from moneylenders, often at usury interest rates, and millers to delay or reduce

investments. Poor infrastructure, in the form of roads and irrigation dampen production incentives and reduce market access. In general, there is a fundamental lack of an enabling environment, in terms of infrastructure and institutions. This enabling environment needs to be developed in order to improve food security, alleviate rural poverty and generate export revenues from the rice industry (ibid).

The study argues that the role of the public sector in the future development of these markets should be to provide an enabling environment for the private sector to gain access to credit and improved marketing channels. The private sector should be encouraged to develop high valued niche markets, which will benefit those few farmers who are supplying high quality varieties of paddy.

3. RESEARCH METHODOLOGY

This chapter consists of description of the study area, research design (sampling design and sampling methods), data collection methods and data types and methods of data analysis.

3.1 Description of the Study Area

The study was conducted in *Metema* District. *Metema* district is located at 36°17' E and 12°39' N' in North Gondar about 900 km northwest of Addis Ababa and about 180 km west of Gondar town. *Metema* is one of the west most District's of the Amhara Regional State. The District has an international boundary of more than 60 km long distance between Ethiopia and Sudan. *Metema* is found North of Quarra and Alefa, west of Chilga south of Tach Arma Choho Districts' and east of Sudan border. It is one of the 21 Districts' in North Gondar Zone. The district is subdivided in to 18 PAs and two town associations.

The altitude of *Metema* ranges from as low as 550 to 1608 m asl while the minimum annual temperature ranged between 22°C and 28°C. Daily temperature becomes very high during the months of March to May, where it may get to as high as 43°C. Mean annual rainfall for the area ranges from about 850 to around 1100 mm. It has a unimodal rainfall. The rainy months extend from June until the end of September. However, most of the rainfall is received during the months of July and August. Rainfall during these months is erratic. The soils in the area are predominantly black and some are soils with vertic properties. There are about 9 types of soils in the area where about a quarter of the size of the District is Haplic Luvisols and about 22% are Vertisols or soils with vertic properties (IPMS, 2005). Seasonal water logging, especially during the heavy rainfall months, is so high and it is the major production problem of the area. However, the soils in the area are believed to be fertile and consequently, farmers do not apply fertilizer (IPMS, 2005).

According to CSA (2008) *Metema* has a total population of 83,000 with an area of 3995 km². Detail information about human population and land area of the district is presented in table 2.

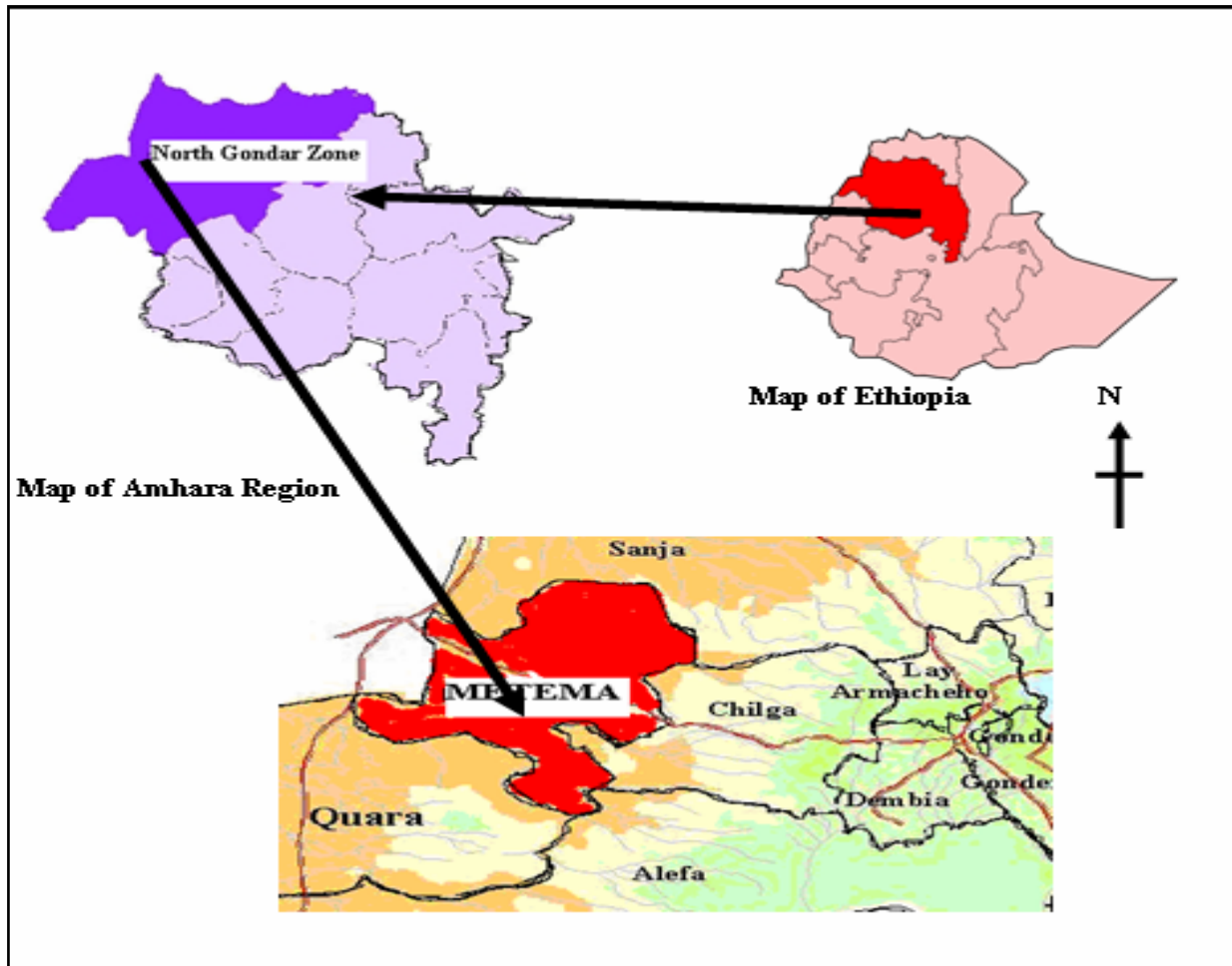
Table 2. Land area and human population in the study area

Description	
Land area, km ²	3995
Rural population	
Male	33,338
Female	28,456
Subtotal	61,794
Urban population	
Male	11,603
Female	9603
Sub total	21,206
Total population	83,000
Human population density, head/ km ²	21

Source: CSA, 2008

Only 23.6% of the area is under cultivation (Azage et al., 2009). The area has 103,908 ha of cultivated land, 71,324 ha of Smallholder, 13,908 ha of commercial farms and potential cultivable land of 18,676 ha. Besides, there is 312,300 ha of forest and grassland and 23,877 ha of uncultivable land. Average land holding is about 5 ha (IPMS, 2005) which is very high compared to the highlands.

The area is characterized by mixed farming system (i.e. crop and livestock production). Sesame, cotton and sorghum are the dominant crops grown in the area. These crops cover around 90% of cultivated area of the district (IPMS, 2005). Livestock production is an integral part of production system of the area. Production of cattle (milk, meat), goat (meat) and poultry is a common practice. Cattle are exported to the Sudan while goats are mainly used for the local market. Transhumance cattle production system is a common phenomenon with highland cattle moved to the lowlands during the main rainy seasons from June to October in search of feeds (Azage et al., 2009).



Source: Dessalegn, 2008

Figure 2. Map of the study area (Amhara region and Metema District)

3.2 Research Design

In this study, mixed methods was employed to get detail and diverse information on the same issue. Use of mixed methods also helps to triangulate the reliability of the information which was gathered. It is usual for researchers to employ mixed method designs to investigate different aspects of the same phenomenon (Sarantakos, 1998). In this study both quantitative and qualitative methods were employed. Semi-structured interview, focus group discussion, key informant interview and personal observation methods were used to gather the required data. Cross sectional type of research design was used.

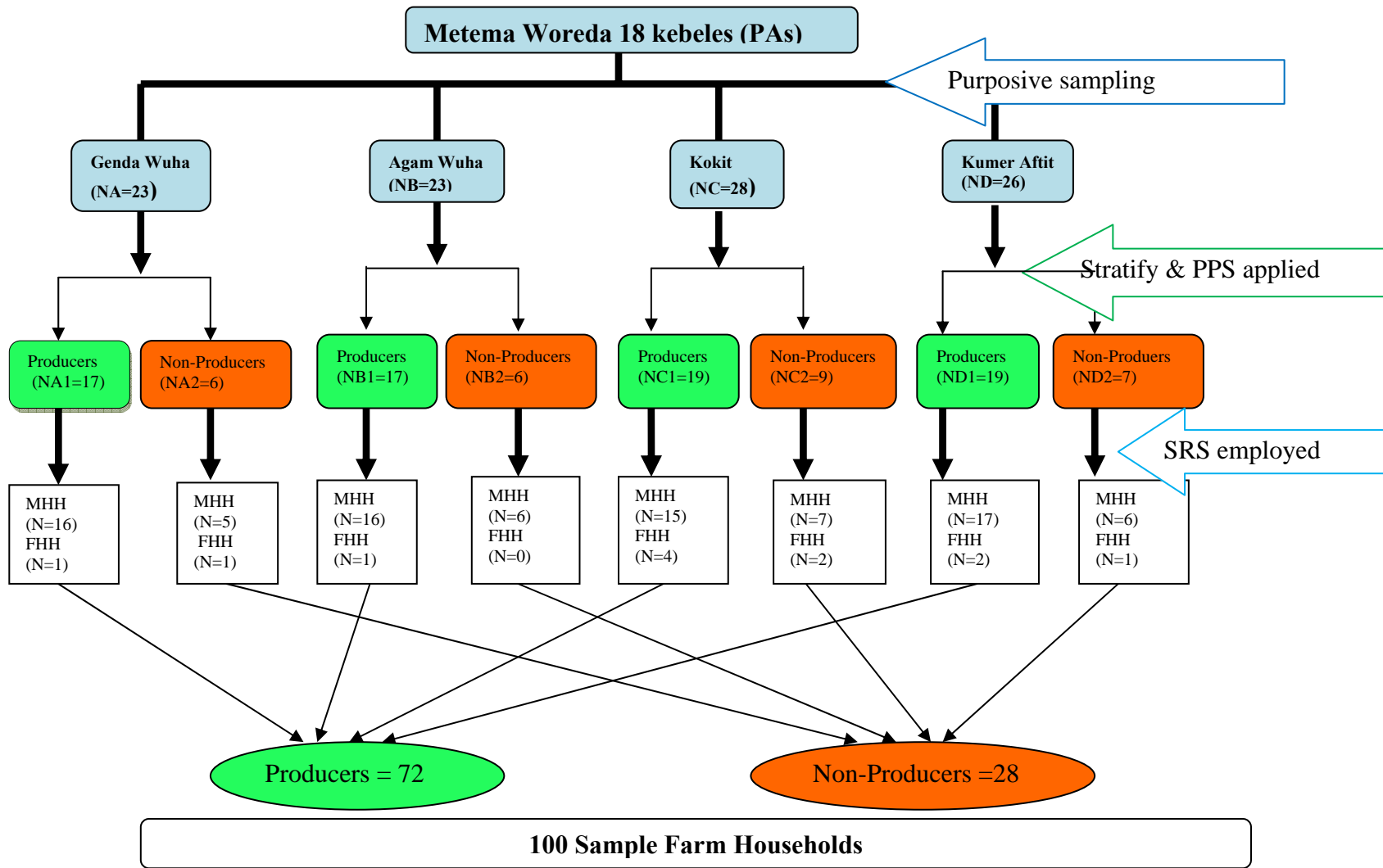
3.2.1 Sampling Procedure

The study area, Metema District, is selected purposively since the area has high potential for rice production but not efficiently utilized yet. Besides, it is one of the Pilot Learning Woredas (PLW) of Improving Productivity and Marketing Success (IPMS) project of International Livestock Research Institute (ILRI), who sponsored this research. Initially actors who were involved in a value chain were identified using review of related literature and interview of some key informants. Following this, samples were chosen from each segment of the chain to be included in this study using diverse sampling techniques.

The District has 18 PAs and 2 town kebeles. Among these 18 PAs, four PAs (Genda wuha, Agam wuha, Kumer aftit and Kokit) were selected purposively based on their accessibility and recent experience in rice production innovation. The farm households at the production stage of the value chain were stratified into two groups; rice producers and non-producers. In order to have gender disaggregated data at least 15% female headed households were incorporated in the sample for this study. Finally sample of respondents were selected using probability proportional to size method. Simple random sampling technique was used to choose the ultimate sample of households. A total of 100 sample households were chosen for the study (Fig 3).

In addition to farm households, sample respondents were also be selected from the other value chain actors including; input suppliers, market agents, consumers, and supporting actors like; research , cooperatives , extension and NGOs. Such key informants were selected purposively at various levels like selected sample PAs, Metema district, North Gondar Zone and Amhara region. One private input supplier from each sample PAs and one from Metema district were selected as input suppliers. Here primary cooperatives at each sample PAs, Metema cooperative union and DoARD were also interviewed as input suppliers. Regarding the post harvest processors, out of the 15 total grain millers in the sample PAs, only four were selected based on their experience in rice polishing service provision. The consumers were selected from both the study sites and Genda Wuha (district town). Key informants from the support service providers were selected based on their direct responsibility and possession of detail knowledge about rice development in the area. The key informants were selected from DoARD, GARC, primary cooperatives, Metema cooperative union, Amhara seed agency, ARARI and ZoARD. Detail breakdown of selected sample of respondents in the value chain is mentioned in table 3.

Figure 3 Sampling Procedure



PPS- Probability Proportional to Size
SRS- Simple Random Sampling

Table 3. Sample respondents in rice value chain in Metema

Actors	Sample selected
Producers (Farmer)	100
Input Suppliers	5
Retailers	8
Post harvest Processors	4
Consumers	10
Support services	16
Total	143

3.2.2 Method of Data Collection

Both primary and secondary data were collected for the study. The secondary data were gathered from various sources including Metema DoARD, FTCs (Farmers Training Centers) in the sample selected PAs, Gondar Agricultural Research Center, IPMS Metema PLW, primary cooperatives in the selected sample kebeles, Metema District Information Office, and other NGOs who were involved in rice research and development activities in the study area. Besides, relevant literature, official reports and memos were also consulted as secondary data source.

Primary data were collected from sampled actors/stakeholders who are involved in input supply, production, marketing, post harvest processing, consumption and supportive services (research, extension, finance, and facilitation) along the rice value chain in Metema. Household survey, focus group discussion, key informant interview and personal observation methods were employed to gather the information required from such actors. Pre-tested interview schedule and checklists (topical guideline) were employed as survey instruments.

Pre tested Semi-structured interview schedule were used to collect data from farmers. The interview schedule was pre tested on non-randomly selected households. Some modifications were made based on the result of the pretest. Interviewers, who know the area very well, were recruited and trained about the objectives of the study, methods of data collection and interviewing techniques and ethics. Then they collected the data from sample farmers with the supervision of the researcher. Along with the survey, four FGDs were be conducted in the selected PAs (one FGD in each) with 8 to10 participants in each session for in-depth understanding on selected key issues of; input supply, production, marketing, post harvest

processing, consumption, as well as constraints/opportunities, enabling environment and potential interventions to remove the constraints and take advantage of the opportunities.

Apart from farmers, primary cooperatives , farmers and some retailers who participated in rice marketing, grain millers as a post harvest processor, and supportive actors(DoARD, research centers, NGOs, District information office, and other administrative offices) were also interviewed to get a thorough understanding of all the issues at all levels in the chain. Finally, very limited number of consumers in urban areas was also interviewed.

3.2.3 Method of Data Analysis

Both qualitative and quantitative methods of data analysis were used. The study is largely qualitative in nature. System of thematic analysis was used for the data that were collected through focused group discussion, key informant interview, personal observation and secondary document analysis. Functional analysis was used to identify the various actors and their roles in the value chain. Partnerships and linkages, which are central to innovative performance in value chain, were analyzed in their historical and contemporary context to understand their strengths and weaknesses. During analysis a number of tools were employed. For instance; chain mapping and actor linkage matrix were used to identify the various actors and their function, and for mapping patterns of interaction between actors. Actor time line was also used to identify recent innovation activities undertaken and their immediate outcome along the rice value chain in the study area. Besides, SWOT (strength, weakness, opportunity and threat) analysis was used to analyze the challenges and opportunities for technological, institutional and organizational innovation across the value chain.

Regarding the quantitative analysis, simple descriptive statistics such as simple measures of central tendency, mean, standard deviation, frequency, percentages and cross tabulation were used for the survey data gathered from sample farm households. Statistical package for social science (SPSS) version 16 were employed to analyze the data. The analyzed data are presented using tables, graphs and charts.

4. RESULTS AND DISCUSSION

The main findings of the study presented in various sections. The first two section presents description of the demographic characteristics and livestock ownership of sample respondents at the production stage of the value chain respectively. The third section gives an overview of rice production in the study area. The fourth section shows current rice value chain map. The next and the fifth section briefly details the actors and their role, linkage/ interaction, attitudes, habits and practices in the rice value chain. Existing institutional arrangement and enabling environment that affect the functioning of value chain is presented in the sixth section. The seventh section discusses recent innovation activities in the rice value chain and their immediate out comes. The final section analyzes constraints, opportunities and entry points for infusing further innovations (technological, institutional and organizational) to upgrade the value chain.

4.1 Demographic Characteristics of Sample Households

The sample population of farmer respondents handled during the survey was 100. Of the total 88% were male-headed households and only 12% female-headed. Out of the total sample respondents 72(72%) have used improved rice varieties since their introduction in 1995. Out of this, respondents who have used the improved rice varieties, 64(64%) were male. While the remaining 8 (8 %) were female. Whereas, out of 100 sample respondents, 28(28%) were not using improved rice varieties. Out of this, 24(24%) and 4(4%) were male and female headed households respectively. The value of the chi-square test (23.405) indicates that there is significant relationship between sex of the household heads and use of improved rice varieties (table 4). The male-headed households are more likely to use improved varieties of rice than female ones in the study area. This might because female-headed households have limited access to improved seeds, extension services, credit and land as compared to male ones. In addition, they have limited family labor to undertake the farm operation.

As indicated in table 4, most (50%) of the total sample respondents were literate and attended grades 1 to 8, 17% attended adult education and 22% illiterate. On the bases of use of improved rice varieties, 20% and 20% of users of improved rice varieties were attended grade 1-4 and

grade 5-8 respectively. Likewise, 5% and 5% of non-users of improved rice varieties attended Grade 1-4 and grade 5-8 respectively. It was also found that, 12% and 10% of users and non users of improved rice varieties were illiterate. There was highly significant level of relationship between level of education and use of improved rice varieties at 99% level of significance. This shows households with better educational background are more likely to use improved rice varieties. Many studies revealed that there is strong and significant relation between household head level of education and use of improved varieties in particular and farm technologies in general (Degnet et al, 2001; Kidane, 2001; Tesfaye and Shiferaw,2001 and Dessalegn, 2008). Besides, Dessalegn (2008) indicated that the presence of literate people in the household means better access to information and resources, and better social networking. Thereby leads to better adoption of improved technologies at household level.

The survey also showed that the majority of respondents were married (80%); with 10% being single and 10% were either widowed or divorced. The mean age of total sample of respondents was 43.71 ranging from 18 to 70 years. The average age of users of improved rice varieties and non-users was 45.30 and 38.33 years respectively. This shows there is mean age difference between these groups. There is also highly significant relationship between mean age of head of households and use of improved rice varieties. According to focus group discussion participant farmers, since land has not been redistributed, most of the youth farmers have no their own land. They have been using rent in land that is far away from their homestead and not favorable for rice production. Thus, elder farmers are more likely to use improved rice varieties than young (youth) farmers in the study area.

Table 4. Demographic characteristics of sample of respondents

Variables	Total sample	Use of improved varieties		χ^2 /t-test	Sig.
		Yes	No		
Age				45.078	***
Mean	43.7100	45.2951	38.3333		
Sex (%)				23.405	***
Male	88.00	64.00	24.00		
Female	12.00	8.00	4.00		
Total		72.00	28.00		
Marital status (%)					
Single	10.00	5.00	5.00		
Married	79.00	60.00	19.00		
Divorced	9.00	5.00	4.00		
Widowed	2.00	2.00	0		
Level of education (%)				8.585	***
Illiterate	22.00	12.00	10.00		
Adult education	17.00	10.00	7.00		
Grad 1-4	25.00	20.00	5.00		
Grade 5-8	25.00	20.00	5.00		
Grade 9-10	4.00	4.00	0		
Religious education	7.00	6.00	1.00		
Total (N)	100	72	28		

Source: computed from own survey, 2010

***Significant at 1% probability level.

The average family size of the total sample respondents was found to be 5.19 persons. The largest family size was 14 and the smallest was 1. As shown in the table 5, there was mean family size difference between users (5.42) and non- users (4.61) of improved rice varieties. There was also statistically significant relationship between household family size and use of improved rice varieties in the study area. Dessalegn(2008) confirmed that as the number household members increase the probability of the household to make contact with different social networks and hence better access to inputs (labor, seed and information). Moreover, since labor is the single most important and expensive input in the lowlands of Amhara region in general and the study area in particular, larger families with their greater supply of labor are expected to adopt a technology than the smaller family size. Improved rice varieties require higher labor especially for weeding and harvesting activities. In this regard, households with

larger family size were likely to use the improved rice varieties than those who have lower family size.

Table 5. Household family size and use of improved rice varieties

Variable	Use of improved varieties	N	Mean	Std. Deviation	t-value	Sig. (2-tailed)
Number of Household Members	Yes	72	5.4167	1.85950	16.282	**
	No	28	4.6071	1.87260		
	Total	100	5.1900	1.88934		

Source: computed from own survey, 2010

** Significant at 5% probability level.

Farming was the main occupation and source of livelihood for all sample farmers (100%). They have been practicing mixed crop livestock production. However, in addition to the farming activities, some respondents (12%) have also engaged in small trading activities and 6% were government employees (table 6).

Table 6. Source of livelihood (occupation) of sample farmers

Source of livelihood(occupation)	Total sample	
	N=100	%
Farming (mixed crop livestock production)	100	100
Trading	12	12
Government job as guard	6	6

Source: computed from own survey, 2010

4.2 Livestock Ownership

Livestock production is an integral component of the farming system in the study area and contributes very much to rice production in particular and to crop production in general. Important animals kept by the sample farmers are cattle, sheep, goats, donkey and poultry (Table 7). Oxen are the main source of farm power for plowing, harrowing, and threshing. About 37% of the respondents owned one pair of oxen, 32% owned one, 19% owned three, 5% owned four, and the rest percent owned 5. The sample respondents have, on average, a pair of oxen (2.18) with highly statistically significant difference between users and non-users of improved rice

varieties. Similarly, donkeys are also important animal kept mainly for transportation purpose. Rural farmers mainly uses “Carro” locally made wheel pulled by single or pair donkeys. They used it to transport farm implements, seeds, production, production byproducts, water, men and women to farm plots, market and home. Majority of sample of respondents 66% have one or more donkey. On average they have one donkey (1.12).

Table 7. Livestock ownership of sample farmers

Type	Use of improved varieties				Total Sample		t-test	Sig.
	Yes		No		N	Mean		
	N	Mean	N	Mean				
Ox	48	2.3542	14	1.5714	62	2.1774	2.254	***
Cow	41	3.0732	10	1.8000	51	2.8235		
Calf	42	2.7619	8	2.7500	50	2.7600		
Bull	12	1.2500	4	1.0000	16	1.1875		
Heifer	29	1.6897	6	1.3333	35	1.6286		
Donkey	51	1.1176	15	1.1333	66	1.1212		NS
Goat	43	6.3721	12	5.3333	55	6.1455		
Sheep	11	3.6364	7	5.8571	18	4.5000		
Hen	51	6.3725	14	5.3571	65	6.1538		
Beehives	6	3.5000	1	8.0000	7	4.1429		

Source: computed from own survey, 2010

***Significant at 1% probability level.

NS- not significant

The study revealed that the difference in the ownership of number of oxen has implication on the use or adoption of improved rice varieties. Farmers who have high number of oxen are more likely to use improved rice varieties than those with small number of oxen.

4.3 Overview of Rice Production in Metema

Rice is a new crop in the country as well as in the study area, Metema. It was introduced very recently. According to elder farmers and Metema DoARD senior rice agronomist, rice production has been introduced to the area since 1995. Its introduction started as an adaptation trial with three introduced varieties namely; X-Jigna (N. KOREA), Kokit (IRAT-209), and Tigabe (IREM-194) by AARC and DoARD over an area of 2.5ha. In the meantime, farmers were exposed to the adaptation trial and trained about various rice food preparation techniques. In view of that, farmers showed high interest to obtain and produce the seed. Even if the adapted varieties were not approved and released by the seed approval committee of the country, based on farmers demand, the adapted varieties had been released informally and delivered to farmers for demonstration purpose. However, among the adapted varieties Kokit (IRAT-209) and Tigabe (IREM-194) varieties were formally released by AARC for Metema and its surrounding areas in 1999/2000 (Sewagegne, 2005; and Taddese, 2005).

According to *IPMS (2005)*, before 2002, these varieties were well accepted and widely grown by many farmers in Meka, Awlala, Genda Wuha ,Kemechela, Kokit and Agam wuha PAs of Metema. During this time, there was one rice polisher in Genda wuha¹ where all farmers bring and polish their paddy rice. It was provided to the District for demonstration purpose with the facilitation of regional agriculture bureau. It encouraged farmers to produce more and to adapt rice feeding, and the numbers of farmers who produce rice reach approximately 500ha. Farmers were getting the service charged with 0.75 birr / kilo of paddy rice. However, the polisher was transferred somewhere else and farmers were discouraged to grow rice. Even though new polisher was given to the District, farmers were dispirited to produce rice between the years 2002-2004 since the new polisher was not installed on time due to administrative and institutional failure, and many farmers were not aware about the presence of new polisher (personal communication). As a whole, the rice polisher was owned and provides service by the facilitation of DoARD and former cooperative office (currently included in DoARD). According to some key informant farmers and staffs from such offices pointed out that absence of continuous supervision about polisher service provision, lack of assigned responsible person,

¹ Genda wuha is the District town of Metama

shortage of budget and technical person to maintain at times of technical failure were some of the challenges for less effective and efficient rice polisher service provision.

In addition to the absence of polisher, the variety that was grown in the District was affected by shortage of rainfall further discouraged farmers from growing rice. As a result, only 8 ha were under rice in 2004 (IPMS, 2005). Furthermore, According to focus group discussion participant farmers, there was problem of efficient service delivery especially of polisher service. The number of farmers who brought their production to the polisher was too small. Accordingly, they were forced to leave their production in the polishing center until some more rice came to it. That was to save fuel. Hence, this wastes time, cost and effort of farmers thereby discouraged to grow rice. The polisher has also high crack percentage which was not preferred quality for market purpose.

Considering such a problem, ARARI with its branch centers has developed new varieties that could tolerate shortage of rainfall and is adaptable to the area. Following the launching of IPMS project, the project took rice as one of its target commodity and facilitates market oriented crop production through creation of partnership with respective stakeholders; it started to work together with Gondar agricultural research center. Collectively, these conditions might then encourage farmers to grow rice again. Then after, a number of interventions have been undertaking with the facilitation and budget support of IPMS. The innovative activities which were made so far and their immediate outcomes are briefly described in a subsequent section which discuss about innovations in rice value chain development.

4.3.1 Land Holding and Area Allocated to Rice

The average land holding size of the respondents was 5.88 ha which is higher than the national average holding size per household and holder 1.25 and 1.21 ha respectively (CSA, 2007) and the regional average holding size of 1.04 ha per household. Out of the total sample respondents (100), 70(70%) have their own arable land, 48(48%) have rented land and 3(3%) rented out their land to others (table 8). The result of the study also shows strong and statistically significant relationship between average land holding size and use of improved rice varieties. This

highlights as the amount of own and rented in land increases the probability to use improved rice varieties also increased. This in turn increases the chance to get a land with favorable soil characteristics for rice production.

As shown in table 8, the amount of mean area allocated for rice shows an increasing trend in the previous three years (2007-2009). However, the mean amount of land allocated for rice in the last three years is very small as compared to the average land holding size.

Table 8. Land ownership and amount of land allocated for rice production (2007-2009)

Variables	Total Sample		Use of improved varieties				t-test	Sig.
	N	Mean	Yes		No			
			N	Mean	N	Mean		
Land Ownership (ha)								
Own arable land	70	5.8893	58	6.3017	12	3.8958	1.527	***
Rented in arable land	48	3.5260	31	3.4677	17	3.6324		
Rented out arable land	3	2.0833	3	2.0833	0	0.0000		
Total(N)	100		72		28			
Amount of land allocated for rice production(ha) N=72								
	N	Minimum	Maximum	Mean	Std. Deviation			
2007	27	.125	1.500	.34259	.297410			
2008	38	.001	1.500	.36516	.330538			
2009	47	.125	1.250	.49202	.352981			

Source: computed from own survey, 2010

*** statistically significant at 1 % probability level

4.3.2 Type and Source of Input Used for Rice Production

According to the current study all sample of respondents (N=100) interviewed have awareness about the presence of improved rice varieties that can grow in their surroundings at different points in time (since its introduction in 1995 up to the time of the survey). As indicated in table 9, out of 100 samples of respondents, 72 (72 %) households have produced/used the improved

varieties since their introduction in 1995. While the remaining 28% are not producing rice. Households used modern inputs (chemical fertilizer, chemicals and farm implements) for rice production. Cooperatives, FREG members², neighbor farmers, DoARD and DAs were identified as source of those inputs mentioned by most of the respondents.

Table 9. Type and source of input used in rice production in Metema

Did you use agricultural inputs?	Type of inputs used							
	Improved seeds		Fertilizer		Herbicide		Farm implements	
	N	%	N	%	N	%	N	%
Yes	72	72	45	62.5	58	80.6	6	8.3
No	28	28	27	37.5	14	19.4	66	91.7
Total(N)	100		72		72		72	
Source of Input								
Primary Cooperatives	19	26.4	45	100	52	89.7	0	0.0
Local market	1	1.4	5	11.1	0	0.0	0	0.0
DoARD	22	30.6	0	0.0	0	0.0	6	100
FREG members	30	41.7	0	0.0	0	0.0	0	0.0
Research centers	11	15.3	0	0.0	0	0.0	0	0.0
Private suppliers	0	0.0	0	0.0	42	72.4	0	0.0
Friend/relative outside the village	13	18.1	0	0.0	0	0.0	0	0.0
Friend/relative in the same village	15	20.8	0	0.0	0	0.0	0	0.0
Neighbor farmers	38	52.8	0	0.0	0	0.0	0	0.0
Total(N)	72		45		58		6	

Source: computed from own survey, 2010

Type and source of improved varieties used

Since rice is a new crop for the country as well as in the study area, there is no local variety grown in the area. Various improved varieties; “X-Jigna”, “Kokit”, “Tigabie”, “NERICA-3”, “NERICA-4” and “Supperica-1”, were introduced in to the area at different point in time starting from 1995. As can easily be seen from figure 3, the majority (32.40%) of the respondents did not know the names of the varieties they used. However, 8.5%, 4.2%, 8.5%,

² Farmers research and extension group (FREG) is a group of farmers organized to participate farmers in the research and development activities of rice through on farm seed multiplication and dissemination.

21.1% 14.1% and 11.3% of the respondents used “X-Jigna”, “Kokit”, “Tigabie”, “NERICA-3”, “NERICA-4” and “Supperica-1” varieties respectively.

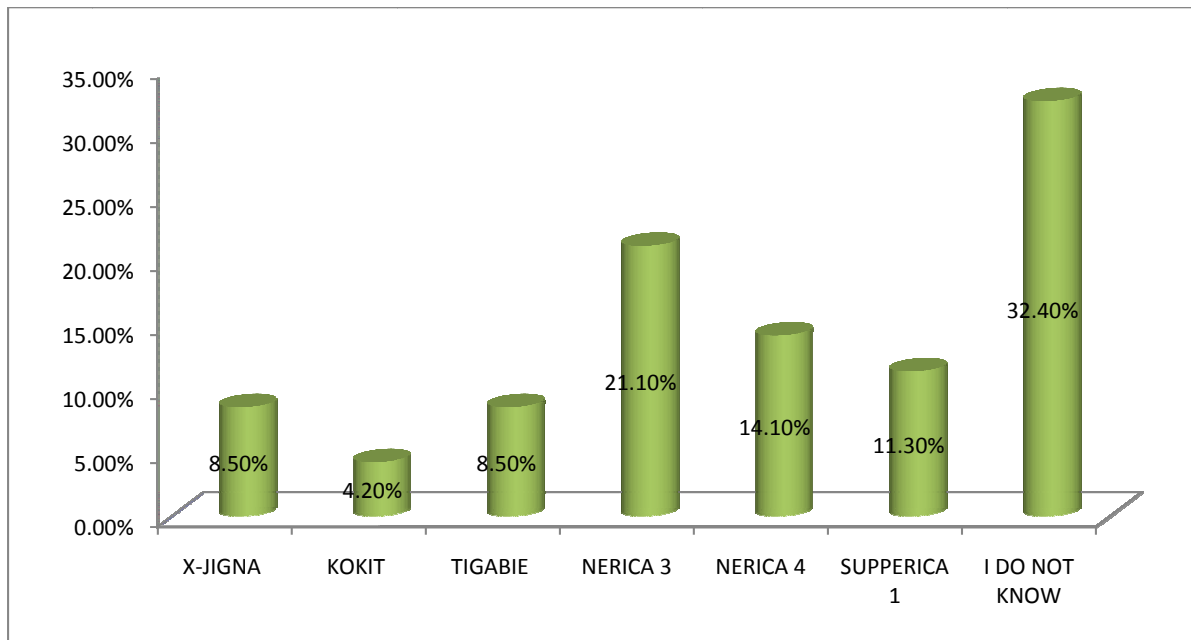


Figure 4. Type of varieties used by the sample respondents

Source: Drawn from own survey, 2010

In the study area, farmers used multiple sources to get improved varieties. As indicated in table 9; neighbor farmers, FREG member farmers, DoARD and primary cooperatives are the most important source of rice seed. Out of 72 respondents, those who used improved varieties, majority (52.8) obtained the seed from their neighbor farmers who are using improved rice varieties. The other 41.7%, 30.6% and 26.4% respondents used FREG member farmers, DoARD and primary cooperatives as seed source respectively. Besides, Gondar Agricultural Research Center was also mentioned as source of seed by very limited number of respondents (15.3%). These might be host for improved rice varieties demonstration and popularization intervention of Gondar Agricultural Research Center in the study area. According to focus group discussion, farmers obtained the seeds through exchange either in the form of cash or in kind. They also obtained it as a gift from their neighbor farmers, friends/ relatives within or outside their village. In general, the survey result shows, farmers are obtaining the improved varieties from informal sources like neighbor farmers, FREG member farmers, and friends/ relatives. Therefore,

strengthening farmer-to-farmer seed exchange will help for better dissemination and diffusion of rice varieties in the study area.

Fertilizer use

It is evident that chemical fertilizer could boost both production and productivity. Out of 72 sample respondents who grow rice varieties, 45(62.5%) used chemical fertilizer. Whereas 27(37.5%) was not using fertilizer (table 9). High fertility of soil coupled with limited availability and high price of fertilizer was the main reason reported during the focus group discussion with farmers. As indicated in table 9, primary cooperatives are sources of fertilizer for all respondents who used chemical fertilizer (45).

Chemicals used

In Metema District, the level of weed infestation is very high. During the focus group discussion farmers reported weed as a serious problem not only for rice production but also for other crops grown in the area. Hand weeding is highly labor intensive. Nonetheless, due to harsh environmental condition labor shortage is highly pronounced. Some key informant farmers identified weed problem as one of the major factors that affect the amount of land allocated for rice production. Accordingly, the demand for herbicides is very high. This is because use of herbicide helps them to reduce both labor and production costs and amount of time spent for weeding. The survey result, as indicated in table 9, showed that out of 72 sample respondents who grow improved varieties 58(80.6%) used herbicides for rice production. Out of those respondents who used herbicides, 52(89.7%) and 42(72.4%) of respondents obtained from primary cooperatives and private input suppliers respectively. This implies increasing the availability and supply of herbicides might increase the intensity of adoption or use of improved rice varieties.

Farm implement

As indicated in table 9, out of 72 sample respondents who used improved varieties, only 6(8.3%) uses farm implements in rice production particularly of BBM to drain soil with excess moisture.

whereas majority 66(91.7) are not using farm implements. All respondents who used farm implements mentioned DoARD as the only source for the supply of such farm implements.

4.4 Rice Value Chain Mapping

According to McCormick and Schmitz (2001), value chain mapping enables to visualize the flow of the product from conception to end consumer through various actors. It also helps to identify the different actors involved in the rice value chain, and to understand their roles and linkages. Consequently, the current value chain map of rice in Metema is depicted in figure 4.

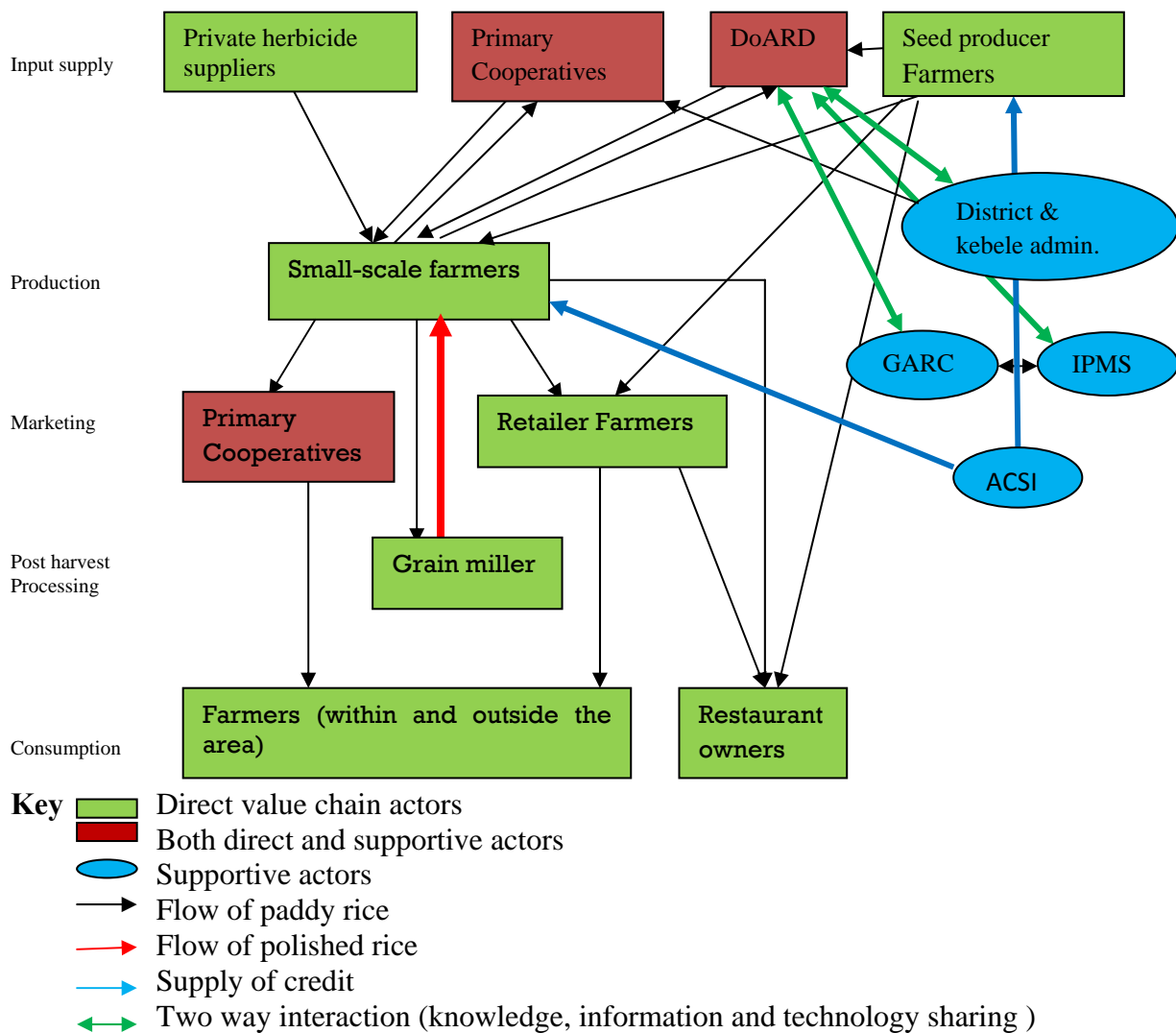


Figure 5. Current rice value chain in Metema

Source: own survey, 2010

4.5 Actors, their Role, Linkage, Attitudes, Habits and Practices in Rice Value Chain

Here in this section, actors involved, the role they have been playing, the prevailing linkage, attitude and practices of actors in the rice value chain is assessed. It is presented in four sub-sections. The first sub-section tries to answer who are the actors involved and what role they have been playing? Following this, the linkage between rice value chain actors (actors' interaction) is presented in the second section. The attitudes, habits and practices of actors, and actors missed in the value chain are also illustrated in the third and final section respectively.

4.5.1 Actors and their Role

This section presents the actors and the role they play in the rice value chain in the study area. In the same way as to Ghimiray et.al (2007), actors and their role is assessed along the different stages of the value chain as; input supply, production, marketing, processing and consumption. The functional analysis result, as clearly presented in appendix 1, highlighted the involvement of diversity of actors who are participated directly or indirectly in the value chain. According to KIT et al. (2006), the direct actors are those involved in commercial activities in the chain (input suppliers, producers, traders, retailers, consumers) and indirect actors are those that provide financial or non-financial support services, such as credit agencies, business service providers, government, NGOs, cooperatives, researchers and extensionists.

In the study area, there are multiple public and non public actors involved along the rice value chain, upstream from input supply to downstream consumers, playing different role. They were; input suppliers, producers, traders, consumers and supporting (indirect) actors. Some functions or roles are performed by more than one actor, and some actors perform more than one role. A brief description about actors involved and their role is mentioned in Appendix 1.

4.5.1.1 Input Supply Stage

At this stage of the value chain, there are many actors who are involved directly or indirectly in agricultural input supply in the study area (Appendix 1). Currently, DoARD and primary cooperatives/ union are the main source of input supply. To some extent private input suppliers,

rice growing farmers, and Gondar Agricultural Research Center are also participated in such activity. All such actors are responsible to supply agricultural inputs; improved seed varieties, fertilizer, herbicide and pesticide, and farm implements which are essential inputs at the production stage.

District office of Agriculture and Rural Development (DoARD)

Regarding the delivery of inputs like; chemical fertilizer, herbicide and pesticide, and farm implements; DoARD is the only actor responsible for the supply of such inputs in areas where there is no primary cooperatives. According to District cooperative promotion main process experts, out of the total 20 Kebeles of the District, only 12 kebeles have primary cooperatives. Besides, it also plays a role in provision of improved varieties through purchasing either from research centers (GARC), seed multiplication agencies, farmers' cooperatives who are working in rice growing areas of the study area, and individual rice producer farmers. It distributed the purchased seed directly to farmers or primary cooperatives on a cash base by adding a transport cost.

Development agents are the main players in input supply activities at grass root level. Their role is different depending up on the presence or absence of primary cooperatives. In areas where there are primary cooperatives , they are playing facilitation role in collecting farmers input requirement/ demand and submitting it to the primary cooperative in their respective kebeles and DoARD. They also play the same role during input distribution. Whereas, in areas where there are primary cooperatives, besides collection of input demand, they are also fully responsible to distribute the input supplied and collect the money with the support of kebele administrations.

Primary Cooperatives / Union

In metema, there are 12 primary cooperatives and one cooperative union. The maximum number of primary cooperatives in each PA is only one. Primary cooperatives are playing an important role in the supply of input required for rice production. Fertilizer, herbicide and pesticide, and improved seeds are the main inputs delivered. These inputs are supplied either in cash or in loan

base. Officials from those primary cooperative in the sample PAs indicated that, by considering the prevailing high rice seed demand among farmers and nearby DoARD in to consideration, they enter in to supply of improved rice varieties very recently by collecting seed from individual rice producer farmers. This was just to facilitate the diffusion of improved rice varieties.

Metema cooperative union is the only cooperative union in the study area based in the District town (Genda Wuha). It played a major role in the supply of input for primary cooperatives and DoARD. Based on input demand from primary cooperatives and DoARD, it undertakes input purchase following an auction process. Ultimately, it distributes the purchased input to the respective primary cooperatives and DoARD again to distribute to farmers. One expert from Metema cooperative union explained that the union supplied fertilizer, chemicals and improved seeds.

Private Input Suppliers

Private input suppliers are also playing a limited role in the supply of agricultural inputs particularly of herbicides. These suppliers are situated both at local and urban centers. As per farmers expression, due to problem of seasonal labor shortage and high wage rate especially at times of weeding, they have been using herbicides namely; 2-4-D. This helped them to reduce weed infestation and cost of labor both for land clearing and weeding. Hence, those suppliers provide them timely supply of herbicides on a cash base without moving longer distance at the required quantity.

Gondar Agricultural Research Center (GARC)

Even though GARC has no mandate to supply input, it was involved in such activity particularly of supply of improved seeds either directly to farmers (for demonstration and on-farm seed multiplication) or to DoARD to distribute among farmers in potential rice growing areas of the District. Amhara region food security bureau has also played role indirectly through provision of budget to Gondar Agricultural Research Center to make researcher managed station based seed multiplication. Accordingly, during 2008/09 cropping season more than 160 quintal of improved

upland rice varieties namely; NERICA-3 and NERICA-4 were multiplied and delivered to Metema DoARD to scale up the production of rice in appropriate areas.

Amhara Region Seed Agency

Following an increasing demand for improved rice variety seed, in 2009/10 cropping season, the agency has attempted to multiply seed on farmers' fields on the base of contractual agreement. Consequently, interviewed DoARD experts reported that an agreement was signed between DoARD and the agency to undertake on-farm seed multiplication on 300 farmers over an estimated area of 205 ha. Unfortunately, due to the prevailing rainfall shortage, it was difficult to get good quality seed. As a result, the agreement could not success. On the other hand, experts from the seed agency indicated that, producing cereal seeds is not a profitable venture for the agency. This is because once the farmers get basic seed the demand for quality seed from the agency decline from time to time since they prefer to get it from other farmers or local market in the nearby area either in the form of loan, gift, and exchange (in cash or kind).

4.5.1.2 Production Stage

Small scale Farmers

The small scale farmers are the key actors who are directly involved in rice production activities. The farmers are largely subsistence producing very little rice for household consumption as well as for market. Thus, the scale of production is too small as per the potential of the area. According to MoARD(2010) the trend in the number of rice producing farmers, area allocated and production in the study area shows high increase rate especially since 2006. As shown in the graph below, the number of farmers who are engaged in rice production has increased from 351 in 2006 to 10,275 in 2009. Similarly the area coverage has also increased from 117 to 7200 ha of land from 2006-2009.

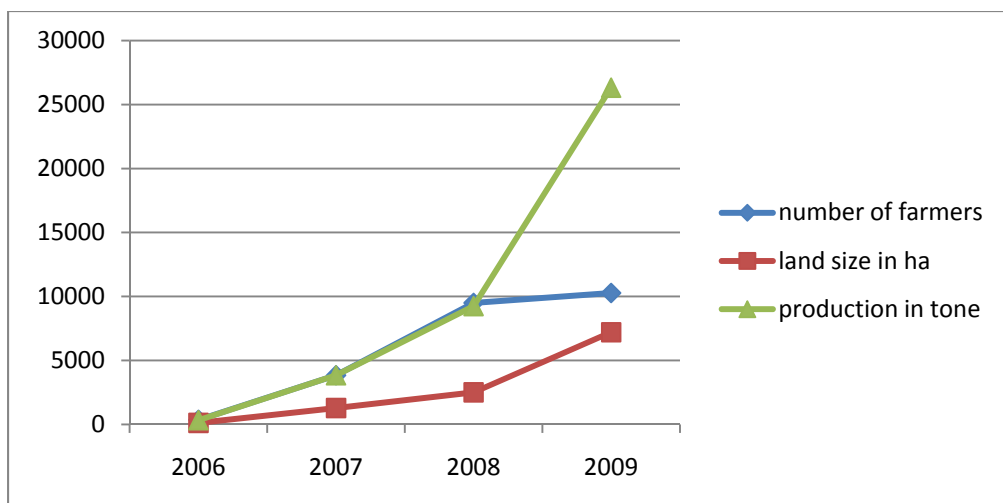


Figure 6. Trends in the number of rice producing farmers, area allocated and production in Metema

Source: Adapted and modified from SG2000, 2009(unpublished) cited in MoARD, 2010

The statistical figures obtained from this source (MoARD, 2010) about the amount of area covered with rice and number of farmers involved in rice production is a bit exaggerated as compared to the data obtained from Metema DoARD. According to crop field evaluation, report of DoARD (2007/08- 2009/2010 cropping seasons) the amount of area covered with rice is only 49.25, 262.5 and 523.75 ha of land for these three consecutive years respectively. Regarding the number of farm household heads who produce rice; only 227, 1082 and 2137 farmers were involved in rice production from 2007/08 to 2009/10 cropping seasons respectively.

4.5.1.3 Marketing Stage

In the area, there is no well developed rice marketing system rather it is informal in type. The marketing actors are very limited in number. Currently, primary cooperatives, producer farmer themselves and some retailing farmers are identified as market actors (appendix 1). Primary cooperatives in sample PAs of this study are involved in purchase of improved rice seed varieties from rice producing farmers in their area and resell it to other farmers by adding some cost of transportation and storage. Furthermore, primary cooperative officials in Kokit and Agam Wuha PAs reported that they also sell the collected rice seed to other nearby DoARD (Quara, Liyarmachiho and west Armachiho).

Out of the total 72 sampled rice producer farmers, during 2008/09 cropping season, 46 (63.9%) of the households sold their paddy rice in the local market. Whereas, the remaining 26(36.1%) of the respondents did not sell to the market. It is believed that these farmers consume what they produce and stored their produce for seed use. As can be seen in the table 10, from the total average amount of production (12.1154 qt.), 8.53 qt. (70.45%) was used for consumption and 4.21 qt. (34.78%) was sold. Total amount of rice that is marketed per household in 2008/09 was on average 193.86 quintal. This implies that farmers are producing rice mainly for consumption purpose.

Table 10. Average amount of rice produced, consumed and sold at a household level

Descriptive measures	Total amount of Rice produced (qt)	Amount used for Consumption (qt)	Amount of Rice sold (qt)
N	72	72	46
Mean	12.1154	8.5357	4.2143
Minimum	3.50	2.50	1.00
Maximum	24.00	24.00	14.00
Std. Deviation	7.24613	6.35629	4.04168
Sum	872.31	614.5704	193.8578
(%)	100	70.4533	34.78

Source: computed from own survey, 2010

Farmers sold their production (paddy rice) to cooperatives, other farmers and some retailer farmers in their vicinity. Besides, some farmers also replied they sold to some urban consumers (restaurant owners). Among those farmers who sold rice, 52.17% replied that they sold to other farmers. The other 36.96%, 6.52% and 4.35% sold to primary cooperatives, retailer farmers and urban consumers (restaurant owners) respectively (table 11). According to farmers' focus group discussion participants, a kilo of rice seed was sold at 8birr/ kg at the local market. When it was exchanged, farmers exchange one kilo of rice with 1 kilo of white teff or 3 kilo of sorghum. However, rice was not sold like any other crop in the market yet.

Table 11. Buyers of rice in Metema

Buyers of paddy rice	N=46	%
Farmers	24	52.17
Cooperatives	17	36.96
Retailer Farmers	3	6.52
Consumers	2	4.35

Source: computed from own survey, 2010

In addition, some private cereal traders and rural petty shops were also involved in rice marketing. However, the rice that they sale is imported from other areas; Woreta and Gondar rice retailers.

4.5.1.4 Post harvest Processing

After harvesting, the paddy rice should be separated from its husk³. Otherwise, it could not be used for consumption as well as market purpose. However, there was no any rice polisher machine in the study area. Currently, grain/flour millers are the only actors who are involved in providing rice-polishing service by substituting the formal rice polishers. Farmers pay 0.40 birr per kilo of paddy rice for the service they have. According to owners of millers, they polish the rice at zero gear and resulting in high percentage of broken milled rice. Thereby, the quality of rice milled is very poor. Hence, it is not used for market rather they used it for household consumption. This highlights a need to ensure the availability and installation of proper rice polishers near to potential production areas. In doing so, farmers will be encouraged to produce more and the produce can then be brought to market in sustainable way.



Figure 7. Grain/flour mills in Metema

Photo: Author

Farmers use back of animals, animal pulled cart “Carro” and manpower to transport rice in to the millers found in their surroundings. Regarding storage of rice, the survey result shows that 96.4% of sampled farmer’s store their paddy rice in locally made storage bins called “*Gottera or*

³ Husk is inedible and hard cover of paddy rice

Gota” which is made of bamboo tree plastered with mud. While, 3.6% of respondents used sack/bag in their home.



Figure 8. Animal pulled cart used for transportation in Metema **Figure 9.** Storage bans to store rice

Photo: author

4.5.1.5 Consumption Stage

Rice consumers were two types; rural and urban consumers. The former includes producer farmers themselves and other farmers those who did not have their own produce. Farmers those who did not have their own produce get it through purchase of paddy rice from other farmers or polished one from rural petty shop who retail imported rice from Woreta or Gondar market. Among the total sample of respondents 89% responded that they have been using it for consumption. Majority (75%) of sampled households respond own production as a source of rice consumed. The remaining mentioned either purchase of paddy from producer or polished one from rural petty shops (table 12). According to key informant farmers, the amount purchased is limited in quantity since the price is too high especially when purchased from rural shops. It cost about 12birr per kilogram of polished rice. They also indicated that they frequently use it to make soup”Shorba” at fasting time particularly by Muslim religion followers.

Table 12 . Status and source of rice consumption

Variables	N=100	Percent
Rice consumption		
Yes	89	89
No	11	11
Source of rice consumed		
Own production	72	72
Purchased paddy rice from farmers	13	13
Purchased polished rice from rural petty shops	15	15

Source: computed from own survey, 2010

Currently majority of producer farmers use it for household consumption and little for the market mainly of as seed. They use it to make traditional Ethiopian foods like; “Injera” and bread”Dabo” either mixing with sorghum or alone, soup ”Shorba”, and couscous “Kinche”. It is also used to prepare locally made traditional beverages like “Tella” and alcohol”Arekie”. According to women key informants, before the introduction of rice, they utilized cereal (mostly of barley) for malt making. They obtained the barley from highland areas at high market price but now they have been using rice. They confirmed that once it is polished, they prefer it for its ease of preparation. It can simply be prepared in the form of soup or couscous by boiling for a short period. Women farmers also explained that it helps them to save their time and energy consumption. Again, it is highly preferred for its high palatability, color (white) and good taste as compared to sorghum for household consumption. Sorghum is the most staple food in the area. Furthermore, they also used the rice straw for house construction (mixing of the chopped straw with mud) and for livestock feed or fattening activity using urea treatment.

The urban consumers were very small in number since there was no polished rice in the study area. This is due to unavailability of rice polisher in the vicinity. Some restaurant owners in urban centers were also consumers of rice produced in the area.

4.5.1.6 Supporting actors

Such actors are those who provide supportive services including training and advisory, information, financial and research services. According to Martin et al. (2007), access to information or knowledge, technology and finance determines the state of success of value chain

actors. DoARD, primary cooperatives, ACSI, Gondar agricultural research center and IPMS in Metema PLW are the main actors who play a central role in the provision of such services.

Training and Advisory Service

DAs, DoARD, research centers and NGOs were the main source of rice training. The survey result revealed that 25% of sample respondents participated in rice training that was organized in the last three years. As shown in table 13, 13% got training from Gondar agricultural research center, the other 12% of respondents participated in training organized by DoARD (DAs). Here, key informant DAs and SMSs from DoARD indicated that IPMS Metema PLW and SNRM project were also played great role in facilitation of the training via provision of budget support.

Table 13. Rice training by organization in Metema

Organizer of Training	Training Participants	
	N=100	%
Gondar Agricultural Research Center	13	13
DoARD (DAs)	12	12
Total	25	25

Source: computed from own survey, 2010

Regarding advisory service, among the total sample farmers who used improved rice varieties (72), 37(51.39%) have been getting advisory service in the rice value chain. DoARD through its DA backed by the district subject mater specialist is the major actor who provides information and advisory service on rice production and management practices. Besides, Gondar agricultural research center, FREG members and neighbor farmers/friends were also mentioned as source of information, advice and experience (table 14). Furthermore, farmers during the focus group discussion indicated that they are getting information particularly of input availability and price from primary cooperatives.

Table 14. Source of advisory service

Source of Advisory Service	Total	
	N=37	%
DAs	31	86.1%
FREG Members	1	2.8%
DoARD Experts	8	22.2%
Research Centers(GARC)	11	30.6%
Neighbors and Friends	25	69.4%
Total	76	211.1%

Source: computed from own survey, 2010

Sample of respondents also identifies the way how they have got the service. Majority of respondents mentioned farm-to- farm visit by DAs, visit to demonstration / model farmers' site and farmer- to- farmer information exchange around homestead as mechanism of getting the service. See detail description in the table 15.

Table 15. Advisory and technical information dissemination method

Mechanism of advisory service provision	Total	
	N= 37	%
Farm to farm visit by DAs	29	80.6%
Visit to demonstration/ model farmers site	19	52.8%
Training	11	30.6%
Field day/experience sharing tour	9	25.0%
Farmer to farmer exchange around homestead	16	44.4%

Source: computed from own survey, 2010

Financial services

In the study area, primary cooperatives, and Amhara Credit and Saving Institute (ACSI) have been identified as a potential source for credit both in kind or on a cash base. The survey result showed that only 48% took credit but the rest did not take credit.

Table 16. Credit availability to the sample farm households

Did you get credit before?	PAs				Total	%
	Genda wuha	Agam wuha	Kumer aftit	Kokit		
Yes	12	6	12	18	48	48
No	11	17	14	10	52	52
Total	23	23	26	28	100	100

Source: computed from own survey, 2010

With regard to credit source out of 48 sampled farmers who took credit, 27.08% of the farmer get credit from Amhara Credit and Saving Institute (ACSI), 85.4% get credit from service cooperatives. From a sample of 48 credit users, about 83.3% used the obtained credit to pay for hired labor and the other 41.7% and 47.9% used the credit to purchase plough oxen and to pay for rented in oxen respectively. About 16.7% used for seed and fertilizer purchase.

Table17. Source and purpose of credit used by sample of respondents

Credit Source	N=48	%
AISCO	13	27.8
Primary Cooperatives	41	85.4
Neighbors	22	45.8
Credit Purpose		
Payment for hired labor	40	83.3
Purchase of fertilizer & seeds	8	16.7
Purchase of ploug oxen	20	41.7
Payment for rented oxen	23	47.9

Source: computed from own survey, 2010

4.5.2 Actors' interaction

In order to have a better understanding of the value chain, once the actors are identified, it is also important to analyze what their interactions/linkage looks like. According to Hall *et al* (2007), to understand patterns of interaction between different actors and organizations, it is first important to map linkages in general ways, but then it is also necessary to understand the nature and purpose of these linkages. Hence, actor linkage matrix tool was used to understand pattern of interactions between the key actors. It allows seeing the extent of links to be systematically investigated.

In the actor linkage matrix, all relevant actors are listed on both the first row and first column of the matrix. Each box in the matrix then represents the linkage between the two actors. The bold ones indicate the presence of strong linkage. As shown in the linkage matrix table 18, strong linkages were observed between rice producers (farmers), primary cooperatives as source of input and marketing, and grain/flour millers. More specifically, even though there are similar actors involved at the various stage of the value chain, the linkage between farmers themselves as a producer and input supplier(through informal farmer-to-farmer seed exchange), primary cooperatives again as input supplier and marketing actor, and grain/flour millers as a post harvest processor were very strong. Whereas, the other links that each actor have just for the purposes of accessing a technology, information and knowledge/experience or collaborating on a joint activity. Such a linkage, however, has its own paramount importance to upgrade the value chain and to have an efficient and effective competitive advantage from the development of the sector. According to Anteneh (2008), the weak interaction among actors might radiate from the actors' habit and practice of poor knowledge and information sharing and missing actor/role that are critical for coordination. These weak interactions call for strong efforts to strengthen the capacities of relevant actors for interacting and learning.

Most of the interactions/linkages along the value chain predominantly of horizontal linkage types; between input suppliers, producers, marketing agents, post harvest processing and consumers. Regarding vertical integration, it is difficult to say there is vertical linkage among value chain actors and external organizations/institutions who are directly involved in rice development in the area as well as in the country.

The type of linkage mostly of informal type mainly between supportive actors in the value chain. There was no any formal and structured linkage mechanisms developed before. However, some of the actors used different kinds of linkage mechanisms. For instance, Gondar agricultural research center and IPMS Metema PLW employed budget, report and joint planning review programs as their linkage mechanisms. The others use informal type of linkage. Various reasons were mentioned as linkage constraints; lack of responsible body who is working on facilitation of linkage among the actors, absence of budget for linkage, lack of institutional/ policy support to create linkage.

Table 18. Metema rice value chain actors linkage matrix

Actors	Private input suppliers	Producers(farmers)	Processors (grain millers)	Consumers	DoARD	Coops.	ACSI	Kebele Admin.	District Admin.	District Info. Office	IPMS	ARARI	SNRM	Amhara Region Food Security bureau	Regional seed agency
Private input suppliers		Input supply (herbicides)	Nil	Nil	Nil	Nil	Credit source	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Producers (farmers)		Exchange of knowledge, information and Supply of inputs	Milling/polisher service	Source of paddy rice	Service (training, advisory and input supply)	Input and credit source, marketing link	Credit source	Admin support	Nil	Awareness creation	Facilitation of Training and technical support	Training, Source of improved rice tech.	Facilitation of training and technical support	Nil	Contractual seed production agreement
Processors (grain millers)				Milling/polisher service	Nil	Nil		Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Consumers				Exchange of knowledge and information	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
DoARD						Capacity building, Technical and admin support	Nil	Admin support	Member of the cabinet	Activity documentation and promotion	Capacity building, linkage facilitation	Training, joint activities(FREG formation), provision of rice polisher	Facilitation of training and technical support	Nil	Facilitation of seed production
Coops.							Nil	Admin support	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Kebele Admin.									Line management	Nil	Nil	Nil	Nil	Nil	Nil
District Admin.										Member of the cabinet	Nil	Nil	Nil	Nil	Nil
District Info. Office											Documentation and promotion	Documentation and promotion	Nil	Nil	Nil
IPMS												Joint planning, implementation of training and demonstration	Nil	Nil	Nil
ARARI													Nil	Proviso of budget for seed multiplication	Nil
SNRM Project														Nil	Nil
Amhara Food Security															Nil
Regional seed agency															

4.5.3 Missing Actors and/or Role in Rice Value Chain

As discussed in section 4.3.1 and summarized in Appendix 1, there are diversity of actors involved in each stage of the value chain; input supply, production, post-harvest processing, marketing and consumption. Even though diversified actors are emerging, it is important to get some understanding of any missing actor, competencies, links and roles that exist within the value chain (Hall *et al*, 2007).

Accordingly, rice polishing/milling service providers (rice polisher machine) are identified as missing actors in the value chain. Currently flour millers are providing the service with poor quality product which cannot be used for market purpose. More importantly, interaction has been missing between the private sector and supportive service actors in the value chain; extension and research because of lack of coordinating body. The missing actor/role analysis revealed that efforts are required to encourage others to play the missing role. For example; private sector actors, NGOs and CBOs can play an important function to fill gap of the missing actor/ role.

4.5.4 Attitude, Habit and Practices of Value Chain Actors

The prevailing attitude, habits and practices among actors have a significant influence on the patterns of interaction between them and propensity to innovate. Habits and practices also determine the way organizations respond to innovation triggers such as policy changes, or changing market and technological conditions. Because habits and practices vary across organizations and across countries and regions, the identification of these habits and practices helps to tailor appropriate policies and incentives accordingly (Hall *et.al*, 2006). Besides, understanding of attitudes, habits and practices of actors is critical to designing effective intervention strategies as well. Hence, this section highlights few attitudes, habits and practices of actors that influence patterns of interaction, information and knowledge sharing, inclusiveness, and risk taking among main rice value chain actors in Metema. For the detail, see Appendix 2.

Attitudes, habits and practices that lead to weak interaction, knowledge and information sharing among actors

Organizations may fail to meet new objectives that require interaction because their traditional attitudes, habits and practices prevent interaction, and knowledge and information sharing (World Bank, 2007). A long tradition of limited responsiveness, top-down, hierarchical, non participatory/ exclusiveness and less risk taking type of organizational culture and, habits and practices lead DoARD to have weak interaction, knowledge and information sharing with the various actors along the value chain. They also influence its inclusiveness and risk taking habit and practices.

Gondar agricultural research center, primary cooperatives', metema cooperative union and farmers in the study area do have negative attitude towards the extension services particularly, DoARD and DAs in their respective areas. For instance, farmers during focus group discussions and key informant interviews pointed out; long tradition of limited response to their needs, interests and services demanded; inability to keep the promises and commitments made; and absence of collective problem identification, planning, monitoring and evaluation opportunities were the major reasons for their loss of trust in the District SMSs and DAs. They also indicated that the advisory services that they provide are top down, irrelevant and infeasible, and both the experts and DAs have limited capacity to provide services. They often perform their duties ad-hoc and there are no predetermined and agreed time frames for the execution of their activities. All such habits and practices of the extension poorly affect its interaction, and knowledge and information sharing with the mentioned actors.

Some key informants from DoARD indicated that the less responsiveness habits and practices emanate from its hierarchical and top-down and non-participatory approaches. The planning process is top-down. The DoARD uses previous year plan as a benchmark to prepare current year annual plan without considering previous year implementation gaps, lessons learnt, and dynamic farmers need and interest. Then, the plan is submitted to zone office of agriculture and rural development. Based on new development direction and particular activities given by the regional government, the plan of the District is also modified by the zone without considering the

needs and interests of farmers, capacity of the DoARD and appropriateness of the task to the area.

This again put its own challenge on execution of the plan. Without knowing the potential of the area, needs of farmers, applicability and acceptance of the activity/technology to the area, the approved plan has been distributed to each kebeles. The DAs are also evaluated against the activities assigned to them and they are also forced to accomplish it. They in turn force the farmer to execute it. Thereby, it affects their interaction, knowledge and information sharing with farmers. Furthermore, there was no habit of joint planning and review, and share of responsibility with the presence of respective actors/stakeholders at a predetermined constant period. Every actor goes individually in their way to successes their mission as if they have different mission. Hence, lessons are not well taken to use them as a clue for the future directions. Everything is accomplished occasionally in a campaign form.

Similarly, both research and DoARD have awful attitude with each other. The linkage between research and DoARD is somewhat informal. Otherwise there is a need to get peridium from research up on doing some collaborative activities in their mandate area. However, there is no room to entertain such a request from the side of research. Up on such a condition researchers were not reluctant to make a contact with the DoARD to incorporate and make research work participatory and interactive. There is limited awareness in the District experts about joint activities which are undertaken in their mandate area is their own responsibility. In turn this emanates from the shortage of budget in DoARD to pay for peridium for any work done with the request of others or plan of individual expert. Besides, they assume that research is in a better position than their host organization in terms of budget availability. Both in research and extension organizations there is bad traditions or effort made so far to work with the private sector.

Developmental activities specifically of agriculture have been undertaking in campaign form with the direction given from District cabinet. Here, according to key informants from DoARD, accomplishment of activities in campaign form might have a benefit from point of view of resource conservation and ability to reach maximum areas and target beneficiaries. However, the difficulty is non agricultural professionals (like; health, education, administrative, etc.) were

included in the campaign team to execute agricultural activities without any prior knowledge particularly about the activity to be performed and agriculture in general. As a result, it discourage farmers and Das, and loss their trust on such actors. These actors with their poor knowledge may lead farmers to take wrong decision and in turn lose faith on the agricultural professionals

On the other hand, even though there have been some recent efforts to make research work participatory, it is less participatory during problem identification and designing research agenda. This is the habit and practice mentioned for the existence of weak interaction, knowledge and information sharing and participation. However, different participatory approaches were used at the implementation stage. Recently, research extension farmers' linkage advisory council (REFLAC) has been established at the zonal level. However, farmers, DAs as well as experts have limited representation. In the newly established BPR (Business Processing Re-engineering) experts are assigned to work on farmers' problem identification and communicating it with research.

In general, from the key informant interview with the different actors, internal hierarchies, top down cultures and approaches, absence of joint planning and review, limited scope and intensity of interaction among actors in sector, less responsiveness were mentioned as habits and practices that influence interaction, knowledge and information flow, learning and participation of possible stakeholders.

Attitudes and practices support good forms of interaction

In contrast to the above cases there were some attitudes, habit and practices that promoted good forms of interaction, knowledge and information sharing and participation of stakeholders among value chain actors. Farmers research and extension group members have developed an encouraging habit of sharing of improved seeds, knowledge and information among farmers with in and outside of their group and enhance their interaction in the area. Accordingly, the result of focus group discussion and key informant interview with various actors revealed that farmers have good habit and practice regarding knowledge and information sharing with other farmers in

their vicinity. The survey result also confirms the validity of this. As described in table 7, farmers were mentioned as main source of input particularly of improved varieties through farmer to farmer seed exchange mechanism.

GARC has tried to practice multidisciplinary, commodity based and participatory approach to incorporate all stakeholders in the development and demonstration of improved technologies in a way of farmers research and extension group, and participatory joint farmer and researcher managed research trial evaluation (both research and development activities). Hence farmers have good attitude towards research activities. Farmers have also good attitude to primary cooperatives. Focus group discussion participants reported that they have participated in planning, monitoring and evaluation of activities of the cooperative at a pre determined period of time.

4.6 Institutional Arrangement and Enabling Environments Influencing Functioning of Rice Value Chain in Metema

For proper functioning of agricultural value chains, there should be appropriate institutional arrangement and enabling environment that facilitate integration among actors and enhance their capacity to innovate (Rajalahti et al., 2008). In this regard, the rest of this part discusses the major enabling environment and institutional arrangement that influence the functioning of rice value chain in the study area.

4.6.1 Enabling Environment

Enabling environments include the policies and infrastructure. From the broader perspective, agricultural focused policy of the country might be considered as supportive policy for proper functioning of the rice value chain development in the country in general and in the study area in particular. In considering the availability of suitable agricultural land and cheap labor force, the government of Ethiopia gives high priority to agriculture and rural development as an engine of pro-poor growth, and efforts to enhance agricultural productivity, increase the commercialization of smallholder surpluses, and reduce rural poverty are a cornerstone of the government's economic growth strategy, Agriculture Development-Led Industrialization (MoFED 2002, 2005). The ADLI strategy argues for greater innovativeness in the agricultural sector to enhance

productivity, increase commercialization, and reduce poverty (ibid). Key elements of the strategy include efforts to promote a market-led transformation of smallholder agriculture, the decentralization of rural services, new and enhanced technologies to conserve and manage scarce natural resources, and continued investment in the development and promotion of new crop technologies.

This shows how much the government gave high priority to the development of agriculture to gear the development of other sectors and overall development. Specialization and diversification took as priority strategy for agriculture development of sufficient moisture getting areas. Introduction of highly productive crop like rice can be considered as one way to pursue the development strategy and ensure food security and sufficiency of the particular area as well as the country as a whole. The government of Ethiopia select rice as a “millennium crop” by taking its potential to full fill food security gap of the country. Accordingly, a national string committee was established to enhance the rice research and development activities in the country (MoARD, 2010). Therefore, this could also be considered as an enabling environment for the development of the rice sector.

The policy of the government towards promoting rice sector development was also encouraging at the local level. This has been demonstrated by regular visits and encouragement of farmers by government officials at regional, zonal and wereda levels. The District cabinet has also taken rice development as one direction to efficiently utilize production potential of the area and ensure food security and self-sufficiency of resellers. Farmers were supported by continuous technical knowledge delivery about the management of rice from both research and extension experts (even with the limited coverage). In addition, the District were supported through the supply of rice polisher machine for demonstration to encourage farmers and create awareness and interest among private investors to get into the business.

Regarding infrastructure development and availability in the area, one main asphalt road crosses the District and link Ethiopia to Sudan. The District has about more than 60 kms asphalt road, 30 kms all weather gravel road, and much dry weather road. This creates an opportunity to transport and supply input from zonal and regional sources to the District town (Gendawuha).

According to key informant farmers and experts from DoARD and information office, in the study area, there is all-weather roads that connect one kebele with another and with the District town. However, some PAs; DAs, Mender 6 7 8, Gubay Jejebit, Tumet (from Shinfa to Tumet), Lencha and Ziebach Bahir have no access to all-weather roads. For those Kebeles that have no all-weather roads, it is hard to transport input (improved seeds, fertilizer and chemicals) from gendawuha (District town) to their locality during the rainy season and before the mud dries out well. The key informants also mentioned that such a problem is more sever coupled with late input supply or distribution. Figure 9 below reveals the structure of road in Metema District.

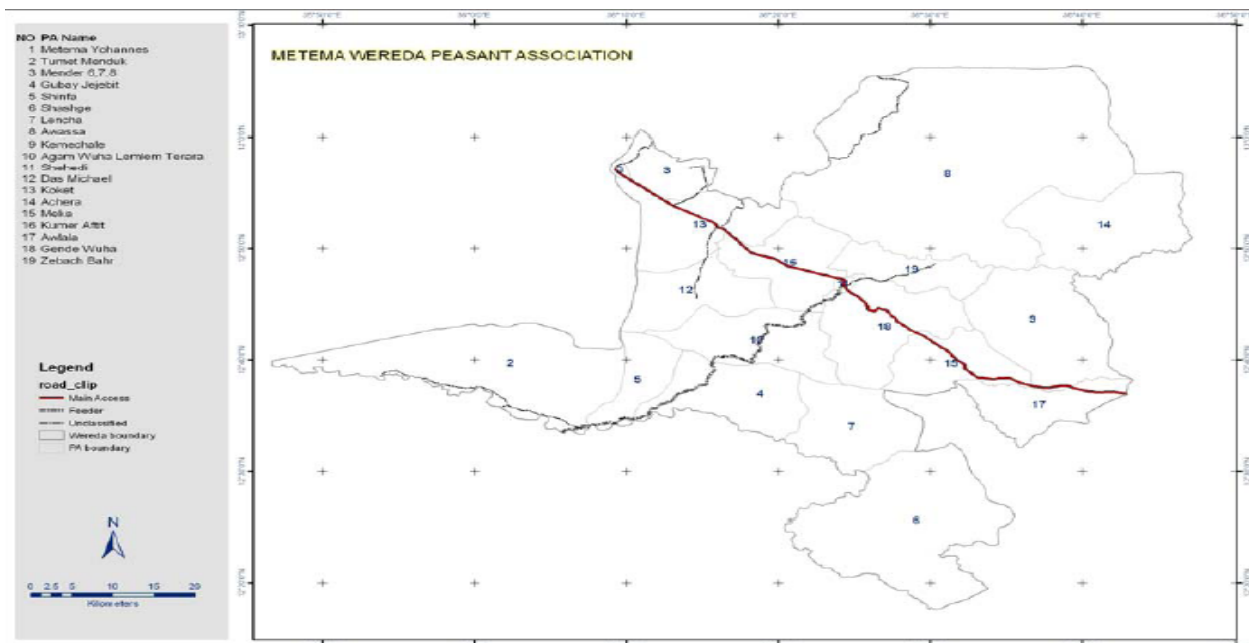


Figure 10. Map of the road structure of Metema

Source: Courtesy by Yasin Getahun, GIS Department of IPMS

In the survey area, wire-less telephone is giving service in a number of kebeles. In Kebeles like Kokit, Shehedi and Metema Yohannes even though there was network problem, there is service of mobile telephone. In Shehedi and Metema Yohannes there is also fixed telephone. The researcher observed in Kokit area during the survey that when individuals want mobile telephone service and lack network connection they climb on tree in search of better network. In general, there is an improvement in telephone service. Hence, access to input and output market information is greatly improved. Similarly, though there is limited coverage, there is electricity

supply in the area. The District town and Metema Yohans (boarder town between Ethiopia and Sudan) have 24-hour electric supply very recently. However, many other kebeles do not have the service yet. Absence of electric supply may create a problem for private sectors to get in to business of rice milling service in the near future. This is because rice polisher machine need high power supply and use of fuel is a bit costly to run the machine.

4.6.2 Institutional Arrangement

The term institutional arrangement in this context describes the mechanisms by which the various actors in a value chain interact or cooperate to promote effective functioning of the value chain. Coordination of value chain actors is one of the key factors for efficient and effective value chain development. There is poor/ unavailability of institutional linkage between value chain actors; research-extension- farmers and each with other actors from cooperatives/union, NGOs and private sector. This is attributed to the absence of responsible organ who is working for efficient and effective integration. Besides, there is limited representation of farmers and private sectors in the identification and planning of both research and development interventions in the area.

As discussed in the actors' identification part, the private actors, which are involved in the rice value chain, are very limited in number. Even though the area is characterized with it high agricultural investment potential and presence of number of private agricultural investors, there was no anybody or department responsible to provide information, advisory service, capacity building, etc. in any of the public sectors; either extension, research or supportive NGOs in the area. If they were supported and encouraged to participate in the rice value chain, they could act as a potential solution for the most pressing problems of the chain; absence of rice polisher and limited supply of improved seeds. In other words, they can contribute a lot for the development of rice value chain by participating directly in input supply, production, post-harvest processing and marketing of rice. Therefore, favorable conditions; capacity building, joint forum, incentives, etc. should have to be facilitated to ensure and benefit from their involvement.

As a whole, the institutional instability due to frequent restructuring of organizational structure and ineffective institutional linkage within the public sector (research and extension actors) aggravated the gap in institutional arrangement. Hence, an effective linkage mechanism has to be placed in place to relive from such a problem and enhance the development of the value chain. According to anteneh (2008), functional linkage can occur through creating networks, partnership and alliance and /or plat forms where all actors in the value chain would be coordinated.

Labor sharing is one of the informal types of institutional arrangement that was identified during focus group discussion with farmers. It has positive influence on the development of rice value chain. As to the discussant farmers, labor shortage at time of weeding and harvesting is the most serious problem that determines their production activities. Besides, rice production is labor intensive in its nature. Hence, farmers have been using labor sharing arrangement as a means to relive from such a problems. Farmers share labor with their relatives and neighboring farmers mostly at times of weeding and harvesting.

4.7 Innovations in Rice Value Chain and Their Immediate Outcomes in Metema

This section describes the recent innovation activities and their immediate outcomes, followed by a chronological summary of these presented in the form of an Actor Time line.

On farm demonstration of improved rice varieties (Kokit and Tigabie) with their full extension package

The demonstration of two improved rice varieties i.e. Kokit (IRAT- 209) and Tigabe (IREM-194) with their production package were conducted in Metema by GARC for three consecutive years from 2004/05-2006/07. The study aimed at introducing and giving awareness about the improved varieties with their production package to farmers and extension personnel, and to collect farmers' feedback on the varieties as well as production package. Improved varieties with and without their production package (i.e. with and without fertilizer) were demonstrated on 8 host farms with representative sites. The improved varieties without production package were

used as a check since rice is a newly introduced crop to the area, there were no local varieties. Yield and economic data and farmers' feedback were collected from all sites.

The simple statistical analysis, partial budget and sensitivity analysis across all sites indicated that the improved varieties with their production package revealed higher yield advantage; percent yield increase and marginal rate of return over the check. Kokit and Tigabe varieties with their production package showed 19.03 Qt/ha, 12.50 Qt/ha and 51.88 %, 39.06% yield advantage and yield increase over the standard checks respectively. The use of improved varieties(Kokit and Tigabe) with their production package gave a net benefit of 5255 and 4346 ETB/ha while the net benefit for the improved varieties without production package (without fertilizer) were 2268 and 2636 ETB/ha. The marginal rate of return for Kokit variety against the standard(Kokit without fertilizer) check were 382% and that of Tigabe variety showed 219% over the Tigabe variety without fertilizer. This implies that for one birr additional cost on the use of Kokit and Tigabe varieties an additional birr of 3.82 and 2.19 can be obtained after paying the input cost (Biruhalem and Dessalegn, 2007).

Field days and personal observations were undertaken to collect farmers' feedback. Improved varieties with their production package were preferred by the farmers since use of production package, especially fertilizer, helped minimize striga infestation in addition to yield increase. Besides, the absence of rice polisher and termite production were the threats of the farmers for future wide dissemination of the technology (ibid).

However, farmers showed high interest to get and grow these improved variety seeds asking the availability of rice polisher in their surrounding as a prerequisite. In the mean time, by understanding the high yield of rice, the high potentiality of the area for upland rice and existing problems of the community, ARARI (GARC) had undertaken NERICA and other elite upland rice variety multi location adaptation trials for three years with the collaboration of Ethiopia institute of agricultural research (EIAR) and AARC. Accordingly, three high yielder and early maturing varieties were released nationally in 2006. Among those varieties NERICA 3, NERICA 4 and Superica 1 varieties have high yield advantage over previously demonstrated rice varieties

i.e. Kokit and Tigabe in the study area. Based on the previous year's adaptation trial at Metema the varieties gave yield of 45, 42 and 37 qt/ha respectively.

In order to fulfill local farmers' seed demand and address the problems immediately, and to enhance a sustainable rice production in the study area, team of researchers from GARC designed a project entitled with Participatory On-farm Seed Multiplication and Dissemination of Rice Technologies in the North Western Lowlands of Ethiopia. It was intended to increase farmers' access to their preferred variety through participatory on farm seed multiplication and farmer to farmer seed exchange; deliver training on production package, post harvest handling and food preparation technique from rice. Ultimately, it would result in a faster rate of adoption and diffusion of rice technology and increase farmers' income.

Participatory on farm seed multiplication and dissemination

Though farmers showed high interest to grow rice, limited availability of and access to improved variety seed was one of the main problems identified to boost rice production in the area. Since there is no public or private organization, who were involved in rice seed multiplication and dissemination in the area, participatory on-farm seed multiplication and dissemination was used as a strategy to create appropriate and sustainable seed supply system and enhance farmers' access to improved seeds. In the process series of steps were followed; formation of farmers research and extension group as seed grower; delivery of training to farmers, DAs, supervisors and SMSs; and facilitation of seed dissemination via farmer to farmer exchange and primary cooperatives.

Organization of Farmers Research and Extension Group (FREG) as Seed Grower

A multi stakeholder meeting was held with DoARD, IPMS project, the then District cooperative office, local leaders, DAs, multidisciplinary team of researchers, and farmers at selected PAs in 2007 so as to organize FREG as seed grower. This is to increase farmers participation in technology multiplication, transfer and utilization, get realistic assessment of the technology under farmers circumstance, monitor the diffusion and utilization of transferred technologies,

and enable farmers to exchange views and ideas and choose their best from their own circumstance. In general this is to reach more farmers and increase the rate of adoption of the technology. Accordingly, four FREGs were organized at selected four kebeles; Agam Wuha, Genda Wuha, Kumer Aftit and Kokit. Each group consisted of 25-30 farmers, representing both female and male headed households. DAs were also member of the group and played facilitation role. Each group has its own chairperson and secretary elected by the group members.

Training of SMSs, Supervisors, DAs and Farmers

Following the formation of the group, DoARD SMSs, supervisors, DAs and FREG member farmers were trained about quality rice seed production, management, and pre and post harvest handling. The training was delivered in two phases. In the first phase, trainer of trainee was given to 3 District crop production and protection experts, 2 supervisors and 13 DAs from kebeles where FREGs are organized and others which are expected to have high potential for rice production and dissemination (Zibach Bahir, Meka, and Shinfu Kebeles) for about two days (Biruhalem, 2008 unpublished). This is to enable such actors to provide technical backstopping when required. Prepared phamplates and handout were also distributed to all participants. Subsequently, the trained supervisors and DAs delivered training to 120 (105 male and 15 female) FREG member farmers at their respective FTC with the facilitation and support of DoARD, IPMS and GARC (ibid).

Meanwhile, various felt needs and problems of farmers which were related to rice production and dissemination were identified and discussed thoroughly. Besides, in an attempt to enhance farmers participation and ensure their involvement in all various phases of technology innovation process, joint planning was conducted on how and when to implement, monitor and evaluate project activities. Hence, host farmers, who are directly involved on seed multiplication activities, number and time of field days, and seed dissemination mechanisms were identified and agreed between members of each group in their respective locality.

Supply of Input (Fertilizer and Improved Seed) to Selected Seed Growers

Seed of three improved rice varieties; NERICA- 3, 4 and SUPERICA-1; Urea and DAP were supplied free of cost to those farmers who are selected as a host for the seed multiplication activity from each FREGs. As a result, 5.4 quintals of seed were distributed to 37 farm households and 6.75ha of land was covered by those improved varieties (ibid). Amount of area covered for seed multiplication across locations is presented in table 19.

Table 19 . Amount of area covered by improved varieties of rice for seed multiplication across locations.

Varieties	Area covered in each PA(ha)				Total
	Kokit	Kumer-Aftit	Genda wuha	Agam wuha	
NERICA- 3	0.25	0.25	0.25	0.25	
NERICA- 4	0.5	3.25	0.5	0.5	4.75
SUPERICA-1	0.25	0.25	0.25	0.25	1
Total	1	3.75	1	1	6.75

Source: Biruhalem, 2008 (unpublished)

Seed grower farmers had got advisory service from both DAs and responsible researchers on a periodic base. Here, field data were collected by respective DAs in their area. Accordingly, the data collected from all the sites showed higher yield performance of such improved varieties with their production package. NERICA-4 gave yield range of 28.6- 38.3 qt/ha with an overall mean of 34.325 qt/ha. While NERICA-3 and SUPERICA-1 gave yield range of 24.6- 32.5 and 24.2- 32.1 qt/ha with an overall mean of 30.425 and 28.325 qt/ha respectively (table 20). Hence, on average 30.425 qt. NERICA-3, 163.04 qt. NERICA-4 and 28.325 qt. SUPERICA-1(total of 221.79 qt.) seed could be produced (table 19).

Table 20. Mean grain yield of improved varieties in all seed multiplication sites of Metema, 2007.

Location	Mean grain yield of varieties		
	NERICA- 3	NERICA- 4	SUPERICA-1
Kokit	32.5	34.2	24.2
Kumer	32.1	38.3	32.1
Genda wuha	32.5	36.2	28.6
Agam wuha	24.6	28.6	28.4
Over all Mean	30.425	34.325	28.325

Source: Biruhalem, 2008(unpublished)

Promotion and Awareness Creation via Field Days

In order to assess farmers reaction about the improved varieties and practices associated with them, field days were organized at various cropping stages, specifically at vegetative and full maturity stages. In the mean time, farmers' feedback and reaction about the improved varieties and their production package were collected for better adoption. Performance of each variety was evaluated and selection criteria and preferred varieties were identified and documented. Participant farmers of all sites identified selection criteria mainly of spike length, tiller capacity, early maturity, seed color and grain yield. Based on such criteria farmers gave high preference to NERICA- 4. But they show high demand to have all the varieties. They also strongly commented that the amount of seed rate they used (80kg/ha) is very low. As to farmers explanation bird attack is severe during time of sowing since most of farm lands in Metema are in side forest and thereby trees are main shelter for birds. Accordingly, the effect of minimum seed rate was highly observed on most of seed multiplication sites.

Besides, FREG members illustrated that a farm plot which was previously cultivated with sorghum will not be appropriate for rice rather plot previously cultivated with sesame and cotton will be conducive for rice production. According to their explanation in former case termite attack will become sever since the bulk sorghum straw that left on the plot help the termites to stay and reproduce on the plot and then it will attack rice seedlings. Whereas in the later case, the plot is a little bit clean and termite will not get favorable condition to stay on that plot and damage rice seedling. In general they determine what shifting cultivation they need to use with

respect to minimum termite attack (**sorghum- sesame or cotton- rice**). On the other side, both the farmers and DAs identified chronic problems that will hinder an effort to boost rice production and dissemination. Among them striga infestation, unavailability of rice polisher and sever termite attack were some of problems that the farmers need quick solution so as to increase rice production and dissemination.

Experience sharing tour

The experience sharing tour was conducted from 29/10/2007 to 2/11/2007 in Fogera District (low land rice producing area). Consequently, 16 farmers, 4 DAs, 2 supervisors and 2 SMSs were attendants of the experience sharing tour. The tour was aimed at sharing of experience on rice production, management, marketing and utilization of both the grain and its byproducts. Accordingly, farmers from both Districts exchange different ideas, knowledge and skill concerning about upland rice production system and package, rice polisher related issues like; price of polisher, service charge and availability of spare parts, post harvest handling, food preparation, utilization of byproducts of rice. Besides, farmers thoroughly discuss on termite protection and management and various sorts of indigenous knowledge were shared between them.

Facilitation of provision of rice polisher

Since the absence of rice polisher was mentioned as a main bottleneck to expand rice production and hinder the value chain development repeatedly by all value chain actors, one rice polisher was obtained from Adet Agricultural Research Center (national rice research coordinator) with the facilitation of ARARI and GARC. It was delivered to the DoARD. However, the polisher is not installed and do not start to provide service.

Station based seed multiplication

Due taking the increasing improved rice variety seeds demand by farmers both within and outside the District, absence of any private or public organization who multiply and supply these

varieties, and high initiation to boost rice adoption and production in the north western parts of the country, Gondar Agricultural Research Center tried to multiply these varieties. The varieties were multiplied in 2008/09 cropping season on the experimental station of the research center which is found in the District. A budget support was obtained from Amhara Region Food Security Bureau to satisfy seed demand of resettlers. The area is one of the areas where resettlement programs of the government takes place. Accordingly, more than 160 quintal of improved rice varieties were harvested and delivered to metema DoARD to diffuse to potential areas for scaling up.

Scaling out and up of rice technologies

Up on getting the multiplied seed and experience from all the aforementioned interventions, the District were engaged in scaling out of improved rice varieties in line with expansion of best practices strategy of the government. Hence, the number of PAs which grow rice increase from 7 to 17 and number of farmers growing rice increased dramatically. Besides, successive training in rice production and food preparation was given to farmers in various kebeles. SNRM project also entered in the development activities of rice by provision of budget support to deliver training and input to farmers in mender 5-6-7 PA. As a result currently the number of farmers who grow rice is increasing.

Table 21. Actor time line of rice value chain development in Metema

Date	Event	Actors involved
2005-2006	Pre-extension demonstration of improved rice varieties (kokit and tigabie) with their full extension package	GARC, DoARD
October 06	Field visit was organized to create awareness among farmers about improved varieties and their production package to enhance its adoption	GARC, farmers, DoARD, ARARI, Zone and regional oARD
2004-2006	On farm and on-station adaptation trial of NERICA rice varieties (NERICA-3, NERICA-4 and superica-1)	AARC and GARC
May 07	Joint planning and discussion was undertaken on the project concept note prepared by GARC researchers	DoARD, IPMS, GARC
June 07	Farmers research and extension group was organized as a seed grower	GARC, DoARD, IPMS
June 07	TOT was delivered to DAs and SMSs about rice production and post harvest handling	GARC, IPMS
June 07	Training was delivered to farmers research and extension group members	GARC, DoARD, IPMS
June 07	Host farmers for seed multiplication was selected from the FREG members by the members in kokit, gendawuha, agamwuha and kumer aftit PAs.	FREG members, Das, GARC, DoARD, IPMS
June 07	Full package of rice production (improved seeds and fertilizer) delivered to host farmers which are selected for seed multiplication	GARC
June- dec. 07	Information and advisory service provided to seed growers and data collection	GARC, DoARD
Sep. 07	Field visit organized to FREG members to share experience with seed multiplying farmers within and across the seed multiplication sites	FREG members, DoARD, IPMS, GARC
Oct. 07	Filed day organized to farming community, zone and District cabinet and other stakeholders who are working on agriculture to create awareness, promote improved varieties and to get institutional support from participating actors	Farmers, DoARD, GARC
Oct. 07	Experience sharing tour arranged to some selected FREG members, DAs and SMSs to Fogera District (Woreta)	ZoARD, DoARD, GARC, IPMS, Metema District information office, farmers
Mar.- June 08	Seed exchange facilitated through farmer to farmer exchange and involvement of primary cooperatives in seed collection and redistribution	DoARD, GARC, primary cooperatives
Aug. 08	Rice polisher provision	ARARI, GARC and AARC
May-Nov. 08	Station based rice seed multiplication	GARC
Apr. 2009 onwards	Scaling up/out of rice technologies	DoARD, SNRM project

4.8 Challenges, Opportunities and Entry Points for Innovation in Rice Value Chain in Metema

A number of challenges, opportunities and entry points for further technological, institutional and organizational innovation for upgrading the rice value chain in the study area were identified by the different value chain actors (input suppliers, producers, marketing actors, post harvest processors” flour millers” and consumers) and key informants (extension workers, experts and officials, agriculture researchers, NGOs, and seed multiplying agency) during the focus group discussion and key informant interview. In this subsection, the major constraints and opportunities are briefly discussed.

4.8.1 Challenges

This section looks at a comprehensive list of value chain constraints that were identified by various chain actors.

4.8.1.1 Producers

Lack of post harvest processing technologies (rice polisher and thresher machines), severe termite attack, limited access to and supply of input particularly of improved seed and herbicides, limited knowledge about post harvest handling were identified as the main constraints for innovation by the farmers who uses improved rice varieties.

Lack of post harvest processing technology

Many farmers during survey time expressed an interest in growing rice, but their interest to engage in it is closely tied with the presence of rice polisher. Currently, farmers use grain/flour millers or traditional mortar called “*Mukecha*” and stone mill “*Wofcho*” to polish paddy rice for their household consumption. During the focus group discussion, farmers pointed out that use of traditional mortar or stone mill will take much time and effort to polish, and also difficult to polish larger quantity at once. The flour millers could not also provide the rice and husk separately and the polished rice is fully crushed. This all have high wastage during processing

and low quality product for market purpose. Thus, it highly influences the rice market development and consumers demand.

Limited access to and supply of agricultural inputs

The most important physical inputs for rice production are improved seeds, fertilizers, and herbicides. Research and extension services, information and appropriate technological support are non-physical inputs that are equally important for higher yields. The ability to ensure maximum outreach of essential inputs to the producers will determine the success of an increase in rice yields and address food security (Ghimiray, 2007).

Farmers who participated both in interview schedule and focus group discussion identified limited supply of improved seeds as a major input related problem in their area. Among the total sample of respondents, 63.9% replied limited access and supply of improved varieties seed as their production problem (table 22). This caused mainly due to absence of responsible rice seed multiplying and distributing agency. According to focus group discussion participant farmers and some key informants, even though an effort was made to distribute the seed via farmer-to-farmer exchange mechanism and involvement of cooperatives has revealed an encouraging result, it could not satisfy the increasing demand of farmers. Limited production coupled with late farmers and cooperatives seed collection after producer farmers consume much of their paddy rice production were also cause for short supply of improved seed.

Regarding the supply of fertilizer and herbicides, shortage of supply, high input price, inappropriate delivery mechanism and delayed supply were also reported. For the delayed supply of input particularly of chemical fertilizer and pesticide and herbicide farmers criticized DAs for their delayed input demand collection from them. On the other side, DAs explained inability of farmers to reflect their input demand on time and prolonged input supply process/ chain as the main reason for the delayed delivery of inputs. As to DAs, delayed farmers input demand request emanate from lack of farmers skill to plan what to produce and how much to produce. In other words they did not know type of crop to be grown and type and amount of input they require. According to farmers explanation during focus group discussion, availability of plow oxen since

they sold their oxen during off season in fear of theft, unable to know the rain fall pattern since the existing rain fall condition affect farmers production and input utilization decision, unable to know exact input delivery price at a time of farmers input demand collection by DAs and cooperatives, were the main problems of farmers regarding delayed reflection of their input demand. When plow oxen price is high and unavailable, farmers were used rented oxen 100birr/day which is too expensive. In such a case, they decide to produce crop with high opportunity cost mainly of sesame. Inputs have been delivered to farmers in the form of hand to hand sale (on a cash base), half pay(mostly of 20%) or credit.

Similarly, even if farmers demand were collected early, the supply might also delay. This is because of prolonged chain of input supply. Key informants from metema cooperative union / DoARD experts identified many reasons as; delayed input request from DAs and primary cooperatives, need of time to compile the request from all the kebeles and to call for potential input suppliers for auction. The auction process by itself has also its own contribution for the delay of input supply. Mostly the winner does not supply the input required both in quality quantity and time.

Sever termite attack

In the area there is problem of termite attack. It attacks the rice seedling at early stage. The problem is more sever in red and drained type of soil. According to farmers, its incidence also associated with the intensity of rain fall. If there is high rain fall during early seedling stage of rice, its damage becomes a bit moderate. However, if the rain stopped for some time it automatically damage the rice seedling. Out of 72 farmers who used improved rice varieties, 44(61.1%) identified severe termite attack as their production challenge. Currently, farmers tried to use their personal experience/ traditional and indigenious knowledge to minimize its damage. Some of the focus group discussion participant farmers expressed they tried to minimize its prevalence by leaving the weed in the furrow after weeding and the others leave all the waste and weed out after weeding. The first group confirms that leaving the weed inside collect the termites and they use it as a feed so they will not go to the rice. The second group said it attract the termites and lead to damage of rice. On the other side, they also use appropriate crop pattern.

Farmers mentioned that previous year sesame or cotton plot is appropriate for rice production with reduced termite attack. They argue that sesame and cotton plot is a bit clean. The result highlighted that appropriate termite protection technology needs to be researched. In addition, the indigenous termite control mechanisms of farmers should also be studied in a more scientific way to come up with best recommendation.

Market problem

Almost all rice producer farmers respond that there were market problems in their area. The major rice marketing constraints are related with non-availability of market/limited access to market, small number of market actors, low quality product (polished rice using flour mills) that can meet consumers demand, and absence of rice polisher (table 22). Furthermore, poor linkage with and less awareness of possible market actors (consumers, retailers and whole seller) about rice production in the area, and not habituated crop in the local market and small amount of production were the other challenges identified by some key informants and focus group discussion participant farmers for rice market development in the area. As a result, major portion of the total production was consumed and very little was sold as seed informally in the local market(table 10). In general, absence of rice polisher is the main causes for the existence of all the aforementioned market related problems. In addition, lack of market information specifically input price is the main constraint in input market in the area.

Striga infestation

Even though the infestation level is somewhat moderate, it is highly affected by striga. Among 72 sample respondents who used improved rice varieties, 28(38.9%) mentioned striga infestation problem as main challenge they faced during rice production. Its infestation appears to be high in repeatedly cultivated land. This is due to loss of soil fertility. Hand weeding, use of fertilizer and use of herbicides were identified as current practices to decrease its level of infestation. This, therefore, needs high attention to get striga resistance varieties in research.

Shortage of rain fall

Since the varieties grown are rain feed and upland types, they need sufficient amount of rain for their proper growth. As indicated in table 22, Shortage of rain fall was mentioned by 76.4% of respondents. During focus group discussion farmers expressed that during the last cropping season (2009/10) the rain stopped early and most of them did not get yield from their rice plot. However, some farmers who plant early (june15-23) and on soil with high water holding capacity, and those who used fertilizer obtain good yield. At the same time, participants argue on the need of early maturing type of varieties to relive form the problem. Some group required to have varieties with less maturity date. On the contrary, others did not support the first group since varieties with less maturity date than the existing one will face shattering problem at normal cropping season. They perceived that the prevalence of high rain fall is more probable than shortage of rainfall.

Complex credit supply and repayment condition

Regarding credit utilization, farmers indicated that the credit obtained is not only used for rice production but also other crop production activities. Rice production requires high cost of production. As shown in table 17, farmers used credit obtained for payment of hired labor, rented oxen, purchase of plough oxen and seed and fertilizer. They indicated that their sources of credit are ACSI, friends/relatives, and primary cooperatives. In order to see problems and importance of these credit institutions to farmers' situation, some analysis was done by taking into consideration criteria like interest rate, collateral requirement and the availability of the required amount of credit.

ACSI is one of credit institutions found in the District. Focus group discussion participant farmers reported that ACSI's interest rate is so high and unaffordable to them. Besides, all farmers also complained on group collateral system. They explained group collateral problem as when some group members left away or failed to pay the loan, the group is forced to pay the loan made available for those group members. Out of the total 46 sample respondents who took

credit, 32.6%(15) and 21.7% (10) respondents mentioned high interest rate and need of group collateral as a challenge in accessing credit from this institution. On the contrary, some farmers during the focus group discussion indicated that ACSI provides better amount of credit than other sources mentioned above. It provide up to 5000 Birr.

All the primary cooperatives in the sample kebeles provide credit to member farmers. However, according to DoARD cooperative promotion expert, the credit provision of cooperatives largely depends on their capital accumulation. They provide credit in kind as well as in cash. Limited supply of credit was the main problem in all the cooperatives. Participant farmers on focus group discussion held at kokit reported that, during 2009/10 cropping season, kokit primary cooperative provided them input and 700 Birr credit which is very small as compared to the amount required. This entails a need to enhance credit availability and efficient service delivery of cooperatives.

In addition to all the above problems, farmers during focus group discussion and key informant interview identified other problems like; lack of awareness about appropriate type of land for rice production, rice plot damage with animals and seed mix. Farmers still believe that rice should be grown in soil with high water holding capacity. However, as there were varieties that require such a condition, there were also varieties (NERICA) which could grow in well-drained soil type. Free grazing type of livestock production system in the area damage farmers' rice fields thus farmers were forced to grow it near to their homestead. This in turn restricts the total area coverage of the crop. Even though there was farmland which is favorable to rice production far from their homestead, farmers were not reluctant to grow rice in such area in fear of livestock and 'kerkero' attack. Regarding seed mixture, as farmers explained that the improved seeds they obtained from farmers, farmer cooperatives as well as DoARD were mixture of red and white type of seed. Such a mixture reduces the quality of their production and created challenge during harvesting since they do not have equal time of maturity. Hence, demonstration of upland NERICA varieties on a well-drained soil, and multiplication and provision of pure basic seed could be potential solution for such a problem.

Tabel 22. Challenges faced by rice producer farmers

Challenges faced during rice production	N	%
Production aspect (N=72)		
Sever termite attack	44	61.1
Absence of rice polisher	72	100
Absence of market demand	10	13.9
Shortage of rainfall	55	76.4
Crop disease	1	1.4
Problem of input supply	30	41.7
Striga infestation	28	38.9
Input supply aspect(N=72)		
Unavailability	5	6.2
Shortage of supply	17	23.6
High input price (costly)	15	18.8
Delayed supply	50	69.4
Inappropriate delivery mechanism	10	13.9
Marketing aspect (N=72)		
Non-availability of market/limited access to market	35	48.6
Lack of rice polisher machines	72	100
Low quality product (polished rice) that meet consumer demand	72	100
Institutional aspect (N=46)		
Limited supply of credit(in case of primary cooperatives)	46	100
Huge bureaucracy to access credit (ACSI)	5	6.2
High interest rate(ACSI)	15	32.6
Need of group collateral(ACSI)	10	21.7

Source: survey result, 2010

On the other hand, as indicated in table 23, farmers who did not use improved rice varieties before express their interest to produce but they illustrate many reason why they were not engaged in rice production activities. Majority of respondents 72.2% followed by 33.3% replied absence of land with favorable soil characteristics appropriate for rice and limited knowledge about rice production since the crop is new to the area were mentioned as their main constraints. In addition, 27.8% respondents identify non-availability of rice polisher and thresher machines in their vicinity and high labor demand for crop management (weeding, harvesting and threshing).

Table 23. Challenges that hinder the use of rice varieties by non producer groups

Challenges of non producers	N=28	Percent
Unavailability and low access to improved varieties	2	11.1
Limited knowledge about rice production	6	33.3
Non-availability of rice polisher and thresher machines	5	27.8
Do not own land with favorable soil characteristics for rice production	13	72.2
Fear of termite attack	1	5.6
Low access to inputs (like chemicals and fertilizers), credit and extension service	7	25
High labor demand for crop management (weeding, harvesting and threshing)	5	27.8
Requirement of inorganic fertilizer	2	11.1
Non-availability of market/limited access to market	1	5.6

Source: survey result, 2010

4.8.1.2 Input Suppliers

As briefly discussed in actor and their role identification part in section 4.3.1, primary cooperatives, DoARD, private suppliers and farmers are the actors involved in supply of seed, fertilizer, pesticide/herbicide and farm implements. The main problems perceived by the key informants from all these actors are late supply of input, lack of transport, absence of adequate amount of capital to supply the input required, limited access to input market information, extended or prolonged input supply process. Key informants from Metema cooperative union and DoARD illustrated that lack of storage and transport facility and conducive road condition are the major constraints that they face to distribute to each PAs once the required input reach to the town of the District (Gendawuha).

In the study area, input markets are relatively undeveloped, with inputs are not available at the right time, in the right quantities or at the right quality. During the key informant and focus group discussion with input suppliers along the value chain; lack of timely input and output market information, inability to get farmers farm input demand on time like fertilizer, improved seeds, insecticide and pesticides, lack of on time input supply from high level suppliers in Gondar and Bahir Dar mostly of Ambasel (late and short of supply), low access to some

agricultural inputs were identified as the most pressing challenges. The District finance office deliver credit to Metema cooperative union with interest at bank rate for the supply of input. However, according to experts from the union, the amount of credit they obtain is not sufficient to deliver the amount of input required.

4.8.1.3 Marketing agents

The number of marketing actors is very limited and they mainly participate in informal seed marketing. In case of primary cooperatives as marketing actor, limited capital availability , sometimes lack of information or linkage with potential rice seed buyers, unable to maintain seed quality (seed mix during purchasing) were the problems recognized. The absence of rice polisher was mentioned as the main obstacle to bring rice as tradable crop in the local market.

4.8.1.4 Post harvest processing (grain/flour millers)

There was no significant problem mentioned by these actors except the limited number of farmers who brought rice to polish.

4.8.1.5 Consumers

Lack of rice polisher here also mentioned as the main challenge to rice for consumption. During focus group discussion with farmers, farmers believed that they had developed the food habit for rice. In addition, the productivity was also very high and the market value was good enough to encourage production. However, the absence of rice polisher hinders the production and utilization of rice by farmers as well as urban consumers.

4.8.1.5 Supportive actors

DAs in the sample PAs, SMSs and officials from DoARD identified lack of technical skill on rice production and management, shortage of manpower who are specialized /have experience on rice production, absence of rice training and production manual, high work load with non

extension activities (mostly of political), and lack of transportation and material facilities as main challenges faced to provide quality extension service. Lack of adequate budget and high staff turnover were also perceived as challenge by such actors. According to interviewed SMSs from DoARD, lack of incentives and flat management coupled with harsh environmental condition of the area are the main causes for high staff turnover.

For improved provision of agricultural extension service, three DAs who graduated from Agricultural Training, Vocational, Educational and Training (ATVET) colleges with plant science, natural resource management and animal science are expected to be placed at each PA. However, during data collection, it is observed that, in two sample PAs (*Kokit and Agam Wuha*) there were no DAs with plant science profession and the extension service related to rice was delivered by other DAs without any prior knowledge about rice. This is also the main challenge faced in provision of quality extension service.

From the side of research, key informant researchers from GARC and ARARI mentioned presence of small number of experienced researchers who are working on rice research as a challenge to develop appropriate rice technologies and deliver technical back stopping for respective end users. Currently, there is only one researcher in GARC who is working on rice breeding research. The protection and agronomic research activities have been under taken by researchers from cereal research program as a part time. Moreover, the key informants reported that, since rice is recently introduced crop and the researchers are also young and recently recruited, there is limited knowledge among the researchers about pre and post harvest handling of rice.

Officials from primary cooperatives in the sample PAs and *Metema* cooperative union also identified the major challenges that they encountered in carrying out of their role like; lack of adequate capital to supply input, participate in rice seed marketing and provision of rice polishing service; lack of transport facility to distribute input to each PA, and absence of storage facility. Furthermore, low educational level and managerial skill of primary cooperative committee members and their bias to their personal business were pointed out as a cause for inefficient service provision of such cooperatives.

4.8.2 Opportunities

On the other hand, availability of favorable soil type and climatic conditions, presence of continuous material and technical support from GOs and NGOs, high crop preference for household consumption especially of its compatibility for traditional food making like *Injera* and *Kinche*, ease of preparation, time and energy saving for preparation (can be prepared as fast food like Kinche) and high market demand were some of the opportunities of the crop by most of the producers. For more detail, see table 25.

Increased awareness about and availability of improved rice varieties

The survey result, as discussed in the earlier sections, shows majority of sample of respondents have awareness about the availability of improved varieties. Due to improved farmer's awareness, the number of households involved in rice production and its area coverage shows an increasing trend. As indicated in table 25, 19.4% farmers respond the awareness and availability of high yielding and adapted varieties as an opportunity for innovation. Because of increased awareness, the number of farmers who grow rice also increased. There are five high yielding and well adapted upland rice varieties for Metema and surrounding area (table 24).

Table 24. List of adapted upland rice varieties released to Metema and surrounding area as of 2009

Name of variety	Yield qt/ha		Maturity date	Time of release	Releasing center
	On station	On farmers field			
Tigabie (IREM-194)	37	32	100-125	1999	ARARI
Kokit (IRAT-209)	36	28	95-120	1999	//
Nerica-3	45	29	90-110	2006	//
Nerica -4	48	30	90-110	2006	//
Superica -1	51	23	90-110	2006	//

Source: Teferi, et.al(2007) and Biruhalem,2008

Favorable land and climatic condition

Metema is one of the potential areas of the Amhara region to grow rice. The survey result highlight 36.1% of respondents mentioned the availability of favorable land (soil with vertic nature and high water holding capacity) and climatic condition as an opportunity to grow rice in the area (table 25). Previous studies in the area indicated that, about 91,526 ha of land covered with vertisols and remain idle in the main rainy season. This is due to excess moisture availability and high water holding capacity of soil combined with the flat land escape of the area. The total estimated area for rice cultivation is about 374,595 has (Tesfaye Z. et.al, 2005). In addition, according to DoARD land use assessment report (2010), there is an estimated 3708.5 ha area of land fully covered with water which cannot be used for production of crops except rice. Seasonal water logging, especially during the heavy rainfall months, is so high and it is the major production problem of the area. However, the soils in the area are believed to be fertile and consequently, farmers do not apply fertilizer (IPMS, 2005).

The area also possesses favorable environmental conditions for rice production. It has an altitude of ranging from as low as 550 to 1608 m asl, minimum annual temperature ranged between 22°C and 28°C, and mean annual rainfall of 850 to around 1100 mm which is appropriate for rice production.

Presence of high consumer demand

Even though rice marketing has not been fully developed yet in the area, there is high rice demand for seed and grain both from farmers in the study area or neighboring areas; *Tachi Armachiho, West Armachiho and Quara Districts*. There is a growing demand for food self-sufficiency and food security since *Metema* is one of the main area under which resettlement activities are taking place. Furthermore, there is a change in awareness on the food value of rice in the study area as well as throughout the nation. Among the sample of respondents 25.0% and 79.2% reported the presence of high market demand and preference for household consumption respectively.

High productivity potential of rice

As indicated in table 25, high productivity potential of rice was mentioned as an opportunity for innovation by 62.5% of sample respondents. During focus group discussion, farmers compare rice productivity and food quality with sorghum and they prefer to grow rice. Farmers reported that rice has high productivity on average 20 qt./ha which is more than 10 qt/ha average productivity of sorghum. Ghimiray et.al (2007) confirms that higher yield potential is considered as an important factor particularly for farmers’ innovation not only because it provides food security at household level but also because surplus production can be sold to generate cash for other expenditure.

Table 25. Opportunities/reasons for farmers to produce rice in Metema

Reasons for production decision	Respondents	
	N	%
Awareness and availability of improved rice varieties	14	19.4
Favorable land and climatic condition	26	36.1
Presence of high market demand	18	25.0
High preference for household consumption	57	79.2
Existence of technical and material support from GOs and NGOs	5	6.9
Need of crop diversification	11	15.3
Crop potential to provide straw for livestock feed	51	70.8
High productivity of the crop	45	62.5
High profitability of the crop	14	19.4

Source: survey result, 2010

Increased institutional support

The existence of various governmental, nongovernmental and community based organizations, who are involved in the rice sector development in the area, is an opportunity for innovation. The availability of DAs at each PA and possibility of promoting rice technologies through FTCs’ is a good opportunity. Use of FREG in rice technology dissemination particularly of rice seed multiplication and diffusion is another opportunity to bring about organizational innovation. Following the decentralized research system of the country, GARC is mandated to provide research service to the area. The main rice research station of the center is placed here in the District and this is a good opportunity for continuous research service provision. The other

opportunity is the existence of none governmental organizations like IPMS and SNRM projects. The projects play a great role in provision of budget support for both the DoARD and GARC. They also facilitate experts and farmers training, and experience and knowledge sharing within and outside the district. Furthermore, existence of primary cooperatives at the grass-root level is another opportunity in provision of input, credit and market information.

Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis of rice value chain development in Metema

<p>Strengths</p> <ul style="list-style-type: none"> • Large number of farmers involved in cultivation • High consumer demand of rice seed and grain • Exchange of improved rice seed, knowledge and information among farmers and FREG members • Availability of number of rice varieties in the hands of farmers 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Lack of knowledge of cultivation and post harvest handling • Lack of market information • Poor market access • Small number of market actors • Low quality product (polished rice) • Poor quality of input supply • Poor and inefficient supply chain • Limited infrastructure and electricity supply • Lack of skilled people for the subsector • Lack of post harvest processing technologies (rice polisher and thresher machines) • Limited access to and supply of input particularly of improved seed and herbicides • Limited amount of rice production and area coverage • High labor demand for crop management (weeding, harvesting and threshing) • Late supply of input • Lack of transport facility • Absence of adequate amount of capital for coop. to supply input required • Extended or prolonged input supply process
<p>Opportunities</p> <ul style="list-style-type: none"> • Increased awareness about and availability of improved rice varieties • Favorable land and climatic condition • Presence of high consumer demand • High productivity potential of rice • Increased institutional support from governmental, nongovernmental and community based organizations • Placement of DAs at the kbele level to provide technical backstopping to farmers 	<p>Threats</p> <ul style="list-style-type: none"> • Shortage of rain fall • Severe termite attack • Striga infestation

5. CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This study tries to identify challenges, opportunities and entry points for infusing further innovation (technological, institutional and organizational) for upgrading the rice value chain; and the actors involved, their role, attitude, habit and practices, and linkage in the rice value chain in Metema, North Gondar, Ethiopia. It also analyzes the enabling environment and institutional arrangement that affect the functioning of the value chain, and recent innovation activities and their immediate outcomes in the study area. The study result revealed that, in the study area, there are multiple public and non-public actors involved along the rice value chain, upstream from input supply to downstream consumers, playing different role. They were; input suppliers, producers, traders, post harvest processors, consumers and supporting (indirect) actors. Some functions or roles are performed by more than one actor, and some actors perform more than one role. Their role is also changing over time. Farmers, DoARD, primary cooperatives, private herbicide suppliers, Gondar Agricultural Research Center and IPMS were the main actors involved in the production, extension and research activities. Among these actors, Gondar Agricultural Research Center is the champion at the early stage of the rice development activities in the area. The center was involved in input supply, research undertaking, seed multiplication and delivery of training. However, recently, the DoARD take the lead in most of the scaling up activities. Besides, new actors like SNRM project and Amhara region seed agency were also evolved in the rice value chain at different times. As a whole, there is domination of public sector actors. The involvement of private sector actors is very limited with the only involvement of private herbicide suppliers.

Findings also show that, though public service providers play what might be termed the central role in the rice value chain development, they mainly concentrate on the input supply and production stages. Significant innovation activities/ interventions were not taken so far at the other stages of the chain (post harvest processing, marketing and consumption) by any of the supportive actors to upgrade the value chain.

The linkage between value chain actors is somewhat weak and informal in type. There is no any plat form or responsible body who is working for effective and efficient linkage between value chain actors. However, there is strong linkage among some actors like; farmers with farmers, and farmers with primary cooperatives. Similarly, there were good and weak attitude, habit and practices. Farmers have high trust to other farmers, cooperatives and Gondar agricultural research center for their timely service provision and share of experience, input and information. In contrast, they do not have trust and good attitude towards DAs and DoARD due to their efficiency, inability to hear about farmers demand, encourage farmers to participate and make a decision on the development interventions which will take place in their surroundings.

Absence of rice polisher was the most prominent constraint in all phases of the value chain; production, marketing, post harvest handling and consumption. Currently, rice is processed using the flourmill or traditional stone mill and “Mukecha” resulting in high percentage of broken milled rice, high processing loss and low quality product. This in turn leads to low consumer demand, decreased farmers’ income and ultimately discourage farmers to produce more. Therefore, acquiring the actual rice polisher near to production areas can benefit the farmers and help the value chain to develop. Accordingly, the value chain is not yet developed. Sever termite attack, shortage of improved seed and limited availability and delayed supply of inputs specifically of herbicide and fertilizer were also main challenges faced in the area. On the contrary, increased farmers interest and awareness about rice production system, availability of high yielding and adapted varieties, potential soil and climatic conditions and presence of high attention and support from both GOs and NGOs were the available opportunities that encourage the development of rice value chain.

5.2 RECOMMENDATION

Given the potential of the area for rice production and its significant contribution to ensure food security and self-sufficiency as well as source of additional income for farmers in the study area, these findings suggest several points for further consideration.

Encourage the involvement of private sector in the development of rice sector in the area: the rice value chain in Metema is highly dominated by the public and less efficient CBOs. The

service delivered by such organizations could not satisfy the needs of farmers and other value chain actors. More precisely, there is less efficient service provision in the area of rice polisher and input supply. Hence, the public sector should play a role in creating an enabling environment (long-term credit availability, policy support, etc.) for the private sector to enter in to such areas

Development of rice processing facilities: absence of rice polisher is the most frequently cited problem by all actors in the locality. Currently, rice is processed using the flour mill or traditional stone mill and “Mukecha” resulting in high percentage of broken milled rice, high processing loss and low quality product. This in turn leads to low consumer demand, decreased farmers’ income and ultimately discourage farmers to produce more. Acquiring the actual rice polisher near to production areas can benefit the farmers and help the value chain to develop. Its presence significantly increases the demand for rice and can attract thousands of farmers to cultivate rice and increase their livelihood. The polishers can also act as rice collection, whole selling and retailing centers. This, again, will help the rice market to develop, to increase the participation of various market actors (retailers, whole sellers, etc) and consumers to get and consume polished rice. Ultimately, all chain actors benefit from the development of the sector.

For sustainable and efficient rice polisher service provision, the private sector has to be encouraged to enter in to the business. Rice polisher service which was provided by the DoARD and cooperative office in the study area was not efficient. This is because, there is shortage of budget for machine maintainance and to hire technical person, long bureaucratic procedure to maintain the polisher at times of technical failuer, absence of well identified responsible person who continously monitor and evaluate polisher service provision in the area, lack of technical person and spare part in the visinity. From such a problem it is possible to recommend that private sectors should be encouraged to participate in such bussiness venture. In doing so, the public sector especially DoARD should play facilitation role in making joint discussion with the private sector and provide the avalable machine to interested investors on a long term credit base. In addition to solving immediate rice polisher service requirement, start of machine operation in the area will help to attract more number of farmers to produce more as well as other private investors to get in to the bussiness. To attract more polisher service providers in the area, it should be profitable venture for them. This could be achieved through increased production.

Intervention to increase production and productivity of rice: The quantity of rice produced at the farm level affected marketable supply, household income, and its contribution for food security and self-sufficiency positively and significantly. It can also affect profitability of rice polisher service provision. Accordingly, increasing production and productivity of rice should go hand in hand with development of processing facilities. Thus, all stakeholders especially the agriculture extension needs to carry out more aggressive promotion or scaling out/up of improved rice technologies for visible impacts through development of appropriate mechanism for input delivery.

Promoting on farm seed production and farmer-to-farmer exchange mechanisms: since there is no seed multiplying agency in the area, it is better to engage in on farm seed multiplication and dissemination via farmers seed grower group organization and facilitating farmer to farmer seed exchange mechanism.

Enhanced capacity building activity: Continuous training should be arranged and delivered on rice production, management, pre and post harvest handling and food preparation techniques to farmers and service providers to create sustainable technical backstopping when required. Furthermore, some effort should also be exerted to improve the leadership ability, knowledge management and information/data documentation and management of bosses and staffs especially actors at grass root level (DoARD and cooperatives).

Strengthening the linkage/interaction among value chain actors: There is a need to change the mindset of actors, i.e. developing a wide set of attitudes, practices. In particular, positive attitudes toward partnership, interaction, networking and learning need to be nurtured among main actors in the value chain. In line with changed attitude and practices of actors, there should also be platform or partnership that holds all actors together to interact.

Creation of an international market linkage: the study area Metema is placed at the Ethio-Sudan boarder. This is a good opportunity to create market linkage via the boarder for increased production and marketing. In order to get the maximum benefit from the international market linkage, it also call for high quality rice polisher to maintain its quality.

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APPENDICES

Appendix 1. Actors and their role in the rice value chain in Metema

Stage of the value chain	Actors	Role/ function played by the actor
Input supply	Private input suppliers	Input supply (herbicides)
	Primary Cooperatives/union	Input supply (fertilizer, chemicals and improved seeds)
	Das	Facilitation of input supply
	DoARD	Input supply
	Research centers	Organization of FREG as seed grower to facilitate seed supply Provision of initial basic seeds to seed growers to make on farm seed multiplication Facilitation of farmer-to-farmer informal seed exchange Station based seed multiplication for scaling up
	Farmers	Input supply (via farmer-to-farmer seed exchange)
	Amhara Region Office of Food Security	Source of budget for researcher managed and station based seed multiplication to resettlers
	Regional seed agency	On farm contractual seed production and distribution
Production	Farmers	Cultivation of rice Exchange of knowledge and information with other farmers
Marketing	Farmers	Selling rice to consumers (other farmers and very limited number of restaurant owners), retailer farmers and sometimes to different cooperatives and nearby DoARD
	Primary Cooperatives	Purchasing and reselling of rice produce as a seed
	DoARD- DAs	Facilitate the marketing of rice between farmers, cooperatives, other Districts' and some private utilizers
	Retailer farmers	Purchasing and reselling rice seed to farmers, primary cooperatives and DoARD in the nearby areas(Quara, Armachiho)
	Urban grain sellers	Importing of rice from Gondar and retail it to urban consumers
	Rural petty shops	Importing of rice from Gondar and retail it to farmers
Processing	Private/cooperative grain millers	Provides milling service
Consumption	Farmers	Consumption of rice produce
	Private restaurants	Consumption of rice
	Urban dwellers	Consumption
Supportive actors	Cooperatives	Provision of credit for farmers
	DAs	Training of farmers Delivery of advisory service to farmers Preparation of farmers field days
	DoARD	Provision of advisory service Provision of training to DAs and farmers Field supervision Facilitation and provision of technical support to farmer cooperatives/union
	Kebele Administration	Community mobilization and awareness creation
	District Administration	Facilitation and coaching
	District Information Office	Documentation and promotion of activities done on rice to other area through mobile video show

Appendix 1. Continued.....

Stage of the value chain	Actors	Role/ function played by the actor
Supportive actors	Gondar agricultural research center (ARARI-GARC)	Development/adaptation of improved rice varieties and production technologies On farm demonstration of improved rice technologies Formation of farmers research and extension group (FREG) Delivery of training and advisory service for SMSs, DAs and FREG farmers Preparation of field days /experience share tour
	IPMS Metema PLW	Facilitation/coordination/ budget support
	SNRM Gondar Project	Facilitation and budget support
	Zone Agriculture and Rural Development office	Technical backstopping Budget source Transport facilitation for farmers and experts experience sharing tour

Appendix 2. Attitude, habit and practices of main value chain actors influencing interaction, knowledge and information sharing, inclusiveness, and risk taking

Actors	Restrictive attitude, habit and practices	Supportive attitude, habit and practices
Farmers	<ul style="list-style-type: none"> • Mistrust on DoARD and DAs • Mistrust with private herbicide suppliers 	<ul style="list-style-type: none"> • High interest to adopt improved technologies • High trust on primary cooperatives, Gondar agricultural research center and neighboring farmers • Farmer to farmer exchange of knowledge, information, experience and technology
Primary cooperatives	<ul style="list-style-type: none"> • Limited interaction with other actors other than farmers • Conservative behavior in business undertakings 	<ul style="list-style-type: none"> • High participation of members in planning, monitoring and evaluation of cooperative activities
DoARD	<ul style="list-style-type: none"> • Less responsiveness • Top-down planning and decision making • Less inclusiveness • Internal hierarchy • Weak monitoring and evaluation • Bureaucratic decision making process • Less demand driven service delivery • Mistrust with research • Weak interaction with stakeholders • Inappropriate performance evaluation technique • Poor plan implementation efficiency • Focus on occasional tasks (mostly of politics) • Less appreciative behavior of staff 	

Appendix 2. Continued.....

Actors	Restrictive attitude, habit and practices	Supportive attitude, habit and practices
Research	<ul style="list-style-type: none"> • Mistrust on DAs and DoARD • Poor interaction with the private sector • Less participatory at problem identification and designing of research agenda 	<ul style="list-style-type: none"> • Flat management structure • High professional incentive in terms of capacity building via long and short term training • Participatory and interactive decision making • High information and knowledge sharing habit • Periodic monitoring and evaluation • See failure as a learning opportunity

Appendix 3. Sample farm households interview schedule

Instructions:

- ☞ Make a brief **introduction** to each farmer before starting the interview; greet them in the local way; know each other and ask his/ her name; tell them the **purpose** and **objective** of your study;
- ☞ After getting the informed consent of respondents, please, ask each question so clearly and patiently until the farmer understands;
- ☞ Please, fill up the interview schedule according to the farmer’s reply (do not put your own opinion);
- ☞ Please, do not try to use technical terms while discussing with farmers and do not forget to use/record the **local unit**;
- ☞ During the process;
 - 1: **Write** the answer of the respondent on the space provided,
 - 2: **Ask & write** details where required,
 - 3: **Encircle** or **tick** the chosen answer;
- ☞ Prove that all questions are asked and the interview schedule format is properly completed; and
- ☞ At the end, leave farmers with words of thanks

General Information

Name of Respondent: _____
 District: _____
 Peasant Association (PA): _____
 Name of Village: _____
 Date of interview: _____
 Name of enumerator: _____ Signature: _____
 Questionnaire code: _____

1. Demographic characteristics of sample of respondents

N o.	Name of HH Members <i>(use the first name only and start with the HHH)</i>	Relation with the HHH <i>(use the code specified below)</i>	Sex Male=1 Female= 2	Age --years	Marital Status Single =1 Married =2 Divorced =3 Widowed =4 Never married =5	Education Level Illiterate, no schooling =1 Adult Education =2 Grade 1-4 =3 Grade 5-8 =.4 Grade 9-10 =5 Preparatory(11&12) =6 Other(Religion) =7	Occupation Farming =1 Off-farm =2 Non-farm =3 1&2 =4 1&3 =5 2&3 =6
01							
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							

HH- Household; HHH- Household Head

NB: please specify those nonfarm and off-farm activities that sample HH engaged in it.

Code for Question about relation with the HHH

Head.....01	Uncle/Aunt08
Wife/husband.....02	Cousin09
Son/daughter.....03	Grand Parent.....10
Father/mother.....04	Children from another family.....11
Sister/brother.....05	Other non-Relative.....12
Stepson/stepdaughter.....06	Other relative.....13
Stepfather/stepmother.....07	Renter14

2. Farm Characteristics and Rice Production Condition

2.1 Farm size

- 2.1.1 Do you own arable land? 1. Yes _____ 2. No
- 2.1.2 How much land do you own? Arable land ___ Grazing land_____ (in timad; 1ha=4 timad)
- 2.1.3 Do you have rented in (Cash/Share) arable land ___ Rented out arable land ___ (in timad)?

2.2 Livestock Ownership

2.2.1 Livestock holding of the household

Species of Livestock	No.	Species of Livestock	No.
Ox		Donkey	
Cow		Goats	
Calf		Sheep	
Bull		Chicken	
Heifer		Bee Hives	
Mules		Others (specify) _____	

2.3 Rice Production

- 2.3.1 Are you aware of the presence of improved rice varieties which can grow in your locality?
1. Yes _____ 2. No
- 2.3.2 When did you first hear about the improved rice varieties? In _____
- 2.3.3 Have you ever used such varieties before? 1. Yes _____ 2. No
- 2.3.4 If yes, why did you decide to produce rice?
1. Awareness and availability of improved rice varieties
 2. Favorable land and climatic condition
 3. Presence of high market demand
 4. High preference for household consumption
 5. Existence of technical and material support from GOs and NGOs
 6. Need of crop diversification
 7. Crop potential to provide straw for livestock feed
 8. High productivity of the crop
 9. High profitability of the crop
 10. Others(specify)_____
- 2.3.5 How much land have you allocated for rice production from your total own/sharecropping/
rented land in the last cropping seasons?

Year	Total land holding(in timad)	Total land under rice (in timad)	Varieties used	1. X-Jignna 2. Kokit 3. Tigabie 4. NERICA 3 5. NERICA 4 6. Supperica 1	Average yield /ha
2007/08					
2008/09					
2009/10					

2.3.6 what are the challenges that you faced in producing and using rice varieties before?

1. _____

2. _____
3. _____
- 2.3.7 If you are aware of the presence of improved rice varieties and still you have not been producing it, do you plan to produce rice in the coming cropping seasons? 1. Yes 2. No
- 2.3.8 If yes, why will you produce? _____
- 2.3.9 If the answer for question number 2.3.3 is no, why have you decided not to produce improved rice varieties?
1. Unavailability and low access to improved varieties
 2. Limited knowledge about rice production since the crop is new to the area
 3. Non-availability of rice polisher and thresher machines in their vicinity
 4. Absence of land with favorable soil characteristics appropriate for rice production
 5. Fear of termite attack
 6. Low access to inputs(like chemicals and fertilizers), credit and extension service
 7. High labor demand for crop management (weeding, harvesting and threshing)
 8. Requirement of inorganic fertilizer
 9. Non-availability of market/limited access to market
 10. Non-remunerative price
 11. Others(specify)_____
- 2.3.8 What suggestions do you have to tackle such challenges and enable you to produce and benefit from rice production?
1. _____
 2. _____
 3. _____

3. Production Services

3.1 Input Supply

- 3.1.1 Have you ever used agricultural inputs (fertilizer, chemicals, farm implements, etc.) for the production of improved rice varieties? 1. Yes 2. No
- 3.1.2 If no, what was the main reason behind? _____
- 3.1.3 If yes, which type and from which source did you get such agricultural inputs in the rice production process?

No.	Type of Inputs Used	Source	
1.	Improved seeds		1. Cooperatives/cooperative union
2.	Fertilizer		2. Local market
3.	Pesticides/herbicides		3. AISCO
4.	Farm implements (specify)		4. District OoARD
			5. FREG members
			6. Research centers
			7. NGOs (specify)
			8. Development agents
			9. Private suppliers
			10.Friend/relative outside the village
			11.Friend/relative in the same village
			12.Neighbor farmers
			13.other (specify)-----

- 3.1.4 Why did you prefer the chosen sources to get the needed inputs? _____
- 3.1.5 How did you get the input from the mentioned sources? _____

No.	Type of Inputs Used	How	
1.	Improved seeds		1. Through purchase 2. On credit base 3. In kind 4. As a gift 5. Through exchange 6. Others(specify)_____
2.	Fertilizer		
3.	Pesticides/herbicides		
4.	Farm implements (specify)		

3.1.6 Do you always get inputs at the right time? 1. Yes 2.No

3.1.7 If no, what are the reasons? 1. Unavailability 2. Far distance 3. Others (specify)

3.1.8 Do you always get inputs in the quantities that you need every year? 1.Yes 2.No

3.1.9 If no, why?

1. Not available

2. Too expensive

3. Cash shortage

4. I am not sure of benefit

5. Not available on time

6.Others(Specify)_____

3.1.10 Have you encountered problems in accessing these inputs? 1. Yes 2. No

3.1.11 If yes what are the problems?

No.	Type of Inputs Used	Problems
1.	Improved seeds	1. Unavailability , 2.Shortage of supply, 3.costly,4.Remoteness of input selling site, 5.Others(specify)
2.	Fertilizer	1.Unavailability 2.Shortage of supply3.costly4.Remoteness of input selling site5.Others(specify)
3.	Pesticides/herbicides	1. Unavailability 2.Shortage of supply3.costly4.Remoteness of input selling site5.Others(specify)
4.	Farm implements	1.Unavailability 2.Shortage of supply3.costly4.Remoteness of input selling site5.Others(specify)

3.1.12 How did you solve these problems?

1. _____
2. _____
3. _____

3.2 Access to credit

3.2.1 Did you borrow money for rice production before? 1.Yes 2.No

3.2.2 If yes, from where and for what purpose did you collect the credit?

Source	For what purpose do you use the loan received?
1.ACSI	1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
Cooperatives/cooperative union	1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
NGOs	1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
Bank	1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
Private moneylenders	1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
Relatives	1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)

Church		1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
Neighbors		1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
Iddir		1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
Iqub		1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)
Others specify		1. Payment for hired labor 2. Purchase of fertilizer & seed 3. Purchase of farm implements 4. Payment for rented oxen 5. Others (specify)

3.2.3 If your answer for Q. 3.2.1 is yes, have you paid the loan? 1. Yes 2. No

3.2.4 If your answer for Q. 3.2.1 is no, what is the reason? _____

3.2.5 Did you face any problem in accessing credit? 1. Yes 2. No

3.2.6 If yes, what was the problem?

1. Limited supply of credit

2. Huge bureaucracy

3. Limited access to transport

4. Others(specify) _____

3.2.7 How did you solve these problems? _____

3.3 Information/knowledge flow

3.3.1 Training

3.3.1.1 Have you ever participated in rice production system training in the last three years?

1. Yes 2. No

3.3.1.2 If no, why? _____

3.3.1.3 If yes, on which aspects, by whom and for how long you have got the training?

No.	Training type	By whom	How long?	Year
1	Rice seed production mechanisms			
2	Crop management			
3	Rice marketing			
4	Pre and post harvest handling			
5	Rice food preparation technique			
6	Use of rice straw as animal feed for fattening			
7	Composition of all			
	Others(specify)			

3.3.1.4 Was the training you get easily understandable and practicable?

1. Yes 2.No

3.3.1.5. Was the information/knowledge you got through training useful? 1. Yes 2.No

3.3.1.6 Which aspects were not useful? _____

3.3.1.7 Were you able to employ the new knowledge you acquired? 1. Yes 2.No

3.3.1.8.If yes,what? _____ If no,whynot? _____

3.3.2 Advisory service

3.3.2.1 Did you get advisory service on rice production practices before? 1. Yes 2. No

3.3.2.2 If no, why?

- 1. No service provider nearby
- 2. Possessed the required information
- 3. Availability of contact farmers
- 4. Do not have time to get the service
- 5. Others (specify) _____
- 3.3.2.3 If yes, for how long do you get the service? _____ Years
- 3.3.2.4 Who provides the advisory service?
 - 1. Development agents
 - 2. NGOs (specify) _____
 - 3. Research centers (specify) _____
 - 4. FREG members
 - 5. District oARD experts
 - 6. Neighbors and friends
 - 7. Others (specify) _____
- 3.3.2.5 How do you get the advisory service?
 - 1. Farm to farm visit by the development agent
 - 2. Visit to demonstration/ model farmers site
 - 3. Training
 - 4. Field day/experience sharing tour
 - 5. Others (specify) _____
- 3.3.2.6 How frequent were you visited by development agents last year? _____
 - 1. Once per month
 - 2. Twice per month
 - 3. Three times per month
 - 4. Four times per month
 - 5. Others, specify _____

3.3.3 Research

- 3.3.3.1 Source of rice production, marketing and consumption research/innovation in your area?
 - 1. Gondar Agricultural Research Center
 - 2. Adet Agricultural Research Center
 - 3. DoARD
 - 4. IPMS project
 - 5. Other (specify) _____
- 3.3.3.2 Have you ever participated in problem identification and/or research-planning?
 - 1. Yes
 - 2. No
- 3.3.3.3. If yes, specify the organization and year _____ Number of times _____
- 3.3.3.4 What are the technology type/ services that you get from ARC?
 - 1. Improved varieties
 - 2. Training
 - 3. Advisory service
 - 4. Information
 - 5. Others(specify)_____

4. Marketing

- 4.1 Did you sell improved rice varieties as seed/grain before? 1. Yes 2.No

4.2 If no, why you did not sale ? _____

4.3 If yes, how much and to whom did you sell your production?

Total production	Amount for home consumption	Amount sold (in kg)		To whom	1. Other Farmers as Seed/Grain 2. Consumer 3. Intermediaries 4. Retailers 5. Whole Sellers 6. Others(Specify)	Where	1. Farm gate 2. In the market to whole seller/retailers 3. Retailing yourself 4. Others(specify)
		Seed	grain				

4.4 Why have you preferred the mentioned consumers/ markets to sale your production?

4.5 Distance of market center from your home/farm _____ minutes, _____ km

4.6 Means of transportation used

- 1. Vehicles
- 2. Back of animals
- 3. Manpower
- 4. Others(specify)_____

4.7 If you were used vehicles, was it easily accessible? 1. Yes 2. No

4.8 If you were not used vehicles, why? _____

4.9 Was there any other problem you faced in rice marketing? 1. Yes 2. No

4.10 If yes, what was the problem?

- 1. Lack of market information
- 2. Poor linkage with other value chain actors (retailers, traders, consumers, etc.)
- 3. Low consumer demand
- 4. Non-availability of market/limited access to market
- 5. Low quality product that meet consumer demand
- 6. Absence of rice polisher
- 7. Market distance
- 8. Absence/ limited access to transportation
- 9. Others(specify)_____

4.11 How did you solve these problems? _____

4.12 Are there market related opportunities that motivate you to produce rice before and in the future time?

- 1. High consumer demand for consumption of rice
- 2. High demand for rice seed from farmers in nearby areas
- 3. Presence of boarder market(via ethio-sudan boarder)
- 4. Others(specify)_____

4.13 Linkage with commercial value chain actors

- 1. Retailers
- 2. Whole sellers
- 3. Consumers
- 4. Others(specify)_____

4.14 Are there marketing cooperatives/ farmers organization who are working on rice? 1. yes 2. No

what services do they provide? _____

4.15 Sources of market information

No.	Input market information	No.	Output market information
1			
2			
3			

5. Consumption

- 5.1 Have you ever used rice for household food consumption? 1. Yes 2.No
- 5.2 If no, what is the main reason?
1. Lack of knowledge/skill on how to prepare food recipes from rice
 2. Absence or low access to rice
 3. Absence of sufficient production
 4. Lack of training
 5. Low preference as food (why?_____)
 6. Expensive to use it as household food consumption
 7. Others (specify)_____
- 5.3 If yes, how did you use it? _____
- 5.4 Why you prefer rice for food consumption? _____
- 5.5 Is there a rice polisher in your area? 1. Yes 2. No
- 5.6 If yes, how much is the distance from your farm/home to polishing center_____ km and how much time will take _____ in minutes
- 5.7 How did you transport the rice production from farm/home to polishing center?
1. Vehicles
 2. Back of animals
 3. Manpower
 4. Others(specify)_____
- 5.8 If you were used vehicles, was it easily accessible? 1. Yes 2. No
- 5.9 If you were not used vehicles, why? _____
- 5.10 What were the main problems that you faced in using rice for food consumption? _____
- 5.11 What suggestions do you have to avoid those problems and enable you to use rice for food consumptions? _____

Appendix 4. Interview Check List

Interview Check List for Farmers' Focus Group Discussion

Actors involved and the role they played:

- Actors involved (both private and public organizations)
- Role/ function they play
- Are the actors involved appropriate for the nature of the sector, the stage of development of the market, and the institutional setting?
- Potential actors missed-role/functions/ contribution they play

1. Producers

- When you did first introduced about improved rice varieties in your locality? _____ Year
- From where these improved varieties came from/ who first introduced you about the improved rice varieties?
- Production trend in the area (increasing, decreasing, etc.)

- Why you decide to produce/ not to produce rice in your area?
- What are the challenges you faced in implimenting production practices; crop husbandry practice(land preparation, sawing, weeding and harvesting), input utilization(fertilizer and chemicals), pre and post harvest handling, etc.
- How do you adapt the recommendation given by the extension or research organization?

Input supply

- Have you got the required agricultural inputs in Quality, adequacy, timeline and price?
- From where and how you get improved seeds(formal and informal sources), fertilizer, chemicals and farm implements?
- Which sources do you like to get improved seeds, fertilizer, cahmicals and farm implements? And why?
- Where do you get the seeds from? (if multiple sources: why?) Where do you prefer to get your seeds from? Why?
- What information do you have about the seed? (variety name, source, production traits, consumption traits)
- Is there a problem in getting these inputs?
- What do you recommend/suggest to alivate the problems and get the service required

Credit

- ☞ From where you have got credit (formal and informal sources) and which source is good for you and why?
- ☞ What are the requirements/criteria to get credit from formal institutions (collateral requirement)? And what is your suggestion on the criteria?
- ☞ In what condition you obtained the loan (individual, group, collateral bases), which one is good for you?
- ☞ Which credit institutions are implementing group lending system?
- ☞ What are the predetermined criteria for group formation?
- ☞ What is the interest rate? Is it good for you? If not why? Is there any difference in interest rate levels of these institutions?
- ☞ When and how do you repay the loan you get (terms of repayment period)?
- ☞ If not repaid on the due date, what actions did the formal lending institution take on you? What is your opinion on the action?
- ☞ What limitations/challenges you encountered to get credit? And what alternative solution do you suggest?

Information/knowledge flow

- Where and how do you get information/ knowledge and advisory service? (training, demonstration, experience sharing tour, farm visit, etc.)
- How do you evaluate the knowledge you aquared during such sessions?
- Have you adapted the suggested management practices to adjust to your farm and economic condition and also to the avalability of inputs? If yes how?

Research

- What is your role in problem identification, prioritization and planning of research agenda in your area?
- Which research center is working with you? What services have you got from the center?
- What problems you observe from the work of research centers? What do suggest to improve the quality of service delivery?

Marketing

- To whom do you typically sell your seed?
- How you sell your production as a seed or grain?(spacified market price-----, gift, exchange, etc.)
- From where do you get input and out put market information?
- What are the challenges and oppourtunities you faced in input and out put marketing?
- What alterative solutions do you suggest to alivate the problems and use the available oppourtunities?

Consumption

- ❖ Do you have enough knowledge about the food preparation and consumption of rice? If yes from where do you get such information/knowledge?
- ❖ What do you think about the feeding quality of rice in your area?
- ❖ If you are using rice for household food consumption, how do you use it?
- ❖ What problems you encountered to use rice for house hold consumption(for sale and food)?
- ❖ What do you feel about avaliability/absence of rice polisher and trresher?
- ❖ Have you attempted to get rice polisher in group by taking credit? If no why?
- ❖ What alternative solutions do you have to improve the development of rice in your area?

Checklist for Supportive Actors

Organizational profile

- Name of the organization: _____
- Name of the interviewee: _____
- Role of the interviewee in the organization: _____
- Location and Contact information: region/zone/District/ kebele/ P.o.Box/telephone
- Type of the organization: public/private/NGO/CBO
- Organizational mission, vision and objectives
- Organizational structure: line of authority
- Total size of the organization (human resource):

Level of Education	Male	Female	Total
Second Degree			
First Degree			
Diploma			
Certificate			
Total			

- Organization budget source/ average annual budget/ availability of donors
- Mandate area/ clients or target groups of the organization
- Type of services provided and manner of service provision

Role of the organization

- What is the role of your organization in rice value chain in the study area?
- How you undertake those roles assigned to you? (In isolation or in collaboration with others)

Challenges and opportunities

- What are the challenges you faced in undertaking those roles assigned to your organization? (For instance shortage of improved technology supplies, technical skill,

human resource, budget; and lack of facilities, transport, field and office equipments; absence of good leadership and incentives, etc.)

- Opportunities available to execute your role and achieve good result in the development of rice in your area (high demand for rice technology, availability of improved technologies, institutional support, etc.)

Patterns of interaction

- Linkage /interaction/ partnership/ coordination between actors(using actors linkage matrix)
- Forms of linkage mechanism
- Strength of linkage (strong, medium, weak, non existence)
- Why linkage is strong/ weak/ non existent
- Linkage arrangement employed
- Factors constraining linkage between actors(policy, organizational, attitudinal and motivation, etc related)
- Are sector-coordinating bodies present or absent? If present, are they effective?

Attitude and practice

- Is there a habit of working with other organizations (private/ public/CBO/NGOs)? If there is, how you characterize the existing relationship (is there Mistrust/ Competition/ Apprehension/ Distain)
- How do you share knowledge with others?
- How you incorporate the needs and problems of your clients/target groups/stakeholders?
- How you perform the planning process? Is it participatory/ consultative/ top-down?
- How you monitor and evaluate the performance of your activities? Is there a joint monitoring and evaluation program or not?
- How decisions are passed (with the participation of responsible bodies/mangers decisions are made in isolation with managers, etc)
- How does the organization treat failure? As a learning opportunity or as something to be covered up? Is the organization very hierarchical?
- Is there a professional incentive like award for good work, promotion, etc.? is the criteria for promotion acceptable by the employees? Is it motivating or discouraging the employees?
- How do you feel about the work of other partner organizations/ individuals who are working with you?(mistrust/trust/mutual respect/ etc.)

Enabling environment (policies and infrastructure):

- Are farmer and other organizations involved in defining research and innovation challenges?
- Availability of infrastructures(road, market, telecommunication, etc.) that promote or impede the expansion/scaling up of rice production
- Are there favorable environment (policies, institutional arrangement and incentive mechanisms) to promote collaboration and rice production in the study area?

Interventions conducted, time and executing organization, and immediate outcome obtained

- What interventions you undertake in rice value chain?
- When did you intervene and what outcomes you obtained?

DECLARATION

I, the undersigned, declare that this Thesis is my own original work and has not been presented for a degree in any other university, and that all sources of material used for the thesis have been duly acknowledged.

Declared by:

Name: _____

Signature: _____

Date: _____

Confirmed by Advisor:

Name: _____

Signature: _____

Date: _____

Place and Date of Submission: _____