Research Report I

AGRICULTURAL EXTENSION, ADOPTION AND DIFFUSION IN ETHIOPIA

By

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Addis Ababa, Ethiopia

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Forward

In 1993 Ethiopia adopted a long tern development strategy known as "Agricultural-Development-Led Industrialization". Subsequently, in the mid 19990s, the "participatory Demonstration and Extension Training System" (PADETS) was launched. Unlike its predecessors of agricultural development programmes based on integrated rural development, such as the Chilalo Agricultural development Unit", PADETS is designed to cover a much wider area of the country with activities by restricting the activities to a single sector that of agriculture. Until recently, it aimed to cover all parts of the country with relatively reliable and adequate rainfall to make possible the transfer of a simple technology revolving around the application of fertilizer.

PADETS departs from the agricultural extension programmes that were practiced in Ethiopia previously, in common with other developing countries, in two ways. First, the demonstration of new methods of production are carried out directly by th efamers themselves under the supervision of extension workers, rather than in fields operatied by the extension service. Second, the diffusion of technology is backed by credit at affordable interest rates. These two factors in combination led to positive results quickly. Indeed, in 1995/96 and 1996/97, which were years of favorable climate, the country did attain a nearly complete level of food self-sufficiency.

In view of the obvious potential of PADETS to contribute to the attainment of food security in Ethiopia, EDRI decided to undertake an assessment of its performance in 2001. Dr. Tenkir Bonger, then a senior research fellow, took charge of the survey. He was later joined by Dr. Gezahegn Ayele and Tadess Kumsa both staff of EDRI, in the preparation of this report.

Newai Gebreab
Director, EDRI

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Acronyms

ACSI	Amhara Credit and Saving Institution
AD	Adopter
ADLI	Agricultural Development Led Industrialization
ARDU	Arsi Development Unit
AV	Average
BO	Better off
CADU	Chilalo Agricultural Development Unit
EDRI	Ethiopian Development Research Institute
FHH	Female Headed Household
HAPA	High Adopter Peasant Association
HAW	High Adopter Woreda
HAZ	High Adopter Zone
LAZ	Low Adopter Zone
LAPA	Low Adopter Peasant Association
LAW	Low Adopter Woreda
MHH	Male Headed Household
NAD	Non Adopter
PADEP	Participatory Farmers Development Program
PADETS	Participatory Demonstration & Extension Training System
PO	Poor
TADU	Tahtai Adiabo Development Unit
SNNPRS	Southern Nation Nationalities Peoples Regional Sate
WADU	Wollaita Agricultural Development Unit

Preface

This is a consolidated and edited Research Report version of the Papers presented at the Ghion Hotel Workshop on 24 February 2004 by the staff of the Ethiopian Development Research Institute [EDRI]. The Workshop's theme was Preliminary Study Report on "*Agricultural Extension, Adoption, Diffusion and Socio-economic Impact in the Four Regions [Tigrai, Amhara, Oromia and SNNPR] of Ethiopia*".

The Paper begins with Background to Agricultural Extension in Ethiopia and the design of the Research followed by a short literature review on extension in Ethiopia. This is followed by the Demographic and Socio-economic Characteristics of the Studied Households, Extension/Adoption/ Diffusion, Input and Credit Services, Performance Evaluation of Extension Service Delivery Institutions and Conclusions and Policy Implications. The final Section [7.0 Conclusion and Policy Implications] pulls together the implications of the findings for policy, technical and institutional innovations.

As the implementation of the Extension Strategy embodied by the Participatory Demonstration and Extension Training Systems [PADETS] is home grown, its first country-wide evaluative report has been undertaken and reported on by an all Ethiopian Team at Ethiopian Development Research Institute (EDRI). The Study Team is grateful to all staff at the regional, *wereda* and peasant association agricultural offices who assisted in the proposal development and fieldwork execution. Ato Dereje Biruk, Amhara Regional Government Agricultural Bureau Head and Ato Gebre Haile, the then Oromia Regional Cooperative Head were particularly helpful. Agricultural officers in Amhara and SNNPR regions were exemplary in their cooperation.

The section on literature review is based on an annotated compilation of the same by Ato Tadesse Mezgebo, Junior Researcher, EDRI for which we are very grateful.

Executive Summary

1.0 BACKGROUND AND RESEARCH DESIGN

1.1 Technology adoption is a dynamic aspect of an innovation process of dissemination and diffusion of knowledge and hardware component of a technology. For efficient impact to be registered on farm households, it requires synergy between policy, technical and institutional innovations.

1.2 Since 1995, Ethiopia has been undertaking a home grown development strategy known as, Agricultural Development Led Industrialization [ADLI]. One of the main facets of this strategy in the agricultural sector has been the generation, adoption and diffusion of new farm technologies in the form of new and improved inputs and practices. In the mobilization of small farmers and the dissemination of better farming practices, the agricultural development strategy has been operationalized through Participatory Demonstration & Extension Training System [PADETS].

1.3 Ensuing enhanced farm output and productivity via increased yield, cropped area, quality improvement and diversification aim at raising the level of living of the rural population, the development of a home market for industry, raising the technical base of agriculture, generating foreign exchange and improved sustainability are the main objectives of the study.

1.4 Although PADETS have been in operation for about 6 years, there has not been a comprehensive national level evaluation of the programme. The cursory monitoring reports are too general and rarely quantified from a scientifically designed and processed data base. Evaluation is essential to assess the outcome of the programme in terms of its stated objectives, identifying its strong institutional and dissemination strategies to reinforce and replicate them as the programme expands into new areas and broaden its scope and depth in the existing ones.

1.5 Towards this end, the Ethiopian Development Research Institute undertook research on Agricultural Extension, Adoption, Diffusion and Impact Assessment in the four regions vis. Tigrai, Amara, Oromia and the South in 2001-2002.

1.6 The study began with Participatory Rapid Appraisal [PRA] checklist for discussion with regional Agricultural Bureaus, zones, *wereda* Development Agents and peasant association members. This was conducted in tandem with the exploration of the subject with related service providers vis- cooperatives, credit and input supply institutions.

1.7 Once the focus and the felt needs of the eventual data users, policy makers and implementers were identified through the PRA, the study team designed a questionnaire containing eight sections presented in sub-section five of the Section One. The 1,920 farm households in the survey were each drawn from high and low adopting zones, *wereda* and peasant associations. By classifying the sample frame into adopter/ non-adopter, male/female and poor/average/better off households, the study employed purposeful and stratified sampling frame from which randomly selected households were interviewed.

2.0 DEMOGRAHIC AND SOCIO-ECONOMIC CHARACTERISTICS OF THE FARM HOSUEHOLDS

2.1 The social and demographic characteristics of the family households are hypothesized to be related to the decision to adopt or not, typology of the technology adopted, its tempo in process and impact.on the household economy and the community.

2.2 The average HH size of 5.61 persons for entire sample is similar with CSA census data. While adopter households have on the average 0.8 persons per household more than non-adopters, the average gap increases to over 1 person in Oromia and the South. The SNNPR has the highest proportion of adult males – on the average 2, 0.4 more than the 1.6 average for all the regions.

2.3 Except in Amhara, where the adopters are markedly younger than non-adopters, there is no significant difference in average age between adopter and non-adopter household heads. Proportionately less of female headed households [FHH] are adopters compared to their male counterparts. Tigrai not only has the highest proportion of female headed household heads but also the largest lag in adoption rate by FHHs.

2.4 Overall, 32.8 % of the farm household heads have attained literacy and above educational level. This ranges from 40% in Amhara, 34.8% in

the South, 31% in Oromia to 25.4% in Tigrai. Within this, the literacy rate of adopters is significantly higher than non-adopters by as much as 12 percentage points. By contrast, the gap in educational attainment between adopters and non-adopters in the South is only 3%. Against a 7.4% attainment of post-primary educational level for all, at 13% and 11% respectively, the South and Oromia have a significantly higher level of educated farmers compared to Amhara [4.6%] and Tigrai [1.3%].

2.5 In all the regions, nearly 59%, 21% 15.4% and 4.9% of the households respectively profess Orthodox Christianity, Islam, Protestant and other religions. The Protestants in the south and the Orthodox Christians in the in Amhara have more proportion of adopters compared to the other religious groups in the same regions [Orthodox Christians in the South and Moslems in the Amhara region].

2.6 The average size of holdings for the sampled households is just over a hectare. At 1.34 hectares per household, adopters have 60% more holding than non-adopters. On the other hand, overall, there is no significant difference in holding between the gender and socio-economic status of the household heads. Although marginal and at insignificant level, socio-economic status is inversely related to size of holding.

2.7 The size of land operated in most cases is greater than the size of land owned. This is due to additional land operated through renting in and share cropping arrangement. Slightly over 75% of the land transactions equally divided between the two took place in Tigrai and Amhara regions. Overall, just over 1/3 of the households [47% adopters and 24% non-adopters] did not have any oxen power of their own.

2.8 Nearly 2/3, slightly over ¼ and over 1/20th of the total households were categorized as poor, average and better off respectively. At 7.9% and 7.1% of their respective total households, the SNNPR and Oromia region have higher rates of better offs.

3.0 EXTENSION, ADOPTION AND DIFFUSION

3.1 In all the regions, there is a very high level of awareness of the existence of development service providers and the more so of Development Agents, credit and input providers. Far less than those who are aware about the existence of the extension services have been contacted by extension. While contact by extension is less than awareness by farmers, contact of extension by farmers is even far less than contact by extension. Except in Kembatta, Alaba and Timbaro [KAT] of SNNPR by Farm Africa, there is virtually no extension contact with NGO development agencies. It appears that most of the technologies were disseminated without the direct involvement of research centers with farmers but via the extension services and farmer to farmer contact.

3.2 The two most important inputs in extension services promoted and adopted in Ethiopia are artificial fertilizers in the form of Urea and DAP and improved seeds of maize and to a much lesser extent wheat and *teff* together with associated management practices in ploughing, planting, weeding, harvesting and storage. About 40% of the households under study have never tried the use of DAP and 15% had used it but for some reasons had discontinued and only 3.5% re-started. Currently, close to 44% of the households are using DAP fertilizer. In a similar vein, about 47% of the households never used Urea fertilizer and 14% of them had used but discontinued and only 1.7% restarted using it. A significant 37% of the studied households do still use it.

3.3 Overall, 63% of the households had tried one or more of the new inputs but nearly 25% of the total households or about 40 % of those who had tried them interrupted using them and only 1/6th of those who had exited restarted. While the regional gap between the highest, SNNPR [58%] and lowest Tigrai [48%] is only 10%, the range between the high and low adopting units within the regions - zones, *wereda* and PA is considerable. At 70% of ever trial of any one of the inputs, SNNPR stands out top both in trial and adoption rate [58%] but with also the highest disparity between zones, *wereda* and PAs.

3.4 Adopters in Tigrai are more consistent with only 15% interrupting and 2% restarting. Conversely, adopters in Oromia appear to be more volatile with as many as half of the total adopters [29%] interrupting and only 5% of them reportedly coming back. While price [high of input and low of output], shortage of complementary inputs and inadequate

extension service are cited as the major constraints for adoption, their obverse are said to promote adoption.

3.5 When three suggested measures of diffusion are taken together, the spatial and temporal spread and the accompanying exposure [nearly 75% when the dis-adopters are included], the latter until 1997/98, have been phenomenal. However, because of exit and very low rate of return to the technology in some years, the rate of the adoption of the new input per household and per unit area have been shallow. It appears that the reigning price trend did not drive farmers to graduate upwards in terms of intensification of the already used inputs and expanding to others which would have otherwise prompted the term Green Revolution at least in maize. This will have to be appraised in the light of the short time dimension of the whole process.

3.6 Another main issue which emerges from the study is the strategy of Lateral Expansion versus Intensification. Farmers will have to travel an average distance of close to 3 km to reach to the development agent, 4.8 km to home agent, 7.8 km to credit service, 7 km to input service, 4 km to demonstration farms and 20 km to research centers. There is no significant difference among the regions in terms of accessibility to development agents. Among others, this suggests whether the lateral expansion of similar services by the development agents is worth the resources allotted to their training and employment or that time is ripe for other strategies of knowledge dissemination while strengthening the capacity and capability of the already existing agents.

4.0 INPUT AND CREDIT SERVICES

4.1 The delivery of the required amount of credit and inputs to finance and employ them in the production process respectively are important components of adoption to bring about the required economic and social impact of technology dissemination. This is particularly crucial in rural Ethiopia where the level of living is very low. Provided that the technology is profitable and sustainable, credit is beneficial both to the users and lenders. While the borrowers benefit from increased incomes and the expansion of their knowledge base, creditors earn interest and servicing cost.

4.2 At consumption levels of 43 and 70 kgs per adopting household respectively, the mean purchase of fertilizer and seed are well below the recommended levels of inputs. Just over 2/3 of the respondents

4.1 Household heads in the study were asked to evaluate the institutions they come in contact with and were directly or indirectly involved in the extension effort. They were asked to rank them as A for being excellent, B for very good, C for satisfactory, D for poor and E for very poor including the reasons.

4.2 All the regions accord their highest ranking to the *kebele* Development Agent Office. This is the grass-root contact having the most important bearing on the dissemination of innovation. The DA office is ranked A and B ranging from 99% in Tigrai to 83% in the Amhara region.

4.3 Next in the ranking order are cooperatives. They are awarded ranks of A and B by 83% in Oromia, 78% in Amhara, 71% in SNPPR and the lowest but still respectable 63% in Tigrai. In all the regions most ranked the *kebele* administration as poor and very poor .

4.4 For those graded A & B, in giving reason for the ranking, the respondents were asked to choose from promptness, being polite, efficient, knowing duty well, nearness, costing less and other specify. The reason for poor performance were the obverse of the good.

4.5 Regarding preferences of handling inputs delivery, nearly half each of the total households opted for cooperatives and Extension for fertilizer and to a lesser extent for seed. Those who opted delivery by the private sector cited timeliness, friendliness, flexibility, low interest, non-requirement of collateral, being more sympathetic etc. Most of these are the hallmarks of a competitive market led economy.

4.6 In the light of the poor qualities of input and credit provisions services and the associated problems mentioned under 4.3, it is worth considering a policy which provides social protection for farmers within a competitive input marketing framework.

5.0 PERFORMANCE EVALUATION OF EXTENSION SERVICES DELIVERY INSTITUTIONS

5.1 Household heads in the study were asked to evaluate the institutions they come in contact with and were directly or indirectly involved in the extension effort. They were asked to rank them as A for being excellent, B for very good, C for satisfactory, D for poor and E for very poor including the reasons.

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1. BACKGROUND TO AGRICULTURAL EXTENSION AND RESEARCH DESIGN

1.1 Background to Agricultural Extension in Ethiopia[1]

Over 85 % of Ethiopia's 70 million people are rural and 94 % of the farmlands are operated by over 7 million small holders cultivating an average of less than a hectare. Agriculture contributes just over half of the gross domestic product. Although the country's 1.1 million sq. km area ranges from 126 metres below sea level in the Afar Depression to over 4,620 metres in the Semien Mountains, 95 % of the cultivated lands are on plateaus and mountains above 1500 metres. Whereas lands below 1,500 metres make up about 61.5% of the area, they contain less than 5% of the cultivated land but about 30% of the livestock units.

Depending on altitude, accompanying levels of rain, topography and soils, the country is divided into 18 main agro-ecological zones and 62 minor ones in which about 146 types of crops are believed to be grown. An estimated 56 % of the area is suited to one or another type of crop. But, the currently operated area is about 16.4 million hectares. Tree cover makes up only 3.6% of the total area. The country has 9 major and many other minor river systems which are yet to be significantly harnessed for irrigation.

With 26 million heads of cattle, 23 million sheep, 17 million goats, 7 million pack animals, 1 million camels and an estimated 49 million chicken, it has the largest livestock unit in Africa. Despite its considerable cultivable land area and livestock, due to the low productivity emanating from the use of traditional inputs and methods, its per capita agricultural output of about US$80 is one of the lowest in the world. This is despite concerted efforts towards the generation of improved seeds, breeds, fertilizer inputs and the establishment of extension efforts since the turn of the last century.

Efforts along this line began in 1908 with the formal establishment of Ministries replacing the traditional *gebbi* governance system. The legal notice issued in the period stipulated measures to institute reward for the hardworking who adopted the best crop and animal husbandry practices and penalizing those violating them. Enticing some local and foreign firms to introduce modern farming, eucalyptus and irrigation in some areas were the main innovations introduced during this period..

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[1] Most of the information here is gleaned from the Annual Evaluation Reports [1993/94-1998/1999 written in *Amarigna*] of the Task Force set up by the Ministry of Agriculture for this purpose.

The Government regulations of 1930 constituted agriculture as a Ministry on its own. Following the liberation of the country from Italian occupation, demonstration farms were set up at Shola [Addis Abeba], Adensa [Gojam] and Adami Tulu [in the rift valley near Zwai] to test suitability and adaptations of imported cattle and chicken breed. Shortly afterwards, with the assistance of FAO, a number of Ethiopians were sent for training abroad in different areas of modern agriculture.

Major breakthrough in extension work began in 1952 with the Ethio-American Point Four Programme. Mirroring the Land Grant universities of the US, education, research and extension were entrusted to the newly established Alemaya College of Agriculture in unison with Kansas State University. When Alemaya became a constituent part of the then Haile Sellassie University in 1963, its extension mandate was transferred to the Ministry of Agriculture. Soon afterwards, its sole national research function was transferred to the newly established Institute of Agricultural Research [IAR] the forebear of the current Ethiopian Agricultural Research Organization [EARO]. By the mid-sixties, the number of extension centres in the country reached 120.

The same period brought the realization that thinned efforts spread in all parts of the country could not generate the most desired productivity gains rapidly. It was hence felt that there was a need to focus on high potential areas with the simultaneous introduction of multiple innovations in the realm of research, extension, credit, marketing, institution building and social and physical infrastructure. These became to be known as comprehensive approaches to rural development. They were to be the precursors of minimum packages to be replicated at lower cost in other parts of the country.

The Chilalo Agricultural Development Unit [CADU] which later embraced the whole of Arsi to become the Arsi Rural Development Unit [ARDU] and the Wollaita Agricultural Development Unit [WADU] were set up as comprehensive agricultural development models. They were largely funded by Sweden and the World bank respectively. The Adea Development Unit near Addis, funded by USAID obtained part of its *modes operandi* from the above two projects. The Ethiopian Revolution of 1974 disrupted the completion of the Tahatai Adiabo Development Unit in Tigrai [TADU] which was structured along the lines of the above comprehensive projects.

Four years before the onset of the February 1974 Revolution, the experiences garnered from the maximum packages was operationalized for dissemination

under the Minimum Package Programme 1 [MPP1]. Its stage by stage operation beginning with observation, demonstration and finally operation was found to be too gradualist. Its replacement, MMP2 in 1977 under the new military regime, envisaged a more rapid dissemination and broke down the extension activities into crop, animal, forestry and soil and water Departments.

The new approach was beset by a host of problems. The division into 4 sections resulted in the fragmentation of efforts, multiple chain of command, lack of integration, the proliferation of administrative staff, bureaucratization, diversion of field staff towards political duties and limited relation between research and extension. Following the adoption of Training and Visit Strategy of Extension by the World Bank, in 1984, MPP2 gave way to the Participatory Farmer Development Programme [PADEP] for which the country was divided into 8 ecological zones.

Finally, since 1995, the PADEP was replaced by the Participatory Demonstration & Extension Training System [PADETS]. Compared to the previous strategies of extension, the three core essential and two other features of the PADETS strategy are:

i. sizeable demonstration plots in the field of the farmer himself/ herself instead of the fenced government plot
ii. the provision of input credit under local government collateral arrangement
iii. market led inputs and output prices
iv. institutional linkages with rural development committees
v. systematic inclusion of women and the young

Its stated objectives are increased incomes and levels of living, fostering food security and improved health, free organization by sex, age and lines of occupation, provision of raw materials for industry, enhancement of foreign exchange and the conservation of natural resources and the environment all through the provision of appropriate technologies and the participation of women. The latest extension packages cover food crops - 11 maize, 14 wheat, 6 *teff*, 2 barley, 6 sorghum and 3 millet varieties. The high value commercial crops include beans, peas, peanut, potatoes, onions, tomatoes, cabbages, carrots, sweet potatoes and coffee.

In the livestock sector, 5 varieties of bulls are promoted in conjunction with AI services and 12 types of fodder. The post-harvest package encompasses

animal drawn carts, maize and *kocho* processing equipment and improved storage facilities. Improved animal drawn farming tools are also demonstrated. The natural resources utilization and conservation component includes the multiplication and distribution of seedlings, planting different types of trees, the rehabilitating denuded areas and the dissemination of better management practices for water and soil resources.

Since the 1995/96 crop season, when PADETS became operational in all regional states and ecological zones of the country, the two main inputs, fertilizer and selected seed have witnessed widespread and increasing rates of adoption. This is despite the removal of all input subsidy since 1997/98. Between 1995 when the PADETS became operational and the latest evaluation report for 1999, the consumption of fertilizer increased from 35,272 to 2,168,756 quintals. For the same periods, the data for the other major input of the package, seed, was 11,043 and 177,783 quintals.

The number of participating farmers leaped from 31,256 to 3,731,217 covering nearly 40% of the farming population. The value of credit, which began at 8.1 million *Birr* has reached 150.2 million. Demonstration plots in the fields of farmers covered by the package now stands at 3,807,658. In terms of its spread in hitherto unknown areas, adoption rates of new varieties and fertilizer, diffusion and increased yield rates, some have begun to speak of green revolution albeit only in maize.

1.2 Conceptual Framework

Technology adoption is a dynamic aspect of an innovation process of the creation, dissemination and diffusion of knowledge and hardware component of a technology. It demands the synergy between technical and institutional innovation for efficient impact to be registered on farm households. The first step in the methodology is to define adoption, its measurement, description, adoption time frame to be selected, which help to set out the ways and means of measuring impact and estimating return to extension and/or research. Adoption is a new practice from research, adaptations/ innovations and or from other external agents.

For an agricultural technology, in this case seed and fertilizer packages still in the process of diffusion, the cut off point between adoption and non-adoption may not be so straight forward. It could be based on acreage [certain minimum field size], variety and level of involvement in the package [fertilizer, seed etc], change in management and farming practice, extent of

adaptation or modification by the farmer, number of use of any, part or the whole package or any combination of the above.

While adoption is a point in time measure of participation in a given technology and method, a cumulative function of the selected adoption and process could be captured by the Logistic Curve. It follows a curve akin to S – slow initial growth followed by a more rapid increase then slowing down as cumulative proportion of adoption approaches its maximum. Such an exercise could indicate the tempo of change and assist in the projection of demand for the inputs and accompanying services. One important weakness of this exercise is that it assumes fixed price ratios, infrastructure and technology over the period when the curve is fitted.

Not only is diffusion a gradual process, but also that an individual farmer adopting the technology may not follow the pattern depicted by the Logistic Curve. This is because he/she may test the technology on small part of farm and if positive outcome given the objective function of the farmer, increase use and/or take part in a selected item in the package, incorporate other(s) later or leave them out altogether. It is thus important to record the sequence of and the selections in the package. Others may adopt all together because of complementarities or perceived or actual incentives.

The role of extension in this process needs to be spelt out so that its contribution in impact assessment and the rate of return is not unduly exaggerated. A comparison of current and past adoption levels and the reasons for will help in the extrapolation of demand. The reasons for decreasing levels of use or abandonment may provide a clue for future policy and organization of extension or related institutions.

The difference in social and other characteristics in the level of adoption between early and late adopters could assist in the formulation of hypotheses for the possible pace of the spread of the technology in other areas and the critical interventions required to accelerate the process. One of the reasons for adoption study is to provide evidence on returns to extension and/or research. The study and its process has to ensure that farmer adoption took place after the recommendation became available and that the information utilized by farmers had its origin in extension.

This requires collecting data that allows change in the technology is clearly attributable to the research or extension. It requires the estimation of the value of increased production or other benefits and disaggregate the portion

that can be attributed to extension. In addition to the data collected from farmers, it will require additional complementary information from extension and other institutions. If benefit is largely from yield, then the first step is to record changes from farmer, other reports, crop cutting survey or experiments[2].

It is not easy to find farmers who manage comparable fields and the only difference is adoption of technology under study. This also applies to comparable farmers to differentiate them on the bases of using and not using the technology. Year to year variation of weather also compounds the reliability of data. There is also the assumption that widespread adoption has not affected prices. If it has, as is the case now in Ethiopia, this has to be taken into account and the benefit will have to be disaggregated between farmers and consumers.

Variable cost of technology, other costs implied in other parts of the farm, unexpected or unexplored factors influencing the actual distribution of a new technology or of its benefits, impact on long tem sustainability as a benefit and/or cost, gender, impacts on the demand of labour and incomes of the poorest segment of the population need to be considered.

1.3 Research Problems[3] and Objectives

Since 1995, Ethiopia has been undertaking a home grown development strategy known as, Agricultural Development Led Industrialization [ADLI]. One of the main facets of this strategy in the agricultural sector has been the generation, adoption and diffusion of new farm technologies in the form of new and improved inputs and practices. Towards this end, in the mobilization of small farmers and the dissemination of better farming practices, the development strategy has been operationalized through PADETS. Ensuing enhanced farm output and productivity via increased yield, cropped area, quality improvement and diversification aim at raising the level of living of the rural population, the development of a home market for industry, raising the technical base of agriculture, generating foreign exchange and improved sustainability are the main objectives.

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[2] This study will be complemented by such crop cutting survey of CSA undertaken in the same crop season as fieldwork in this study.

[3] This study, however, sets out to cover only some parts of the problems outlined here.

Although PADETS have been in operation for about 6 years, there has not been a comprehensive national level evaluation of the programme. The cursory monitoring reports are too general and rarely quantified from a scientifically designed and processed data base. Evaluation is essential to assess the outcome of the programme in terms of its stated objectives, identifying its strong institutional and dissemination strategies to reinforce and replicate them as the programme expands into new areas and broaden its scope and depth in the existing ones.

Considering the ecological, social and farming system diversity of the country, there are bound to be different responses and tempos of performance. Such evaluation will be able to pin point the possible weaknesses and strength configuration of the national extension system's content and method of delivery thereby picking up the rationales for specificities. Whereas the overall adoption rates and associated gains in productivity are significant, there is a high differential between regions, zones, *wereda,* the specific packages and the elements within. Institutional linkages between research, extension and other supporting organizations [local government, input suppliers] are far from being smooth. The unavailability of core input at the right time, place, type and quantity receive mention in all the annual evaluation reports. In some areas, by distributing free seed and fertilizer, many NGOs and the Ethiopian Relief & Rehabilitation have undermined discipline in the repayment of credit.

Given the vast expansion of Demonstration Plots [coming to nearly 4 million] and the associated resources and time of the Development Agents, it is important to evaluate their continued expansion as strategies of innovation dissemination. In order to deepen and widen the scope and variety of the new technological inputs and methods more effectively and efficiently, there is a need to evaluate the on-going extension programme. In this venture, amongst the major research problems are interfacing the stated objectives of the programme [including sustainable growth enhancement] and the outcomes of its actual field operations.

The extent of participation by the target groups - small and poor farmers on the one hand and women on the other need to be examined. Analysis of the opportunities and constraints of the institutional framework, internal organizational set up within itself and in terms of its relationship with external agencies - rural development agencies, local and national government, research, education, marketing, credit etc. is another major research problem area.

The current PADETS cover about 40% of the farming households in the country and they are essentially supply driven provisions of technical knowledge. The Second Five Year Development Plan [2001-2006] envisages covering the whole country. 50% is a sizeable national coverage opening up opportunities for significant horizontal dissemination of information, knowledge and the adoption of profitable technologies and methods. Specifically, it is hoped that the study will assist:

1. Federal level policy makers to gauge the extent of the current level, opportunities and constraints in the extension programme
2. Regional level policy makers, zonal and *wereda* level rural development officers to take note of the assessment of their performance by their major stakeholders - the farmers, and compare the same with the other better performing regions
3. Raise pertinent questions about PADETS for further refinement of the strategy
4. Serve as a benchmark for further studies in the future and raise issues for investigation in ensuing studies
5. Further the comparative database in the study of extension

1.4 Sampling Design

The first major two major decisions before embarking on the study were the question of defining adoption and the geographical/political demarcations of coverage. Adoption in this study was defined as the use of the fertilizer and/or improved seed extension package for cereal cultivation in the preceding two years. On the basis of this, the research delimited the four major mixed farming highland regions - Tigrai, Amhara, Oromia and the Southern Region, where such technologies have been introduced earlier and have also expanded to a significant extent. Given the resource constraint, inevitably, the other marginal cereal growing parts of the other regions of the country were not to be covered[4].

The focus of the research being the exploration of the factors hindering and/or promoting adoption as defined above, it was considered as a central primary defining parametre in the design of the research and the bases for sampling. Hence, among the four regions, high and low adopting zones [highest and lowest percentage of farmers adopting] were selected. Similarly within the zones and *wereda*, high and low adopting *wereda* and peasant

[4] Such areas can be the focus of a further study along similar lines.

associations respectively were identified for the study. The study thus involved four regions, eight zones, 16 *wereda* and 32 peasant associations equally distributed in the four regions. See Annex Table 1 for the full list of the regions, zones, *wereda* and peasant associations covered in the study.

Once the areas for the study were delimited and classified into adopting [AD] and non-adopting [NAD], the next step was to further stratify the sampling frame. Given the relatively high percentage of female headed households, the lack of male adult labour in such households and social and cultural disadvantage faced, the first dichotomous sampling frame was further classified, by the gender of the head of the households into male headed [MHH] and female headed [FHH]. Following the great agrarian reform of 1975, although the vast majority of peasants in the four highland areas of the country have access to own holdings, a number of studies suggest differentiation based on the ownership of livestock, remittances, access to labour and non-farming incomes. Rather than pre empting variables, the criteria and the identification of such differentiation into poor [P], average [AV] and better off [BO] was however left to the community itself consisting of elders and development agents.

From such stratified sample frame, a proportionate random sample of sixty households per peasant association was drawn out for interview. Hence, the total households covered in the study is 1920 [60 x 32 peasant associations] equally distributed in the four regions, eight zones and 16 *wereda* randomly drawn from a purposefully set frame as in the above scheme. The sampling procedure is at the same time purposeful, stratified and random. The following table summarizes the distribution of households in the study by analytical [adopters/non-adopters, female/male headed HH, better off/ average/poor] and administrative/political categories at regional and zonal levels. For the full lists including *wereda* and PAs see Annex 1 & 2.

Table 1.1 The Distribution of the Studied by Households by Status of Adoption, Gender of Household Head and Socio-economic Status

Regions	Zones	Adoption Status				Gender of HHH				Socio-economic Status of HHH						THH
		AD	%	NAD	%	MHH	%	FHH	%	PO	%	AV	%	BO	%	
Tigray	Western Zone (HAZ)	111	46.3	129	53.8	169	70.4	71	29.6	182	75.8	53	22.2	5	2.0	240
	Eastern Zone (LAZ)	118	49.2	122	50.8	152	63.3	88	36.7	177	73.7	61	25.5	2	0.8	240
	Total	**229**	**47.7**	**251**	**52.3**	**321**	**66.9**	**159**	**33.1**	**359**	**73.8**	**114**	**24.8**	**7**	**1.4**	**480**
Amhara	East Gojam (HAZ)	193	80.4	47	20.0	206	85.8	34	14.2	146	60.8	81	33.8	13	5.4	240
	North Wollo (LAZ)	59	24.6	181	75.0	184	76.7	56	23.3	157	65.4	57	23.8	26	10.8	240
	Total	**252**	**52.5**	**228**	**47.5**	**390**	**81.2**	**90**	**19.8**	**303**	**63.1**	**138**	**28.8**	**39**	**8.1**	**480**
Oromia	East Wallaga (HAZ)	120	50.0	120	50.0	209	87.1	31	12.9	137	57.0	85	34.5	18	7.5	240
	West Hararghe (LAZ)	64	26.7	176	73.3	207	86.2	33	13.8	124	51.6	106	44.3	10	4.1	240
	Total	**184**	**38.3**	**296**	**61.7**	**416**	**86.7**	**64**	**13.3**	**261**	**54.3**	**191**	**39.9**	**28**	**5.8**	**480**
SNNP	Kambata - Timbaro(HAZ)	235	97.9	5	2.08	201	83.7	39	16.3	203	84.5	31	13.5	6	2.5	240
	North Omo (LAZ)	97	40.4	143	59.6	219	91.2	21	8.8	141	58.8	65	27.1	34	14.1	240
	Total	**332**	**69.2**	**148**	**30.8**	**420**	**87.5**	**60**	**12.5**	**344**	**71.6**	**96**	**11.8**	**40**	**16.6**	**480**
	All Regions	**997**	**51.9**	**923**	**48.1**	**1547**	**80.6**	**373**	**19.4**	**1267**	**66.0**	**539**	**28.0**	**114**	**6.0**	**1920**

THH= Total Households

1.5 Fieldwork Execution and Data Collection

The basic instrumentation of the research was household survey questionnaires administered to the farming households with slight variations between adopters and non-adopters. However, prior to that, in order to identify the proper domains of the research, following literature survey at national and continental level, the study began by enlisting support and identification of the felt needs at policy and operational level. The Study Proposal was discussed and amended at a Workshop including Their Excellencies the Minister of Agriculture, the Director of EDRI and other

federal and regional level senior stakeholders. Fieldwork began with a courtesy call on the regional Presidents accompanied by their respective Agriculture Bureau Chiefs, regional cooperative heads, regional credit and input supply institutions and other related senior officers. The list of the contacted senior officers and dates is attached in Annex Table 1.3.

While the above were conducted in general terms without any formal enquiry format, the next field engagement was conducted with the help of Participatory Rapid Appraisal [PRA] Checklist at extension/research and specialist service delivery levels. This was meant to provide a broad overview, assist in demarcating the scope and focus of the study and also serve in the comparative framework of responses and problem identification between farmers and their service providers. Below the policy maker level, the next contacts were the four agricultural bureau chiefs and their staff followed by the zonal, *wereda,* Development Agent [DA] and Peasant Association [PA] level. The extension and specialized services enquiry format of the PRA consisted of:

A. Extension and Research

A.1 Regional, Zonal and *Wereda* Departments of Agriculture

A.1.1 Management – staff profile, organizational chart, operational spread, budget, communication process, staff management

A.1.2 Link with Research

A.1.3 Mode of Extension Intervention

A.1.4 Supply of Inputs

A.1.5 Credit Management

A.1.6 Evaluation of the Service Delivery Institutions

A modified version of the above was also used in the discussion with research station management and research staff but also including aspects special to research such as micro-climate, topography, soils and varieties being developed and/or under use.

A.2 Micro Level - Development Agents and Peasant Associations

Whereas the above provided the broader operational mechanisms as enunciated by the office functionaries under A.1.2-A.1.5 to be compared with the information provided by the farmers about the same, at farmer association and development agent level, micro-level data about the study areas – Peasant Associations [PA] and

Development Agents [DA] particulars, work schedule, Management Committee members of PAs, climate, topography, animal diseases and the coping mechanisms for climatic variability were recorded. Furthermore, at such micro-levels, intimately understood issues about land tenure and marketing were also incorporated in the PRA checklist for discussion.

B. Related Services

These were input and credit delivery institutions –

B.1 Cooperatives – at regional, zonal and *wereda* - the format of enquiry were as at under A.1

B.2 Credit institutions – format of enquiry - applicable sections of A.1

B.2.1 Amara Credit and Saving Institution – ACSI;
B.2.2 Tigrai Micro-finance institution – Dedebit
B.2.3 Omo Microfinance
B.2.4 Oromia Credit and Saving

B.3 Input Suppliers – format of enquiry - applicable sections of A.1

B.3.1 Ambassel Trading
B.3.2 Agricultural Input supply Enterprise [AISE]
B.3.3 Guna Trading
B.3.4 Wendo Trading
B.3.5insho Trading

The main instrument and means of data collection on which the analyses is based emanates from the two sets questionnaires administered to adopters and non-adopters. With the exception of aspects of adoption and its evaluation, which were substituted by the reasons for non-adoption and the technical and social requirements for future adoption by the current non-adopters, the questionnaires for both were structured along similar lines the outline of which is provided below.

Agricultural Extension, Adoption, Diffusion and Impact Assessment: Household Survey

1. **Household particulars**
   – sex, age, education, marital status, religion, labour mobility

2. **Assets**
   – Land, livestock, farm equipment, non-farming assets

3. **Extension & Research**
   – improved inputs and practices, frequency and mode of contact, recommended vs actual practices and application of inputs, awareness about rural development services, membership of modern and traditional institutions, contributing factors towards adoption and non-adoption of inputs and practices, evaluation of the services of DA

4. **Inputs & Credit**
   – sources of, pattern and use, promptness of delivery, Repayment, problems, preference of sources and borrowing.

5. **Production, Incomes & Expenditure**
   – cropped area and production in 1993/94, labour and oxen *timad* days, source and cost of labour, oxen *timad* and machine days, non-farm incomes, expenditures

6. **Marketing**
   – Transactions in the low and high seasons, advance borrowings for consumption and production

7. **Consumption & and Welfare**
   – frequency of consumption of a variety of food items, modern utilities, health, family planning and education services, inter-temporal wellbeing compared to last, five and ten years ago

8. **Evaluation of Direct and Indirect Service Delivery Instiutions**
   - Credit agencies
   - Input agencies
   - Cooperative
   - Local Extension
   - Farmer groups
   - *Wereda* agricultural office
   - *Wereda* administration
   - *Keble* administration

2. LITERATURE REVIEW

Since the coming into being of the maximum package rural development projects like CADU and the minimum packages like EPID [See Section 1.2 for details], there have been a number of adoption/difffusion studies. Within the framework of this study, there are recent post PADETS [1994-] and a few ones before which can be considered as base-line studies for comparison with the post-PADET period ones.

The latest countrywide study on Fertilizer Marketing, Adoption and Credit by the Development Studies Association [2001] reported that the probability of adoption and the intensity of the use of the new inputs increased with asset ownership such as oxen, literacy and being a surplus producer. In the study period, there was a 10% rise in price of fertilizer and as a result, 46-52 % of farmers reduced their consumption, 4-5% ceased using fertilizer at all and around a quarter continued using the same amount. About 80% of the farmers' perceived that the price of fertilizer was higher than expected. The ratio of DAP to grain price at the central part of the country rose by 352% for *teff*, 670% for maize, 463% for wheat and 395% for barley. In a longer period between 1992 and 2001, the ratio went against farmers.[5]

One of the latest study employed a Tobit model to explain adoption, [Beyene:2001] found that access to credit, availability of inputs as a package, the availability and number of oxen, more proximity to roads were the main variables enhancing adoption. To a lesser extent, farm size, level of education and household size were directly related to the probability of adoption. Age also did so but with inverse relation.

A later study of adoption [Tesfaye Zegeye *et.al* 2000] in two districts [Yilmana Densa and Farta in Gojjam] concluded that, when stepwise regression was used to different combination of variables, participation in demonstration and access to credit were found to be the main explanatory variables for adoption. The reasons for ceasing the application of improved wheat varieties were unavailability in sufficient quantity, expensiveness, lack of credit and poor yield. Regardless of farm size and participating in demonstrations, contact with extension agent raise the probability of adoption.

A study on the use and intensity of fertilizer and herbicide on the central highlands on *teff* and wheat in a similar period [Legesse *et al:*2001] reported

[5] This was of course partly compensated by gains in yields.

that rather than factors such as extension activities or attitude to price or risk, structural ones, in particular oxen ownership and distance to market were the determining factors of adoption and intensity of use of a modern technology. The policy recommendation included that given the importance of oxen and expected migration of the ox-less with intensification, government has to deal with short term and medium term credits such that farmers easier access for credit for example by establishing rural credit cooperatives.

Sharada, Weir and John Knight [2000] on adoption/diffusion and education reported that the three main media of the transfer of knowledge in process were extension, friends, neighbours and by observing when others were doing the innovative practices. Younger ones obtained information from the wealthiest ones or those on the same wealth level. However, overall the wealthier and older farmers mostly influence the more educated ones.

An adoption study confined to *teff,* [Teklu *et al* 2000I] found the marginal rate of return ranging from 101.75% to 458.22% from ten improved *teff* varieties. Only 21% of farmers planted improved *teff* varieties even though 51% of them were aware of them. 58% of the farmers used fertilizer and herbicide together. In the study area, farmers followed stepwise method on their adoption of package of technology.

Regarding the adoption of improved maize seed and fertilizer in two zones in the South , Getahun *et al* [2000] concluded that the reasons for not using preferred seed was expensiveness, un-availability and poor quality. Most farmers preferred local maize variety due to its perceived early maturity, high yield and being of intermediate size. Even though credit decision is sometimes made jointly, most of the time, it is made by the males rather than by the females members of the households. The farmers' sources of finance for production are credit, animal and crop sales. Off farm income, the use of hired labor, credit and being a contact farmer significantly influence the adoption of fertilizer.

In another recent post-PADETS baseline survey of the adoption of fertilizer, Setotaw *et al* [2000], found that, although 71% of the farmers are aware of the recommended rate, only 16% of the sampled farmers applied it. 92% of the farmers adopted fertilizer and/or improved seed; 82.9% indicated that incremental crop yield due to applied fertilizer application was sufficient to pay input loans and 83% apply the recommended rate of DAP but only 14% did so for UREA.

In a related study about fertilizer procurement and distribution immediately following the PADETS approach to extension, Mulat's [1995] findings indicated that in the four years (1988-1991) trials conducted in various part of the country showed that the yield

response of crops to nutrient varied by soil type, region, altitude, variety of seed, length of growing period and organic mater content of the soil. And in general, poor agro-climate and agronomic condition have generally resulted in lower yield responses. The week bargaining power of the small farmers is said to be due to lack of organization and the evident scattered locations. Examination of value-cost ratio showed that further increase in fertilizer price could erode the incentive to use the inputs especially in remote and marginal areas.

A number of adoption and related studies have also been undertaken as parts of partial fulfilments for the requirements of PhD dissertations elsewhere [Assefa Admassie:1995; Bisrat Aklilu: 1976] and MSc Theses at the Department of Economics, Addis Abeba University [Mulugetta : 1999;.Nigussie : 2001; Itana :1985 and: 1998].
Encompassing 20 of the the Minimum Package Project Areas [MPPs] of the defunct Extension Project Implementation Department [EPID], Bisrat Aklilu [1976] fitted a logistic model using the variables profitability, variability of farm size and number of extension agents to explain the tempo of adoption. For micro or house level study level, factor analysis method with dependent variables of index and number of years of fertilizer use were set with the independent variables [direct and proxies] for age, education, farm size, tenancy, extension contact, management knowledge index, fertilizer motivation index, social participation, distance, oxen to land ratio, borrowings, value of livestock owned, man to land ratio, consumption unit, government exposure index and media exposure.

The study found that that diffusion is not a haphazard process but depended on profitability, variation of output and number of agents at the disposal of farmers. However, contrary to many contemporary studies and others following the study, it reported that landownership, cultivated holdings and value of livestock owned were not important in explaining either of the dependent variables. Even though they are not early adopters, with time, as risk is reduced and profitability is generated, small farmers were as likely to adopt as the others.

Policy recommendation included the stabilization of prices at profitable levels to farmers, but with the understanding that the cost may be prohibitive in the long term. Infrastructure improvement and input subsidy are said to can download part of the cost of price stabilization.

Most of the MSc theses used the Probit and Tobit probability of adoption and intensification of adoption models with similar findings. Mulugeta Tassew's [1999] regression model resulted in family size, attendance of agricultural training program and farm income as influencing adoption positively with education as third variable in terms of significance. In the study area, the value cost ratio was 3 for barely and only 1.98 for wheat.

In Nigussie's [2001] study in Arsi, the quantity of seed and chemical fertilizer, Dap, use of recommended rate, cultivation of plots at least four times, performing farm activity on time, land quality, age and sex had significant and positive impact on productivity. In the South Shewa study by Itana Ayana [1985], employing a Probit model, the application of fertilizer at 50% of the recommended rate for *teff* and the yield difference due to application of fertilizer were insignificant. The variables literacy and unavailability of cash for down payment [negatively] followed by adequacy of rain fall and the price of farm inputs [inversely related] increased the probability of adoption.

The intensity of input use and profitability study by Lelissa [1998] in Ejere district argued that inappropriate price policy and marketing hampered the adoption of technology during the government of the *Derge*. 96% of the farmers who adopted fertilizer, used less than the recommended amount. 87.5% of the farmers used chemical fertilizer since the late 1960's. In 1997/ 98 cropping season, 78.3% of the sample, applied fertilizer and 11.7% of the total users abandoned using it and 90% of them explain that lack of cash was the main obstacle for using it.

Only 32.9% of the farmers were familiar with improved seeds, and in 1997/ 98 cropping season, 19.2% of the sampled farmer used improved seed. In 1997/98, 44.6% had no access to extension service. More over at the same time 20.8% has no access to credit. Credit recovery rate was as high as 94%. The value cost ratio was 2.9, 3.0 and 2.6 for wheat, barley and *teff* respectively. Fertilizer adoption is influenced significantly by access to credit followed by age, area rented-out in hectare, use of animal dung [all inversely related] and ownership of oxen.

In a similar period, in Lume and Kewet, in North Shewa again, but this time

on credit, Assefa [1989] concluded that agricultural credit was influenced by a set of economic and demographic factors. Borrowers were characterized by having had higher level of education, operational area, investment resources; access to more improved technology, involvement with the level of input and product prices and extension service arrangement. The policy recommendation included an integrated approach, which included credit, input supply, awareness, appropriate system of pricing and improved marketing facilities.

In a pre-PADETS study in Ankober and Sela Dingay districts, North Shewa, which have had relatively late visitations by extension, for fertilizer, farm size, pesticide use, economic, technical, social feasibility and risk averse behaviour were found to be important in adoption decisions [Yohannes Kebede *et al* 1990]. Amongst the earlier studies of extension, Tennassie Nichola's [1987] is the only one which estimated the economics of extension. It estimated a 40% internal rate of return [IRR] for wheat in Arsi. Moreover, this was found to be relatively stable to different demand and supply price elasticities. A pre agrarian reform study by Gerald Gill [1974] concluded that the traditional system of share cropping quite apart from being inequitable, constituted an effective barrier to the wide spread of agricultural advance through adoption of improved purchased inputs. [6]

Except for the study by the Development Studies Association [2001], which is confined to fertilizer marketing and credit, the current study is perhaps the first ever to have looked into adoption/diffusion at a national level albeit in the main four main regions which have over 95% of the farming households in the country.

3. DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS OF THE FARM HOUSEHOLDS

3.1 Introduction

Among the critical factors of production in a peasant economy are the quality and quantity of labour, land[7], livestock, other working assets, knowledge/ skills and institutions. The profile of labour is important both on the supply and demand side of the rural economy. Analysis of the quantity, skills including literacy and numeracy, age and sex composition of labour together with its social division of tasks and cultural values are important to appraise

[6] The details of this study and its implication for current land tenure policy debate might be enlightening.

[7] That is including climate and weather.

its potential and actual productivity. The ratio between those who work and dependent on the economically active population together with the state of the art of production determine the per capita available for consumption and investment. In order to gauge the impact of agricultural extension and diffusion, the variables in the peasant economy set out as above need to be is interfaced with the array of policies and programmes aiming to improve land and labour productivities to meet economic and social objectives.

In this study, the social and demographic characteristics of the farming households are hypothesized to be related to the decision whether to adopt or not and the related typology of technology adopted, its tempo in process and impact on the household economy and the community[8]. Before embarking on one of the main aspects of the study, Extension, Adoption, and Diffusion in section III, it will thus be useful to examine the social and economic characteristics of the households using various indicators such as household size, literacy rate, religion, marital status and socio-economic category.

3.2 Demographic Characteristics

The average HH size for the entire sample of 5.61 is consistent with CSA census data. The average aggregate for the regions shows significant variation from just under 5 persons per household in Amhara and Tigrai, to nearly 6 and 7 in Oromia and the SNNPR respectively [Table 3.1]. While the adopter households have on the average 0.8 persons per household more than non-adopters, the average gap increases to over 1 person in Oromia and the South. The average age of a household head is close to 45 years with no significant difference between regions.

About 16% of the households do not have adult males on the farm[9] and more of these are among the non-adopters. On the other end, an average of close to 15% of the households do have three or more male labour with the highest proportion being among the adopter household groups. The SNNPR has the highest proportion of adult males [on the average 2, that is 0.4 more than the 1.4 average for all regions]. In terms of age groups, the regional average for active labour force [15-59] years stands close to 2.8 adult equivalent. Except in SNNPR, where by nearly 5% the working age group

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[8] In attempting to develop analytical models explaining the technology dissemination, adoption and diffusion, a number of the variables here will be used as independent variables.

[9] At 19%, the total share of FHH is more because of the absentee male heads

among the adopters is significantly greater, in others, the difference between the two groups is almost the same.

The dependency ratio reaches close to 50% of the available labor force. The proportion of the old age group [over 60 years] from the total population stands at 7.6% in descending ratio from north to the south. Except in the SNNPR, the most striking characteristics of this age group is its significant preponderance among the non-adopters [9.4% compared to the overall average of 7.6%] in all the regions. Its share of the total population between adopters and non-adopters varies from 6.6% in Amhara, 2.8% in Tigrai, 1.8% in Oromia and a mere 0.1% in the South.

Except in Amhara where adopters are markedly younger than non-adopters, there is no significant difference in average age between adopters and non-adopter household heads. Proportionately, less of female-headed households [FHH] are adopters compared to their male counterparts. The share of female households in adoption is less than their total proportion by 10%, 20%, 13% and 10% in SNNPR, Tigrai, Amhara and Oromia

respectively. Only in the South, their share as adopters is more than their total percentage share of households by 7.5%. On the other hand, Tigrai not only has the highest proportion of female-headed household heads [34% against 19% for the four regions] but also the largest lag in adoption rate by FHHs.

Overall, 32.8% of the farm household heads have attained literacy and above educational level. This ranges from 40% in Amhara, 34.8% in the South, 31% in Oromia and 25.4% in Tigrai. Within this, the literacy rate of adopters is significantly higher than non-adopters by as much as 12 percentage points. At 24%, the highest gap in educational attainment between adopters and non-adopters is in Amhara.

Table 3.1 Demographic Characteristics [Average] of Households by Region

	Whole sample			Tigray			Amhara			Oromia			SNNPR		
	NAD	AD	Total	NAD	AD	Total	NAD	AD	Total	NAD	AD	Total	NAD	AD	Total
HH Size	4.9	6.2	5.6	4.5	5.3	4.9	4.4	5.2	4.8	5.4	6.5	5.8	6.1	7.3	7.0
House head:															
Age (years)	45.6	45.0	45.2	48.3	49.8	49.0	47.0	39.4	43.5	43.7	44.66	44.3	42.6	46.2	45.0
Percent male	74.5	84.1	79.6	56.7	76.3	66.0	74.3	87.8	81.5	83.4	94.4	87.9	88.2	80.7	82.9
Percnt female	25.5	15.9	20.4	43.3	23.7	34	25.7	12.2	18.5	16.6	5.6	12.1	11.8	19.3	17.1
# male adults															
%															
0	21.4	11.5	16.2	34.1	20.6	27.7	25.7	9.8	17.3	12.7	8.1	10.8	9.7	8.6	9.0
1	50.8	46.9	48.8	45.6	49.1	47.3	50.9	61.4	56.5	56.5	52.3	54.8	48.6	31.3	36.5
2	17.3	20.9	19.2	14.7	18.4	16.5	16.4	19.3	17.9	19.8	21.3	20.4	18.8	23.5	22.1
3+	10.4	20.7	15.8	5.6	11.8	8.5	7.1	9.4	8.3	11.0	18.3	14.0	22.9	36.6	32.5
Mean male adults	1.2	1.6	1.4	0.9	1.2	1.8	1.7	1.3	1.2	1.32	1.6	1.4	1.7	2.1	2.1
Age:															
≤14 years	2.2	2.7	2.5	2.0	2.4	2.1	1.8	2.5	2.2	2.5	3.1	2.8	2.7	2.9	2.8
15-59 years	2.5	3.2	2.8	2.1	2.6	2.3	2.2	2.3	2.4	2.6	3.9	2.8	3.2	4.9	3.8
≥60 years	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.1	0.2	0.3	0.3	0.3	0.2	0.3	0.3
Percent:															
≤14 years	38.7	41.9	40.2	36.5	39.7	38.0	35.6	45.3	40.7	41.7	45.9	43.4	41.8	37.6	38.8
15-59 years	51.6	52.3	52.0	48.8	48.8	48.8	56.0	51.4	52.6	51.6	49.2	50.6	52.8	57.3	55.8
≥60 years	9.4	6.1	7.6	14.2	11.4	12.9	10.0	3.3	6.5	6.8	4.9	61.0	5.2	5.3	5.2

NAD = Non-adopters AD = Adopters

In this region, adopters have also a much more youthful profile. By contrast the gap in educational attainment between adopters and non-adopters in the South is only 3%. Against a 7.4% attainment of post-primary education for all, at 12.7% and 11% respectively, the South and Oromia have a significantly higher level educated farmers compared to Amhara [4.6%] and Tigrai [1.3%] .

Religion and its associated values expressed in permissible working days and attitudes to innovation may be an aspect of the socio-cultural dimension that may have an impact on the adoption and labour input pattern. In all the regions, nearly 59%, 21%, 15.4% and 4.9% of the households respectively profess Orthodox Christianity, Islam, Protestant and other religions. By far the vast majority in Tigrai and Amhara [96% and 70% respectively], belong to the Orthodox Christian faith, 46% in Oromia and 23% in the South also

adhere to the same religion. In a marked departure, nearly 58% in the South are Protestants.

The Protestants in the South and the Orthodox Christians in Amhara have more proportion of adopters compared to other religious groups in the same regions [Orthodox Christians in the South and Moslems in Amhara region]. The proportion of adopters rises to as much as double that of non-adopters only among the Protestants of the SNNPR.

Table 3.2 Household Profile by Level of Education, Religion and Wealth

Coupled with its lead in post-primary level education, total and proportionately more
availability of labour in the adopting households, it appears that in the SNNPR, the social
foundation for dissemination of the new technology may have been on a firmer ground.

	Whole sample			Tigray			Amhara			Oromia			SNNPR		
	NAD	AD	Tot	NAD	AD	Tot	NAD	AD	Tot	NAD	AD	Tot	NAD	AD	Tot
Education of head															
Illiterate	73.5	61.6	67.2	78.9	69.7	74.5	72.6	48.8	60.0	74.6	60.9	69.0	63.2	66.1	65.2
Literate	10.0	13.2	11.7	13.9	20.2	16.9	14.2	26	20.4	5.7	6.6	6	4.9	2.7	3.3
Primary educ	11.1	16.1	13.7	5.2	9.2	7.1	9.7	19.7	15	11.7	17.3	14.0	22.2	17.3	18.8
Post-primary	5.5	9.1	7.4	2.0	0.4	1.3	3.5	5.5	4.6	8.1	15.2	11.0	9.7	14	12.7
Religion of head															
Orthodox	58.2	59.6	58.9	96.8	94.7	95.8	54	84.3	70	38.5	57.9	46.5	36.1	17.9	23.4
Muslim	29.8	12.6	20.7	2.8	4.8	3.8	45.1	15.4	29.4	56.2	36.5	48.1	1.4	1.8	1.7
Protestant	10.8	19.5	15.4	–	–	–	–	–	–	4.9	2.5	4	58.3	57.6	57.8
Others	1.1	8.3	4.9	.4	.4	.4	.9	.4	.6	.4	3	1.5	4.2	22.7	17.1
Marital status															
Married now	72.9	85.7	79.7	56.7	75.3	65.6	71.1	89.3	80.8	82.4	93.9	87.2	85.1	85.2	85.1
Others	27.1	14.3	20.3	43.3	24.7	34.4	28.9	10.7	19.2	17.6	6.1	12.8	14.9	14.8	14.9
Wealth															
Poor	72.3	59.1	65.3	85.7	58.8	72.9	70.8	56.7	63.3	59.7	45.7	54.0	75.7	69.0	71.0
Average	22.4	33.7	28.4	11.9	38.2	24.4	22.1	35.4	29.2	35.0	44.7	39.0	16.7	22.9	21.0
Better off	5.2	7.1	6.2	2.4	3.1	2.7	6.6	7.5	7.1	5.3	9.6	7.1	7.6	8.0	7.9

3.3 Land

Access/ownership and the size of land is one of the important determinants of adoption of new/improved inputs and practices. Size of land ownership may affect adoption of technologies or lack of it due to indivisibilities inherent in a technology, or via its effect on the performance, productivity and total benefit accruing to the adopting peasant farmer.

Table 3.3 Average Size of Holding by Adoption Status, Gender of Household Head and Socio-economic Status

	Adoption Status			Gender of HHH			Socio-econ Status			Sample size+		
	NAD	AD	All*	Male	Fem	All	Poor	Averg	Better	NAD	AD	All
Region												
Tigray	.78	.92	.85	1.12	.85	1.02	1.1	1.0	2.0	251	224	475
Amhara	.79	1.18	1.00	1.05	.96	1.03	1.08	1.02	1.02	211	251	462
Oromia	.90	1.36	1.10	1.06	.1.31	1.09	1.05	1.07	1.01	265	194	459
SNNPR	.78	1.74	1.45	.77	.96	.80	.78	0.77	.74	142	332	474
Zone**												
W. Tigray	.87	1.13	.99	1.3 1	.91	1.06	1.03	.1.07	1.45	132	107	239
E. Tigray	.68	.73	.70	1.09		.98	.97	.86	5	119	117	236
KAT	.90	.69	.69	.97	1.0	.98	.95	.95	2	5	232	237
N. Omo	.77	4.18	2.21	.59	.89	.63	.65	.67	.474	137	100	237
E. Welega	1.42	1.87	1.66	1.17	1.21	1.18	1.2	1.16	1.11	105	118	223
W. Hararg	.56	.58	.57	.95	1.41	1.0	1.01	.99	.98	160	76	236
E. Gojam	1.11	1.12	1.12	.96	.78	.94	.88	1.06	.84	43	191	234
S. Wollo	.71	1.36	.88	1.17	1.04	1.14	1.2	.93	1.12	168	60	228
Total	.82	1.34	1.10	.99	.96	.99	.99	.97	1.06	869	1001	1870

*Highly significant difference at (P= 0.01) ** Significant difference at (P=0.005)

+ Refers only to household category of adopters and non-adopters

The average size of holding for all the sampled households is just over a hectare. At 1.34 hectares per household, adopters have about 60% more land than non-adopters. On the other hand, overall, there is no significant difference in holding between the gender and socio-economic status of the household head. At holdings of 1-1.1 hectare per household, Amhara and Oromia respectively have similar levels. The SNNPR at 1.45 hectares has just under double for the lowest average holding size, Tigrai, 0.85 hectares[10]. However, given the larger per household population size in Oromia and the SNNPR, the per person holding size narrows down the gap with Tigrai and Amhara [Annex Table 3.1a]

Except in Tigrai where the margin is smaller, the average per household holding of adopters culminates in the South where the level for adopters is double the non-adopters. In Oromia and the SNNPR, on the average, female-

headed households have more holding than their male counterparts. By socio-economic status, only in Tigrai do better off households have double the average for the poor ones. In the others, although marginal and at insignificant level, socio-economic status is inversely related to size of holding.11

The average land size operated also follows similar pattern to that of land holdings. The size of land operated is, however, is in most cases greater than the size of land owned. This is due to additional land operated through renting in and share cropping arrangement. [Table 3.4 and Annex Table 1b]. Overall, 412 cases of equally divided between leasing in and leasing out [barring double engagement, involving 22% of all the sampled households] of land transaction were reported. While the share of the adopters in the transaction [177] is less than that of non-adopters [235], only 34% of the adopters leased out but 66% leased in. The proportion is the reverse for the non-adopters where 62% of the cases were leasing out. It appears that adopters who have more labour and own holdings also accessed even more land to increase their acreage. Slightly over 75% of the land transactions equally divided in between the two took place in Tigrai and Amhara regions.

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[10] Overall, while most people in the South are dependent on the much smaller *enset* plots, the sampled households came from grain based farming systems with higher land labour ratio areas.

[11] With periodic land distribution and redistribution, this could probably be because of labour, livestock [including oxen] and remittances as the main differentiating variables rather than land.

Table 3.4 Land Transaction by the Studied Households

Regions		Adopters						Non-adopters						Total					
		LO		LI		Total		LO		LI		Total		LO		LI		Total	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	Tigrai	25	37.3	45	62.7	70	39.5	52	59.1	36	41.0	88	37.4	77	48.7	81	51.3	158	37.4
2	Amhara	13	22.0	46	78.0	59	33.3	57	66.3	29	33.7	86	36.6	70	51.6	75	48.4	145	36.7
3	Oromia	8	32.0	17	68.0	25	14.1	19	51.3	18	48.7	37	15.7	27	43.5	35	56.5	62	14.7
4	South	14	60.8	9	30.1	23	13.0	18	75.0	6	25.0	24	10.2	32	68.1	15	32.9	47	11.1
Total		60	33.8	117	66.2	177	99.9	146	62.1	89	38.9	235	99.9	206	51.1	206	44.9	412	99.9

LO = Lease out, LI = Lease in

Another frequent form of reallocation of land through exchange is share cropping. Not only did adopters accessed more land through leasing in but also via share cropping. Thus, of the 497 cases of sharecropping reported, 259 [52%] were undertaken by adopters. As in leases, the Amhara region reported relatively higher rate [32%]. At nearly 26% each, Oromia and the South are also heavily involved in sharecropping [Table 3.5]. At only 17% of the total share of total sharecropping, in Tigrai the phenomenon is less common. Dispelling double transaction in the form of leasing in, leasing out and/or sharecropping, 47% of the households are engaged in some form of land transaction.

Table 3.5 Share Cropping by the Studied Households

		Adopter		Non-Adopter		Total	
	Region	N	%	N	%	N	%
1	Tigrai	31	37.3	52	62.7	83	16.7
2	Amhara	90	56.9	68	43.1	158	31.8
3	Oromia	57	44.5	71	55.5	128	25.7
4	South	81	63.2	47	36.8	128	25.7
	Total	**259**	**43.3**	**238**	**56.7**	**497**	**99.9**

Despite the relatively high level of ownership/access and land transactions in the trend towards balancing the supply and demand of labour, land and traction power, 26 landless households were reported in South Wollo, E.Gojam and Western Tigray zones with the highest proportion of them in E.Gojam zone[12].

[12] However, the total number of such households in Amhara and Tigrai, 26, is only 2.6 % of the sampled households in the two regions or 3.6% of the three zones where such landlessness are reported.

3.4 Livestock

Livestock ownership is one of the most important forms of asset and factors for adoption of a particular technology in the farming systems of smallholder agriculture. Besides traction by oxen, livestock serve as sources of major asset holdings and a means of food security. They also play the role of insurance against certain economic and social risks. The socio-economic and cultural functions are other facets of livestock in the rural economy.

In the context of this study, oxen draught power is critical farming input with premium for timeliness in the plough culture of highlands Ethiopia. Overall, slightly over 1/3 of the households [24% adopters and 47% non-adopters] did not have any oxen power of their own. This total overall average figure is partly inflated by SNNPR where 41% of the total households are oxenless. Part of this is because some households depend on the hoe cultivated *enset* plant especially in KAT where oxen are not as critical as in the plough culture areas. The highest oxenlessness among the strictly cereal culture region is in Tigrai [35%] with 42% from among the non-adopters group and 22% of the adopters. The pattern in Oromia is similar. Close to 50% of the non-adopters and 14% of the adopter [31% average] households in the Amhara region do not own any oxen.

On the other hand, a sizeable majority of adopter households own at least a single ox, which enables the adopter to share or loan his/her oxen under various arrangement for ploughing his/her plot of land. This trend can be discerned from all regions under study. However, the greatest majority of non-adopters or double the number of adopters do not own a single ox. This might have been one of the factors lowering the tempo of the adoption of the technology with the non-adopters lagging behind the adopters. See Table below for the detailed distribution.

Table 3.6 Distribution of Sample Households by Oxen Ownership

No of Oxen	0	1	2	3
NAD	427	272	187	19
AD	246	342	343	84
Total (N)	673	614	530	103
NAD [%]	47.2	30.1	20.7	2.1
AD [%]	24.2	33.7	33.8	8.3
Total (%)	35.5	32.0	27.6	5.4
Tigray				
NAD	105	80	63	4
AD	49	76	95	8
Total (N)	154	156	158	12
NAD	41.7	31.8	25	1.6
AD	21.5	33.3	41.7	3.5
Total (%)	32.1	32.5	32.9	2.5
Amhara				
NAD	113	71	41	1
AD	35	84	118	17
Total (N)	148	155	159	18
NAD	50.0	31.4	18.1	0.4
AD	13.8	33.1	46.5	6.7
Total (%)	30.8	32.3	33.1	3.8
Oromia				
NAD	134	80	57	12
AD	40	56	75	26
Total (N)	174	136	132	38
NAD	47.4	28.3	20.1	4.2
AD	20.3	28.4	38.1	13.2
Total (%)	36.3	28.3	27.5	7.9
SNNPR				
NAD	75	41	26	2
AD	122	126	55	33
Total (N)	197	167	81	35
NAD	52.1	28.5	18.1	1.4
AD	36.3	37.5	16.4	9.8
Total (%)	41.1	34.8	16.9	7.3

3.5 Non-farm activities

In addition to ownership of various forms of assets, households depend on and engage in different off-farm activities for their livelihood. Participation of households in non-farm activities helps the rural households in generating diversified income in addition to farm income. The participation of farm households in non-farm activities differs among regions and accounts for different forms of activities. The regional distribution in terms

of participation indicates that the majority of farm households did not report participation in non-farm activities. In Tigray a total of 75 households participate in non-farm activates of which 52% are in adopters category while 48% belongs to non-adopters category [Table 3.7]

Table 3.7 Distribution of Households by Participation in Non-farm Income Activities by Adoption Status, Region and Zone

Region	Not involved						Involved in one or more					
	Non-adopter		Adopter		Total		Non-adopter		Adopter		Total	
	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
Tigray	216	53.3	189	46.7	405	100	36	48.0	39	52.0	75	100
Amhara	207	47.0	233	53.0	440	100	19	47.5	21	52.5	40	100
Oromiya	267	58.8	187	41.2	454	100	16	61.5	10	38.5	26	100
SNNPR	124	29.0	303	71.0	427	100	20	37.7	33	62.3	53	100
Zone												
W. Tigray	125	56.8	95	43.2	220	100	7	35.0	13	65.0	20	100
E. Tigray	91	49.2	94	50.8	185	100	29	52.7	26	47.3	55	100
KAT	5	2.3	210	97.7	215	100	--	--	25	100.0	25	100
N. Omo	119	56.1	93	43.9	212	100	20	71.4	8	28.6	28	100
E. Welega	107	49.1	111	50.9	218	100	13	59.1	9	40.9	22	100
W. Hararg	160	67.8	76	32.2	236	100	3	75.0	1	25.0	4	100
E. Gojam	41	18.7	178	81.3	219	100	5	23.8	16	76.2	21	100
S. Wollo	166	75.1	55	24.9	221	100	14	73.7	5	26.3	19	100
Total	814	47.2	912	52.8	1726	100	91	46.9	103	53.1	194	100

This picture indicates that almost 1/2 of the total farm households are involved in some form of non-farm activities. The farm households have been less involved in non-farm activities in Tigray regions than Amhara, Oromya and SNNPR regions. In Oromya the least number of households (26) participate in non-farm activities of which 60% are non-adopters farm households. In SNNPR and Amahara, about 53 and 40 households respectively participate in non-farm activity. It accounts for 52% and 62% of adopter households in SNNPR and Amahara respectively. At zonal level, this figure provides us slightly different picture. In KAT zone very few households from non-adopter groups participate in non-farm activities. This is an indication of many households migrating from KAT zone to engage themselves in industrial activities such as in sugar factories.

Table 3.8 Types of Non-farm Income Generating Activities

	N	Percent
Shop	35	15.2
Transport	16	6.9
Weaving	21	9.1
Furniture	60	26.0
Construction	60	26.0
Other	39	16.9
Total	231	100

The most important activities in which farm households participate include furniture, construction works, shop centres or small kiosks, weaving and transport activities. Other activities include employment schemes of seasonal nature in which farm households often migrate from one geographical area to another. Typical example of this would be state plantations and sugar factories which absorbs a significant amount of agricultural labour force during slack seasons

3.6 Socio-economic Status

Wealth status was compiled from the perception of the community and Development Agents depicting how a household can be categorized into poor, average and better off. There are no definite measuring criteria for classification of wealth category but are aggregations of assets, incomes and social positioning in the community. It is a relative measure specific to the particular community.

Nearly 2/3, slightly over 1/4 and just over 1/20th of the total households were categorized as poor, average and better off respectively[13]. At 7.9% and 7.1% of their respective total households, the South and Oromia region have the highest rates of better offs. The 2.7% equivalent ratio for Tigrai is by far the lowest.

The gap in the ratio of the poor socio-economic category among adopters and non-adopters is wide [13%]. At 14% each, this is slightly more in Oromia and Amhara regions. It is 16% in Tigrai but only about half these rates in the South. The pattern is similar among the average households. Most of the

[13] For comparison purposes, the households themselves were also asked to categorize their social position among the three. The aggregate were similar with the community categorization.

poor categories are classified are in the non-adopter group of households. The smallest proportion of households for poor categories is indicated in Oromia, followed by Amhara and SNNPR regions. Given that there is no significant difference in the average size of holdings [Table 3.3] amongst the socio-economic categories, the limited variations observed is accounted for by ownership of livestock, remittances and non-farm incomes.

4. EXTENSION, ADOPTION AND DIFFUSION

4.1 Introduction

Extension contact is an important instrument for dissemination of agricultural technologies. This facet is very important particularly when the technology is relatively hitherto unknown in specific geographical coverage or localities. Research and extension are vital continuum for adoption and impact. In this respect, it will be imperative to determine the pattern of the extension and dissemination process. There are numerous institutions, which promote and disseminate technologies. Among them are government extension agents, NGO development agents and other related but quasi-extension agencies.

In Ethiopia, government extension agents are the most important instruments in the dissemination of the technologies. They are considered as knowledge brokers between technology generators and adopters/users. Their impact can be partly gauged by the awareness level of their existence by farmers, distance from farm households, level of engagement and possible impact in output and some measures of perception and attitudinal change among the farmers brought about as a result of the extension effort

This paper first attempts to measure the extent of awareness, contact, medium and participation in extension followed by measures of adoption in space and time, problems for non-adoption and factors promoting adoption and finally some comments about the diffusion process are stated.

As shown in Table 4.1 below, in all the regions, there is a very high level of awareness of the existence of development service providers and the more so of Development Agents, credit and input providers. The awareness about research is much less with none reporting in the South. Except in Tigrai and the SNNPR, awareness about the existence of Home Agents is also minimal.

Table 4.1 Awareness About Major Rural Development Services by Region and Adoption Status in percent

	Tigray		Amhara		Oromia		SNNPR	
Services	NAD	AD	NAD	AD	NAD	AD	NAD	AD
Dev't Agent	46.4	53.6	38	62.0	49.9	50.1	22.4	77.6
Home Agent	51.9	48.1	60.0	40.0	50.0	50.0	32.6	67.4
Credit Service	48.9	51.1	29.0	71.0	35.9	64.1	16.2	83.8
Input Service	44.8	55.2	27.0	73.0	36.8	63.2	8.4	91.6
Demo Farm	38.6	61.4	35.4	64.6	19.2	80.8	11.5	88.5
Research	9.1	90.9	15.6	84.4	--	100	--	-

The next step form awareness is contact by extension followed by direct engagement. Far less than those who are aware about the existence of the extension services have been contacted by extension. Hence only 67% of adopters and 25% of non-adopters reported to have been contacted by extension. Only 47% of the total responding farmers reported to have been contacted by extension in the last two years.. The gap in contact between adopters and non-adopters is the lowest in Oromia followed by Amhara. At only 9%, the

lowest contact [with non-adopters] by extension is reported in North Omo. East Gojam and Kembata/Alaba/Timbaro [KAT] had the highest contact among non-adopters. [Table 4.2]

Table 4.2 Contact with Farmers by Extension

Region	NAD	Sample	AD	Sample
Tigray	19	249	76	227
Amhara	32	220	76	250
Oromiya	33	283	91	196
SNNPR	10	144	40	330
Zones				
W. Tigray	13	131	78	108
E. Tigray	25	118	75	119
KAT	40	5	32	229
N. Omo	9	139	57	101
E.Welega	42	120	95	119
W. Hararg	26	163	84	77
E. Gojam	44	46	79	194
S. Wollo	29	174	64	56
Total	25	896	67	1003

Extension agents respectively have not contacted over 90% and 80% of the non-adopters in SNNPR and Tigray. This picture consistently portrays that most of the extension services were geared towards adopting farmers. The process might have excluded potential adopters, who might have decided to adopt the technology but had no access to the technology.

Farm households may be responsive to technological change through the advice provided from extension agents. Some progressive farmers would like to know about the technological change and its continuum and hence they often like to meet and gain knowledge about a technology or a certain practice. However, it appears that while contact by extension is less than awareness by farmers, contact of extension by farmers is even far less than contact by extension.

Thus, as shown in Table 4.3 below, about 84% of the non-adopters and as much as 41% of adopters in all the regions did not contact extension agents at their own initiative. Of the total respondents, only 29% reported to have themselves initiated contact with extension in the preceding two years. It appears that even when the economics of adoption becomes more attractive, the system has a long way to go in motivating aware farmers to enlist and engage in the dissemination process. Given that a far more proportion of farmers have been adopters, this picture is indicative of the fact that significant proportion of farm households may have accessed the technology outside of the direct contact of the extension system[14].

Table 4.3 Contact by Farmers with Development Agents [%]

Regions				
	NAD	Sample	AD	Sample
Tigray	14	242	68	217
Amhara	13	214	62	245
Oromiya	26	281	84	194
SNNPR	7	120	35	320
Zones				
W. Tigray	13	128	65	105
E. Tigray	16	114	71	112
KAT	40	5	29	227
N. Omo	5	115	50	93
E.Welega	37	120	85	117
W. Hararg	17	161	83	77
E. Gojam	23	43	65	190
Total	16	857	59	976

[14] See farmer to farmer and other media of dissemination of information under Diffusion in Section 3.5 Table 3.16.

Within this broad picture, the highest number of farm households, close to 90% each from non-adopters group in Tigray and Amhara and over 90% in the South, sought no personal contact with extension agent or did not receive any forms of advice. When only 29% of all farmers reported to have contacted extension, another alternative may be non-government development agencies engaged in the respective areas. It is possible that NGOs working in the rural areas could contact or be contacted by farmers for the delivery of extension services. However, as shown in the table in Annex 4.1, except in KAT of SNNPR by Farm Africa, there is virtually no extension contact with NGO development agencies.

Table 4.4 Contacts Between Farmers and Research [%]

Region/Zones				
	NAD	Sample	AD	Sample
Tigray	6.0	235	16.8	220
Amhara	0.5	192	9.4	224
Oromiya	1.2	245	7.1	168
SNNPR	-	119	0.4	277
Zones				
W. Tigray	--	119	2.0	102
E. Tigray	12.1	116	29.7	118
KAT	-	5	0.5	215
N. Omo	-	114	-	62
E.Welega	-	104	4.0	101
W.'Hararg	2.1	141	11.9	67
E. Gojam		38	8.1	172
S. Wollo	0.6	154	13.5	52
Total	2.3	791	8.0	889

Another possible channel for dissemination of information is research. Except in Tigrai, all regions and zones have had very limited direct link with research centers. Overall, the average farm households who have direct link with research centers stood at 8% even from the adopters category. In the South, 100% of the farm households both from adopters and non-adopter have not had any contact with research centers [Table 4.4]. The on-going formal link with research in all the regions is even far less as shown in Table 4.5 below.

Table 4.5 Formal On-going Link Between Farmers and Research

Regions/Zones	Non Adopter			Adopter		
	Yes	No	Sample	Yes	No	Sample
Tigray	1.3	98	238	6	93	213
Amhara	0.5	99	182	3	97	219
Oromiya	0.7	98	277	1	98	191
SNNPR	-	100	136	0.9	99	322
Zones						
W. Tigray	1.6	98	125	2	96	105
E. Tigray	0.9	99	113	9	90	108
KAT	-	100	5	1	98	222
N. Omo	-	100	131	-	100	100
E.Welega	0.9	98	116	1	97	116
W. Hararg	0.6	98	161	-	100	75
E. Gojam	-	100	37	1	98	170
S. Wollo	0.7	99	145	8.2	91.8	49
Total	0.7	99	833	2.5	97.2	945

Most farm households in all the regions from among both adopters and non-adopters have neither direct contact nor formal on-going link with research centers. It appears that most of the technologies were disseminated without the direct involvement of research centers with farmers but via the extension services and horizonatally between the farmers themselves. For more on extension showing the average distance of the centers and contact with NGO development services, see Appendix Tables 4.1 and 4.2

In addition to the respective agricultural Bureaus, there are various institutions, which provide support to extension services to the farmers. The type of institutions supporting various extension services differs among regions although they perform similar activities. To this effect, the most frequent support service providers in Amahara regions are Amhara Credit and Saving Institute (ACSI), Ambasel Trading, Amhara National Regional State Cooperative Promotion Bureau (ACPB), Agricultural Input Supply Enterprise (AISE) or AISCO. The latter is a Federal institution. In Tigray, the major support institutions are Guna Trading Company, Tigray Cooperative Promotion Bureau (TCPB), and the Tigray Micro Finance Institution (DEDEBIT). In SNNPR, the important institutions are the cooperative Omo Micro Financing and Wondo Trading. In the Oromia

region most important institutions supporting extension services are Rural

Development Cooperative, Oromia Credit and Saving Institute and Dinsho Trading.

4.2 Adoption

Agricultural technology adoption has got a number of processes. It has both spatial and temporal dimensions. It is argued that technology adoption is not a one-off static decision. It rather involves a dynamic process in which information gathering; learning and experience play pivotal roles particularly in the early stage of adoption and diffusion. Farmers move from learning to adoption in a continuous or discontinuous pattern over time. The characteristics of both the user and the technology are important in explaining adoption behavior and the pathway for adoption. The lag between learning and adoption, and the possibility of discontinuation imply that a longer period will require for majority of the farmers to use the technology than if adoption was a one off decision leading to continuous use.

However, there are some deficiencies of these approaches to analyze and predict the potential for adoption of a new technology, particularly at the early stage of diffusion. At a given point in time, the decision to adopt, reject or defer decision about a technology is influenced by the belief derived from the knowledge and perception about the technology at that point in time. Such knowledge and perception includes information on the characteristics of the technology, what it does, how it works, what benefits it generates, what disadvantages there are, if any, where and how to get access to it, what resources are required for its acquisition etc. The prior belief of a point in time may be later modified on the basis of new knowledge and/or observed performance, and a new decision about adoption may be taken. Therefore, forever rejected or never rejected after adoption are not realistic options in the real world. Learning and adoption are continuous processes (Jabbar et al., 1996). The characteristics of both the user and the technology are considered important in explaining adoption behavior and the pathway for adoption.

Table 4.6 Profile of Adoption by Modern Inputs

	Never tried		Discontinued Application		Restarted		Still Applying		Total	
Inputs	N	%	N	%	N	%	%	%	N	%
DAP	747	38.9	280	14.6	58	3.0	835	43.5	1920	100
UREA	901	46.9	275	14.3	33	1.7	711	37.0	1920	100
Wheat seeds	1445	75.3	108	5.6	7	0.4	360	18.8	1920	100
Barley seeds	1837	95.7	6	0.3	1	0.1	76	4.0	1920	100
Maize seeds	1584	82.5	145	7.6	12	0.6	179	9.3	1920	100
Sorghum seeds	1893	98.6	5	0.3	--	--	22	1.1	1920	100
Teff seeds	1842	95.9	29	1.5	1	.1	48	2.5	1920	100
Chemicals	1597	83.2	77	4	12	.6	234	12.2	1920	100
Other	–	–	10	.5	7	.4	65	3.4	1920	100

The two most important inputs in extension services promoted and adopted in Ethiopia are artificial fertilizers in the form of Urea and DAP and improved seeds of maize, wheat and to a much lesser extent *teff* together with associated management practices in ploughing, planting, weeding, harvesting and storage. The use of fertilizer and improved seeds on various crops varies significantly among regions included in the study.

For the purpose of evaluating the adoption and diffusion process, it is important to see the pattern of adoption of the technology as at the time of fieldwork. About 40% of the households under study have never tried the use of DAP and 15% had used it but for some reasons had discontinued and only 3.5% re-started. Currently, close to 44% of the households are using DAP fertilizer. In a similar vein, about 47% of the households never used Urea fertilizer and 14% of them had used but discontinued and only 1.7% restarted using it. A significant 37% of the studied households do still use it. [Table 4.6]

In contrast, the adoption rate of improved seed and chemicals is very low. In spite of their agro-ecological specificity, close to 99%, 96%, 96%, 83%, 83%, and 75% of the households respectively, have never used or tried the use of improved sorghum, barley, *teff*, maize seed, chemicals/pesticides and improved wheat. Apart form the fertilizers, although at much lower levels, improved wheat seed, chemicals and improved maize varieties are the most widely disseminated inputs. Compared to fertilizers, fewer households had tried once and discontinued the application and even much fewer ones re-applied them again.

Reflecting the agro-ecological diversity, the regional spread however reflects the variation in the levels of application among the improved seeds but more homogeneity in the adoption rate of the improved seeds [Table 4.7]. When all the technological inputs adopted by a household are taken as one package and considered together, the overall adoption rate increases from the single input highest of nearly 44% DAP to 50%. Half of all the interviewed households have continued to adopt one or more of the new inputs. Overall, 63% of the households had tried one or more of the new inputs but nearly 25% of the total households or about 40 % of those who had tried them interrupted using them and only 1/6th of those who had exited restarted.

Table 4.7 Spatial Profile of the Adoption of Modern Inputs

	Applied at Least 1 Input	Interrupted	Restarted	Still Applying	Applied Fertilizers	Applied Imrvd seeds	Applied Chemicals
Region							
Tigray	58.1	15.0	1.9	46.0	57.7	15.0	0.6
Amhara	65.6	25.0	2.5	53.5	64.6	36.9	14.2
Oromiya	58.8	29.4	5.0	44.2	55.2	40.6	22.9
SNNPR	70.4	29.0	6.5	57.7	68.5	54.0	29.6
Zone							
W. Tigray	63.3	18.8	0.8	48.3	63.3	10.0	1.3
E. Tigray	52.9	11.3	2.9	43.8	52.1	20.0	
KAT	97.9	29.2	8.3	87.1	97.1	70.0	46.3
N. Omo	42.9	28.8	4.6	28.3	40.0	37.9	12.9
E. Welega	76.3	35.0	6.7	61.3	69.2	53.8	40.4
W. Hararg	41.3	23.8	3.3	27.1	41.3	27.5	5.4
E. Gojam	86.7	27.1	3.3	80.8	86.7	57.9	25.0
S. Wollo	44.6	22.9	1.7	26.3	42.5	15.8	3.3
Total	63.2	24.6	4.0	50.4	61.5	36.6	16.8

Another salient feature of the pattern of adoption worth noting which will be of help when comparing the findings in the other sections of the paper, is the gap in the adoption rates. While the regional gap between the highest, SNNPR [58%] and lowest Tigrai [48%] is only 10%, the range between the high and low adopting units within the regions zones, *wereda* and PA is considerable. At zonal level, this ranges by only 5% between West and East Tigrai; but 35% between East Wellega and West Harerge in Oromia; and 55% between KAT and North Omo in SNNPR.

The range of adopting rates between the zones within regions is partly a reflection of the agro-ecological differences and the farming systems they gave rise to given the current state of the art of production. Thus while there is no significant differences in Tigrai, the low adopting South Wello in Amhara is highly degraded, prone to climatic vulnerability with high density of population. West Harerege is mainly a *chat*/coffee/sorghum complex but without significant cultivation of wheat and maize which are the main technological packages responsive to the widely disseminated DAP and Urea. In the *enset* complex SNNPR, KAT has at slightly higher adoption rate than the adjacent Hadiya and Gurage which like it have significant adoption rates in their mixed and grain producing sections. Three peasant associations in SNNPR have a 100% adoption rate [Annex Table 4.1].

At 70% of ever trial of any one of the inputs, SNNPR stands out top both in trial and adoption rate [58%] but with also the highest disparity between zones, *wereda* and PAs. Thus while there are 100% adopters in KAT, only

42% do so in the other low adopting zone of North Omo. However, even in the low adopting zone of SNNPR, North Omo, there is a 100% adopting PA at Zafine Manuka in Boreda *wereda*. Second in at least one trial [66%] and adoption [53%] is Amhara followed by almost a tie between Oromia [59%] and Tigrai [58%]. Adopters in Tigrai are more consistent with only 15% interrupting and 2% restarting. Conversely, adopters in Oromia appear to be more volatile with as many as half of the total adopters [29%] interrupting and only 5% of them reportedly coming back. This volatility is mostly accounted for by the *chat*/coffee/sorghum complex of West Harerege. Similar pattern of adoption/exit can be discerned between the high adopting East Gojam and low adopting South Wello in Amhara region.

The use of chemicals significantly increases as on traverses the county form North to South vis. 0.6% in Tigrai, 14.2 % in Amhara, 22.9% in Oromia and 29.6% in SNNPR. In the high adopting zones of KAT, East Wellega and East Gojam, the adoption of chemicals/pesticides is significantly higher reaching as high as 46% in the former. On the other hand, farmers were found to be reluctant and refrain from adopting the technology or some might have used the technology and suddenly discontinued and switched off to the traditional practices.

4.3 Reasons for the Adoption and Non-adoption of the Technologies

There are various reasons for the non-adoption of the technology as perceived from the respondents [Table 4.8].

Table 4.8 Reasons for Non-adoption of Modern Inputs by Type [fertilizers & seeds]

	Fertilizers		Seeds		Total	
	N	%	N	%	N	%
Poor extension & demonstration	112	6.3	121	8.6	233	7.3
Low yield	174	9.8	126	8.9	300	9.4
Low output price	165	9.3	143	10.1	308	9.7
Shortage of complimentary inputs	428	24.2	364	25.7	792	24.9
Shortage/high price of input	363	20.5	301	21.3	664	20.9
Unreliable/unsuitable climate	272	15.4	184	13.0	456	14.3
Other	253	14.3	175	12.4	428	13.5
Total	1767	99.8	1414	100	3181	100

High price of input and shortage of complementary inputs were mentioned as major constraints for adoption of both fertilizer-seed technologies [45%]. Risks associated with climatic factor are also held responsible as one of the constraint for adoption. Related to risk, low output price was also mentioned as one of the adoption problems. Problem of extension although mentioned as one of adoption constraints, it is not as significant as the other problems [Table 4.8]. On the other hand, those farm households who adopted the technology perceived multiples of requisites for adoption [Table 4.9].

Table 4.9 Requirements for the Adoption of the Modern Inputs

Requirements	Fertilizers.		Impr Seeds		Total	
	N	%	N	%	N	%
Better Extension & Demonstration	535	22.5	507	21.7	1042	22.1
Higher Yield	387	16.3	367	15.7	754	16.0
Higher output price	142	6.0	142	6.1	284	6.0
Access to more land	406	17.1	376	16.1	782	16.6
Better access to credit	179	7.5	223	9.6	402	8.5
Lower price of input	725	30.5	718	30.7	1443	30.6
Other	3	0.1	2	0.1	5	0.1
Total	2377	100	2335	100	4712	100

Farm households identify lower price of input and better extension services as outstanding factors for adoption of modern inputs [56%]. Access to more plots of land under crop cultivation [17%] and higher yield are one of the 2nd most important requirements for adopting modern farming practices. From such scenario, it could be

discerned that households with better extension services and access to land during period of lower input prices have a higher probability of adopting the technology. In the process of adopting a technology, farmers have preferences for various combinations or single technologies. In fact the preferences for a technology would be affected by choice, which the farm households perceived to be important for their livelihood.

In order to assess the reasons for the adoption of the current inputs and practices and to gauge the demand in the future, both adopting and non-adopting households were asked the factors by rank [the three top ones] contributing towards adoption and non-adoption. The most important preferred inputs by respondents are ranked and provided in [Table 4.10]

Table 4.10 Most Preferred Inputs and Methods by Current Status of Adoption

Inputs/ Methods	Technique not adopted by hh				Technique adopted by hh			
	Rank=1		Rank=2		Rank=1		Rank=2	
	N	%	N	%	N	%	N	%
Inputs:								
Seeds	531	30.1	383	39.9	914	33.5	435	22.3
Fertilizer	522	29.5	199	20.7	721	26.4	671	34.5
Chemicals	49	2.8	53	5.5	102	3.7	11	0.6
Methods:								
Soil Prep.	144	8.1	46	4.8	190	7.0	191	9.8
Planting	401	22.7	54	5.6	455	16.7	530	27.2
Weeding	23	1.3	127	13.2	150	5.5	32	1.6
Others	97	5.5	99	10.3	196	7.2	77	4.0
Total	1767	100	961	100	2728	100	1947	100

Accordingly, seed [34%] and fertilizer [27%] are most preferred inputs ranked under No. 1. And yet amongst them, seed is not yet widely adopted. With regard to practices, improved planting method is not widely adopted. Such practice often refers to seed rate application during sowing. The use of chemicals has also received lower ranking. This seems to be consistent with the adoption level and intensity of the technique. There are certain outstanding reasons why farmers are adopting the desired inputs and practices [Table 4.11]

Table 4.11 Reasons for the Adoption of Desired Inputs and Practices

Reason	Rank=1			Rank=2			Rank=3			Total		
	N	% of reason	% of ranks	N	% of reason	% of ranks	N	% of reason	% of ranks	N	% of reason	% of ranks
Good extension support	426	43.2	21.6	340	34.5	16.8	219	22.2	12.5	985	100	17.1
Own drive	175	24.2	8.9	294	40.6	14.5	255	35.2	14.5	724	100	12.6
Demonstration farm	63	20.3	3.2	132	42.4	6.5	116	37.3	6.6	311	100	5.4
Higher yields	745	55.8	37.7	397	29.7	19.6	193	14.5	11.0	1335	100	23.2
Enough land	68	31.9	3.4	81	38.0	4.0	64	30.0	3.6	213	100	3.7
Credit availability	78	19.8	3.9	165	42.0	8.2	150	38.2	8.5	393	100	6.8
Good supply of input	94	20.8	4.8	151	33.4	7.5	207	45.8	11.8	452	100	7.9
Low price of input	33	22.9	1.7	52	36.1	2.6	59	41.0	3.4	144	100	2.5
High price of output	39	19.6	2.0	66	33.2	3.3	94	47.2	5.3	199	100	3.5
Whether reliability	48	24.1	2.4	79	39.7	3.9	72	36.2	4.1	199	100	3.5
Whether suitability	61	18	3.1	113	33.3	5.6	165	48.7	9.4	339	100	5.9
Enough labor	56	23	2.8	74	30.5	3.7	113	46.5	6.4	243	100	4.2
Other	90	41.1	4.6	77	35.2	3.8	52	23.7	3	219	100	3.8
Total	1976	34.3	100	2021	35.1	100	1759	30.6	100	5756	100	100

Poor extension services and lack of awareness, high price of input and shortage of land were ranked as outstanding problems for non-adoption of technological packages. Institutional factors related to the delivery of extension services ranked as number one problem by 48% 27% and 24% of the respondents respectively.

However, overall, poor extension service was rated 8% in terms of ranking. High price of input followed by shortage of land and lack of confidence ranked with highest rate of all the factors mentioned by non-adopters. The other reasons why non-adopters fail to adopt the technologies as indicated in Table 4.12 are the obverse of the reasons given for adoption. These are low yield, unreliable rainfall, lack of credit, poor demonstration farms and poor input delivery services.

Table 4.12 Reasons for the Non-adoption of Desired Inputs and Practices

Reason	Rank=1			Rank=2			Rank=3			Total		
	N	% of reas	% of ranks	N	% of reason	% of rank	N	% of reason	% of ranks	N	% of reason	% of ranks
Poor ext. service	220	48	11.0	125	27.3	6.3	113	24.7	6.7	458	100	8.1
Less own drive	229	34.2	11.5	220	32.8	11.2	221	33.0	13.1	670	100	11.8
Poor demo. Farm	88	24.0	4.4	151	41.1	7.7	128	34.9	7.6	367	100	6.5
Low yield	173	36.3	8.7	166	34.9	8.4	137	28.8	8.1	476	100	8.4
Not enough land	246	41.4	12.3	209	35.2	10.6	139	23.4	8.2	594	100	10.5
Lack of credit	111	33.8	5.6	112	34.1	5.7	105	32.0	6.2	328	100	5.8
No/poor input supply	106	34.5	5.3	119	38.8	6.0	82	26.7	4.9	307	100	5.4
High price input	374	44.8	18.7	263	31.5	13.4	198	23.7	11.7	835	100	14.8
Low price output	55	14.2	2.8	174	45.1	8.8	157	40.7	9.3	386	100	6.8
Unreliable climate	70	21.0	3.5	121	36.2	6.1	143	42.8	8.5	334	100	5.9
Unsuitable climate	76	25.4	3.8	103	34.4	5.2	120	40.1	7.1	299	100	5.3
Other	248	41.3	12.4	206	34.3	10.5	147	24.5	8.7	601	100	10.6
Total	1996	35.3	100	1969	34.8	100	1690	29.9	100	5655	100	100

4.4 Diffusion

Diffusion refers to the dynamics[15] of the speed, spread, deepening and method of the dissemination and adoption of the package of the technological inputs

[15] When more narrowly defined, the cumulative percentage of adopters for a given technological package of inputs and practices over time, it can be approximated the S shaped logistics curve where the growth rate is slow during the first few years, climbs steeply during the middle years and finally attains a ceiling at the beginning,

and practices. It may be gauged in terms of:

1. The growth rate and the gap between the current and potential percentage when the adoption rate curve flattens

2. The increased intensity, variety of application and more advanced farming practices/management
3. The horizontal transmission of knowledge and farming practices between farmers themselves.

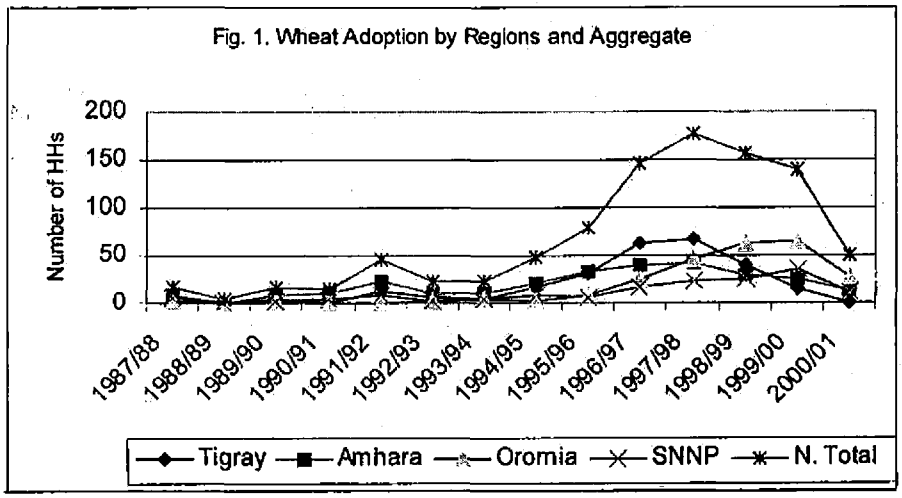
Table 4.13 The Adoption of the Technological Packages 1987[88-2000/01]*

Crop year	Tigrai		Amahara		Oromia		SNNPR		Total		
	N	Cum	N	Cum	N	Cum	N	Cum	N	Cum	% of Growth
1987/88	0		16		2		8		26		
1988/89	4	4	3	19	1	3	2	10	10	36	61
1989/90	8	12	13	32	2	5	3	13	26	62	160
1990/91	2	14	28	60	0	5	6	19	36	98	38
1991/92	27	41	35	95	1	6	9	28	72	170	100
1992/93	19	60	13	108	3	9	3	31	38	208	-53
1993/94	9	69	27	135	6	15	10	41	52	260	37
1994/95	33	102	54	189	4	19	16	57	107	367	105
1995/96	64	168	89	278	16	35	50	107	219	586	105
1996/97	130	298	101	379	51	86	75	182	357	943	63
1997/98	162	460	101	480	125	211	169	351	557	1500	56
1998/99	82	542	102	582	163	374	161	512	508	2008	-9
1999/00	37	579	105	687	186	560	117	629	445	2453	-12
2000/01	4	583	42	729	62	622	33	662	141	2594	-68

**The adoption cumulative is more than the farmers covered because of an average of 20% per annum exit and those adopting more than one inputs are double counted.*

As shown in Table 4.13, the spread of the technological inputs cited above has been quite considerable. When taken separately, between 1987/88-2000/01, the adoption of the package of the technologies increased at an average of 35.4% per annum. Until the price collapse of the latter years beginning from 1997/98, the only year of negative rate of adoption was the crop year following the political transition of 1991/92. In the middle of the PADET years before the steady decline from 1998/1999 onwards, the average increase in the rate of adoption was over 80% after which the average negative rate was about 30%.

As clearly indicated in the following graphs, the adoption of all the four major fertilizer and seed inputs sharply increased from 1994/95, peaked in 1997/98, slightly declined in the following year, more pronouncedly in the next year and a near collapse in 2000/01 when the aggregate national new adoption figure fell from 445 in the previous year to a mere 141. The pattern for the different regions and different units of the technological package was similar [Fig 1-6]. When the technological packages are taken individually and assuming an average of 25% exit annually among the adopters, if it were not the severe decline from 1997 onwards, the current 50% adoption rate could have climbed to a much higher rate.



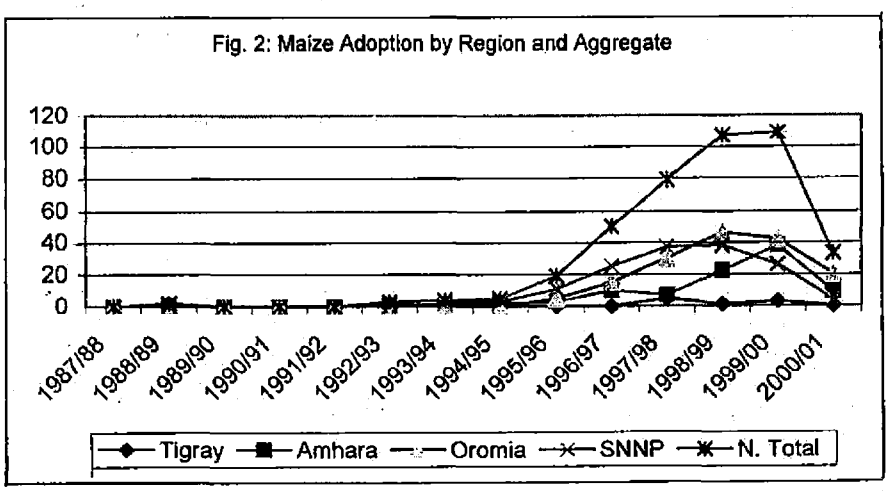


Fig. 3. Fetilizer (DAP) Adoption By Region and Aggregate

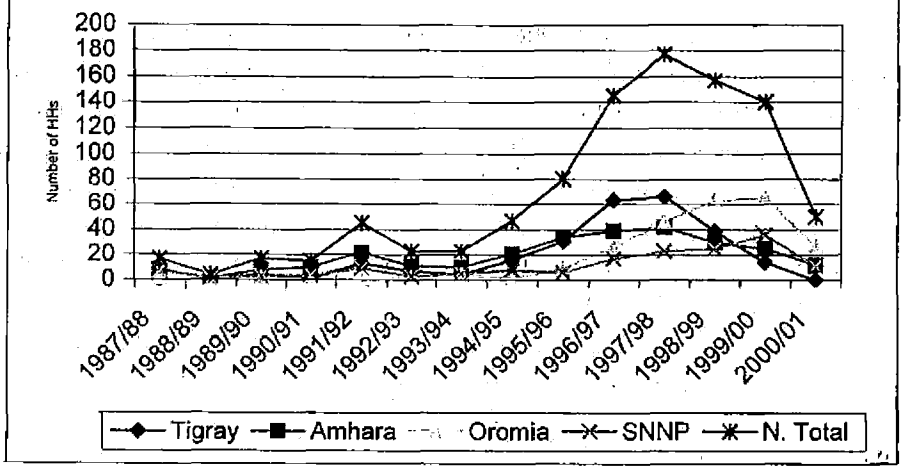


Fig. 4: Fertilizer(Urea) Adoption By Region and Aggregate

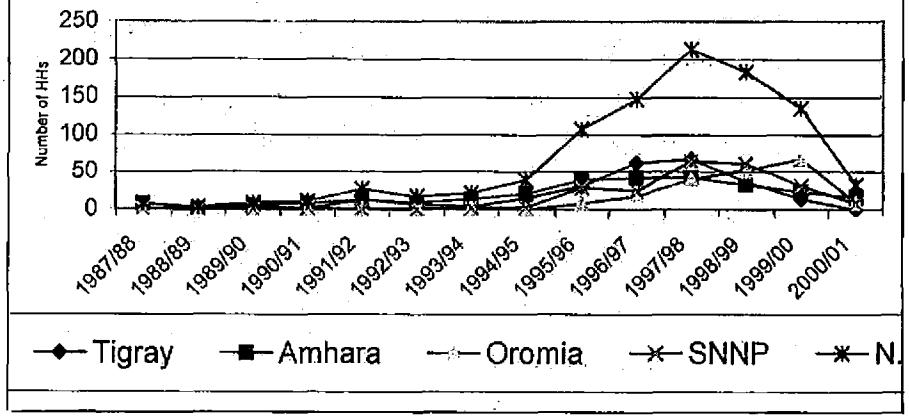
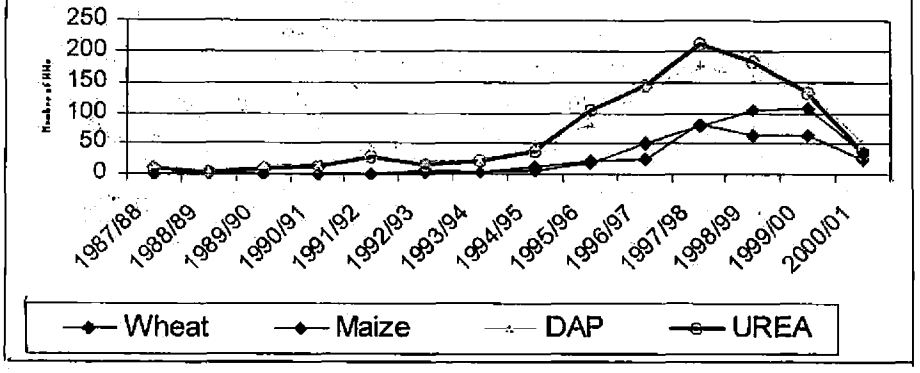
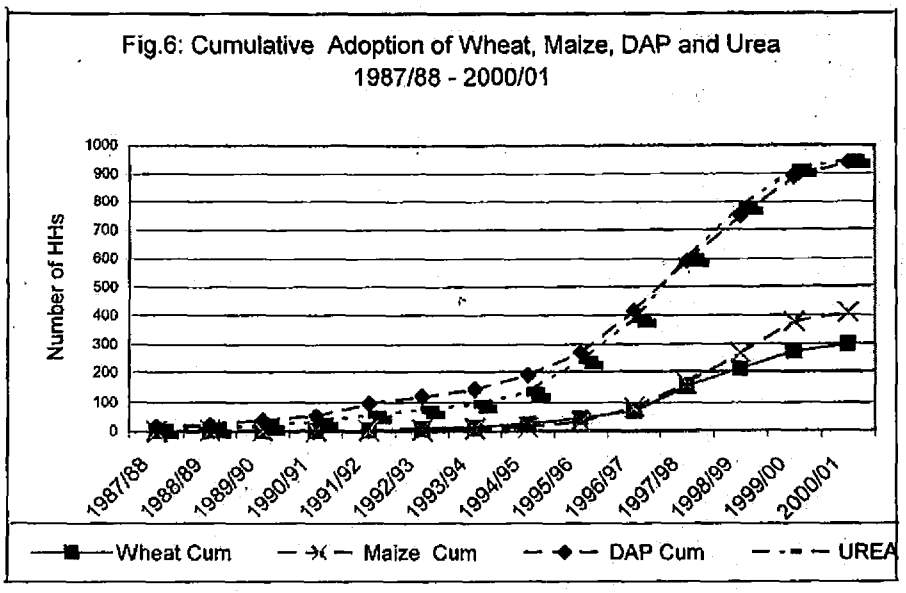


Fig.5: Adoption of Improved Seeds (Wheat, Maize) and Fertilizer (DAP & Urea) 1987/88-2000/01





Considering the fact that some PAs in KAT had reached 100% adoption rates and putting the country-wise ceiling at somewhat lower because of climatic and soil variability, it appears that adoption rate which rose from a mere 107 households making up less than 5% of the total households at the beginning of PADETS in 1994/95 was well on its way towards diffusion but its tempo encountered serious setback since the crop season of 1997/98. Prior to the preceding year, such steady growth rate of adoption was acquired even after the removal of subsidy on the major technological inputs, fertilizer.

Another indicator of the measurement of the degree of diffusion is the intensity of the use of the technological packages, which is captured by the following tables.

Table 4.14 Distribution of Per Household Use of Fertilizer by Region

Region	Amount of fertilizer used									
	1-50 kg		51-100 kg		101-200 kg		201 and Above kg		Total	
	N	%	N	%	N	%	N	%	N	%
Tigray	142	77.6	35	19.1	6	3.3		0.0	183	100.00
Amhara	53	21.4	79	31.9	77	31.0	39	15.7	248	100.00
Oromiya	99	58.2	32	18.8	34	20.0	5	2.9	170	100.00
SNNPR	163	61.7	51	19.3	30	11.4	20	7.6	264	100.00
Total	457	52.8	197	22.8	147	17.0	64	7.4	865	100.00

Only 7.4 % of the households used more than 200 kgs of fertilizer inputs even when both DAP and Urea are aggregated. More than half of the total households used less than 50 kgs of the same inputs. As shown in the following Table 4.15, the rate of adoption of seed is also similar.

Table 4.15 Distribution of Per Household Use of Improved Seed by Region

Region	Amounts of Selected Seeds Used									
	1-50 kg		51-100 kg		101-200 kg		201 and Above kg		Total	
	N	%	N	%	N	%	N	%	N	%
Tigray	51	78.5	9	13.8	3	4.6	2	3.0	65	100
Amhara	69	71.1	18	18.5	8	8.2	2	2.06	97	100
Oromiya	93	93.0	5	5	1	1	1	1	100	100
SNNPR	91	65.9	30	21.7	12	8.7	5	3.6	138	100
Total	304	76.0	62	15.5	24	6	10	2.5	400	100

For adopters the rate of sowing for improved seed is higher than local seed. However, the average use of 31kg/ha DAP and 26kg/ha for Urea is relatively smaller than the recommended rate. On average, 330 farm households use 31 kg/ha of DAP [Table in Annex 4.3-4.4]. This implies that there is sub-optimal use of both fertilizer and seed rate on a plot of land. The table also shows that despite the variation in the amount land covered under fertilizer, the total average of land fertilized for adopters is greater than the unfertilized land for all crops except for barely and sorghum. The highest plot of land under fertilizer was allocated for maize. There seems to be household preference for technology and priority by crop. Maize technology responds more to fertilizer package than other crops depending on agro-ecological potential of the area. It was also the crop most affected by price collapse.

Table 4.16 Rate of Application of Modern Inputs Compared to Recommended Levels by Region and Zone [percent of adopter households]

Region	Seeds				DAP				UREA			
	Less	Same	More	N	Less	Same	More	N	Less	Same	More	N
Tigray	9.1	90.9	-	44	3.8	96.2	-	213	3.8	96.2	-	211
Amhara	6.0	93.3	0.7	149	18.4	81.2	0.4	234	16.6	80.7	2.7	223
Oromiya	7.5	91.0	1.5	134	14.2	85.8	-	176	18.7	81.3	-	134
SNNPR	27.2	45.5	27.2	301	49.2	49.5	1.3	313	46.7	51.4	1.9	214
Zone												
W. Tigray	10.0	90.0	-	30	1.0	99.0	-	103	1.0	99.0		102
E. Tigray	7.1	92.9	-	14	6.4	93.6		110	6.4	93.6	-	109
KAT	32.5	29.2	38.2	212	62.3	35.9	1.8	220	62.6	34.4	3.1	131
N. Omo	14.6	84.3	1.1	89	18.3	81.7	-	93	21.7	78.3	-	83
E. Welega	6.6	92.3	1.1	91	12.1	87.9	-	107	13.5	86.5	-	89
W. Hararg	9.3	88.4	2.3	43	17.4	82.6	-	69	28.9	71.1	-	45
E. Gojam	5.6	94.4	-	143	15.5	84	.6	181	15	83.2	1.7	173
S. Wollo	16.7	66.7	16.7	6	28.3	71.7	-	53	22	72	6	50
Total	16.7	69.7	13.5	628	24.6	74.9	.5	936	21.7	77	1.3	782

In SNNPR, households allocate twice as much of land for maize under fertilizer than unfertilized condition. In Oromia, more land is allocated for *teff* under fertilizer than other crops. Farm households economize the use of fertilizer on sorghum and barley than other crops. For maize, an average farmer uses on 8 kg /ha improved maize variety. In SNNPR, at 15kgs use, the rate is almost double. For other crops like *teff* relatively very high amount of seed rate is used than the normally recommended 70 kg/ha.

Despite lower than recommended rate derived from the questionnaire, most respondents indicated that they use the recommended level of seed rate, perhaps to please the interviewers and the development agents. About 90%, 93% and 91% of the households in Tigray, Amhara and Oromya reported to have used the recommended level of seed rate. It is only in SNNPR that the households reported use significantly deviated from the recommended rate [Table 4.16]. Here only about 45% of the farm households used the recommended level of seed rate. Similar analysis holds true for the use of chemical fertilizers. More than 80% of the farm households used the recommended level of DAP and Urea in all regions except the SNNPR. In SNNPR, close to 50% of the households have applied chemical fertilizer below recommended level for various reasons.

Farm households have various reasons for sub-optimal application of inputs. Most reasons provided by respondents are economic reasons. In Tigray 100% of the respondents indicated that DAP prices were found to be too expensive to adopt, and 50% of the respondents perceived that Urea prices were high [Table 4.17]. In Amhara, 14%, 31% and 34% of the respondents indicated that expensiveness of seeds, DAP and Urea respectively made them unprofitable to use the full package of technology.

Table 4.17 Reasons for Applying Inputs Below Recommended Levels by Region and Zone

Region	Too expensive			Unprofitable at the margin			High labor demand			Other reasons			Number of cases		
	Seeds	Dap	Urea	Seeds	Dap	Urea	Seeds	Dap	Urea	Seeds	Dap	Urea	Seeds	Dap	Urea
Tigray	-	100.0	50.0	25.0	-	50.0	-	-	-	75	-	-	4	1	2
Amhara	14.3	31.3	34.1	42.9	33.3	34.1	21.4	27.1	24.4	21.4	8.3	7.3	14	8	41
Oromiya		30.0	28.6	9.1	10.0	7.1	-	10.0	7.1	90.9	50.0	57.1	11	20	14
SNNPR	18.3	28.3	29.0	21.8	28.9	20.0	33.8	22.6	22.0	26.1	20.1	29.0	142	159	100
	16.4	29.4	30.6	22.8	28.1	22.9	29.8	22.4	21.0	31.0	20.2	25.5	171	228	157
Zone															
W. Tigray		-	-	-	-	-	-	-	-	100	-	-	3	-	-
E. Tigray		100	50.0	100	-	50.0	-	-	-	-	-	-	1	1	2
KAT	17.5	27.5	26.8	19.2	28.3	18.3	38.3	25.4	25.6	25.0	18.8	29.3	120	138	82
N. Omo	22.7	33.3	38.9	36.4	33.3	27.8	9.1	4.8	5.6	31.8	28.6	27.8	22	21	18
E. Welega		50.0	50.0	16.7	8.3	12.5	-	16.7	12.5	83.3	25.0	25.0	6	12	8
W. Hararg		-	-	-	12.5	-	-	-	-	100	87.5	100	5	8	6
E. Gojam	18.2	37.0	37.5	36.4	29.6	29.2	27.3	22.2	25.0	18.2	11.1	8.3	11	27	24
S. Wollo	-	23.8	29.4	66.7	38.1	41.2	-	33.3	23.5	33.3	4.8	5.9	3	21	17
Total	16.4	29.4	30.6	22.8	28.1	22.9	29.8	22.4	21.0	31.0	20.2	25.5	171	228	157

Thus, technology deepening is yet to be accomplished and this will largely depend on the net returns to the inputs which have been severely hampered by the instability and low price of outputs in the face of the removal of the hitherto subsidies. In this respect, diffusion is even at a lesser magnitude that the spread of adoption.

If the method of diffusion is also an indicator of the deepening of the spread of the technology, as shown in the following Table 4.18, now that the adoption rates have reached 50%, there is a considerable farmer-to-farmer dissemination of knowledge. Extension [Demonstration Farm and Development Agent] as a media of innovation accounts for only 57%.

Table 4.18 Sources Information for Innovations among the four Components of the Technologies

Source	Innovations					
	Wheat	Maize	DAP	Urea	Total	%
Self	22	22	49	55	148	6.0
DF & DA	156	256	496	498	1406	57.1
DF WODA	8	44	79	70	201	8.2
Other farmers	80	70	254	132	536	21.8
Own DF	3	6	13	14	36	1.4
Ratio	2	2	7	9	20	0.8
Others	8	17	56	34	115	4.7
Total	279	317	954	812	2462	100.0

DF = Demonstration farm DA = Development Agent WO = without

Furthermore, as shown in Annex Table 4.1, although farmers do have different level of access to extension providers – development agent, home agent, credit, input and research centers, given a drive by the farmers, profitability and good service delivery by the agents, almost all rural households are within walking distances.

When the three suggested measures of diffusion are taken together, the spatial and temporal spread and the accompanying exposure [nearly 70% when the dis-adopters are included], the latter until 1997/98, have been phenomenal. However, because of exit and very low rate of return to the technology in some years, the rate of the adoption of the new input per household and per unit area have been shallow. It appears that the reigning price trend did not drive farmers to graduate upwards in terms of intensification of the already used inputs and expanding to others. This, however has to appraised in the light of the relatively short time span for the whole process.

Another main issue which emerges from the study is that household have to travel an average distance of close to 3 km to reach to the development agent, 4.8 km to home agent, 7.8 km to credit service, 7 km to input service, 4 km to demonstration farms and 20 km to research centers. There is no significant difference among the regions in terms of accessibility to development agent. Among others, this suggests whether the lateral expansion of similar services by the development agents is worth the resources allotted to their training or that time is ripe for other strategies of knowledge dissemination while strengthening the capacity and capability of the already existing agents.

5. INPUT AND CREDIT SERVICES

5.1 Introduction

The delivery of the required amount of credit and inputs to finance and employ them in the production process respectively are important components of adoption to bring about the required economic and social impact of technology dissemination. This is particularly crucial in rural Ethiopia where the level of living is very low. Provided that the technology is profitable and sustainable, credit is beneficial both to the users and lenders. While the borrowers benefit from increased incomes and the expansion of their knowledge base, creditors earn interest and servicing cost.

That the technology is profitable even after the removal of subsidy and the credit arrives in the required amount, time and place are critical to meet the demand of the borrower and the creditor. The quality of service and return to short term investment in the inputs are prerequisites for a well functioning input market. This paper briefly reports on the volume, sources, quality of delivery, repayment and expressed choices of outlets for inputs and credit by the interviewed farmers.

5.2 Volume and Quality of Service

As shown in the table below [Table 4.1], at consumption levels of 55 and 127 kgs per household respectively, the mean purchase of seed and fertilizer are well below the recommended levels of inputs. Just over 2/3 of the respondents reported that the inputs were accessed through loans. Whereas 70% and above in the three regions obtained loans to purchase fertilize, in SNNPR, nearly ¾ acquired them through self financing. Given the smaller volume of finance involved, while loans are still the predominant mode, for seed, like SNNPR, ¾ of farmers in Tigrai also access seed purchase through self means [Table 5.2 and Annex Table 5.1 for seed].

Table 5. 1 Mean Purchased Seed & Fertilizer

Regions	Mean Kg		Mean Value [in Birr]		
	Seed	Fert	Seed	Fert	Total
Tigrai	34	50	66	129	195
Amhara	29	97	61	218	279
Oromia	68	83	86	194	270
SNNPR	67	49	86	87	173
Total	43	70	90	190	280

Table 5.2 Number of Farmers who Took Loans to Buy Inputs [Fertilizer]

Regions	Yes		No		Total	
	N	%	N	%	N	%
Tigrai	125	70.0	80	30.0.2	205	100
Amhara	187	86.1	29	13.9	217	100
Ormia	142	82.1	31	18.9	173	100
SNNPR	60	26.7	165	72.3	225	100
Total	**514**	**62.7**	**305**	**37.3**	**820**	**100**

Marginally cooperatives are ahead in the processing of loans but nearly at par with Extension handling nearly half each. Micro-finance institutions, NGOs and other organizations share the remaining 6% of the loans. In the SNNPR, a mere 43 households against 205, 177 and 142 in Amhara, Oromia and Tigrai respectively accessed input loans. The overwhelming share of the loans in Oromia followed by SNNPR was handled via Extension. By contrast, farmers in the Amhara region obtained them through their cooperatives [Table 5.3].

Table 5.3 Media of Processing Purchase of Fertilizer

Regions	Coop		Extension		Micro Finance		NGO		Other		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Tigrai	53	37.3	69	48.3	8	5.6	6	4.2	6	4.2	142	99.8
Amhara	189	92.1	12	5.8	1	0.7	3	1.3	-	-	205	99.9
Oromia	20	11.2	154	87.0	3	1.7	-		-		177	99.9
SNNPR	8	18.6	27	62.8	-	-	-	-	8	18.6	43	100.0
Total	**270**	**47.6**	**262**	**46.2**	**12**	**2.1**	**9**	**1.6**	**14**	**2.5**	**567**	**100.0**

Table 5. 4 Loan Variation Between Demanded & Obtained

Regions	Same		Above		Below		Other		Total	
	N	%	N	%	N	%	N	%	N	%
Tigrai	139	81.8	26	15.3	5	2.9	-	--	170	100.0
Amhara	138	84.7	7	4.3	16	9.8	2	1.2	163	100.0
Ormia	138	89.0	3	1.9	11	7.1	3	1.9	155	100.0
SNNPR	53	34.9	11	7.2	78	51.3	10	6.6	152	100.0
Total	**468**	**73.1**	**47**	**7.3**	**110**	**17.2**	**15**	**2.3**	**640**	**99.9**

Except in SNNPR, which appears to have a credit bottleneck [see also tables below], for over 80%, the credit obtained is the same as the amount requested. A significant 15.3% reported to have received more than the requested amount. On the other hand, more than half in SNNPR obtained less than the amount required.

Table 5.5 Quality of Fertilizer Delivered

Regions	Underweight		Poor Quality		Both		Other		Total	
	N.	%	N	%	N	%	N	%	N	%
Tigray	33	18.3	18	13.0	6	10.9	60	31.1	117	20.8
Amhara	52	28.9	37	26.8	9	16.4	29	15.0	127	22.4
Oromia	36	20.0	24	17.4	8	14.5	37	19.2	105	18.5
SNNPR	59	32.8	59	42.8	32	58.2	67	34.7	217	38.3
Total	180	31.8	138	24.4	55	9.7	193	34.1	566	

However, as shown in Table 5.5 above, there is a considerable complaint about the actual weight delivered and the quality. Of those who commented on the evaluation of the service with respect to quality, nearly ¼ described it as poor and an even more percentage, 31.8% claimed that the consignment delivered was underweight. Of those who considered that both the quality and the weight were questionable, as many as 2/3 complained about the delivery of fertilizer.

Apart form the amount and quality, timely delivery of fertilizer is critical if the desired levels of yield are to be attained. This partly depends on the level of competitiveness of the fertilizer market. Of those who volunteered to comment on the timely or otherwise arrival of fertilizer, slightly less than half say that it arrived during planting period [rather than before] or late. SNNPR has not only the lowest rate of credit availability, but also problem of timely delivery. Nearly 1/3 of the households reported late arrival of fertilizer [Table 5.6]. Amhara and Oromia appear to have a more efficient/ timely fertilizer delivery system.

Table 5. 6 Time of Arrival of Fertilizer in 1993/94 E.C Season

Regions	Before Planting		During Planting		Late		Total	
	N	%	N	%	N	%	N	%
Tigrai	50	64.0	21	26.9	7	9.0	78	99.9
Amhara	88	75.2	21	17.9	8	6.8	117	99.9
Oromia	73	70.8	26	25.2	4	3.9	103	99.9
SNNPR	52	31.7	59	36.0	53	32.3	164	100.0
Total	263	56.9	127	27.4	72	15.6	462	100.0

The fertilizer financing and delivery problem in SNNPR culminates in delayed planting/sowing where as many as nearly half the households reported such cases [Table 5.7]. At 20%, although Oromia reported the lowest case of delayed planting, when one considers the high marginal loss of output due to late planting, even this is significant.

Table 5.7 Delayed Planting/Sowing Because of Late Arrival of Fertilizer

Regions	Yes		No		Total	
	N	%	N	%	N	%
Tigrai	27	29	66	71	93	100
Amhara	44	30	100	69	144	100
Oromia	44	39	69	61	113	100
SNNPR	102	54	88	46	190	100
Total	**217**	**40**	**323**	**60**	**540**	**100**

For over 80%, the price levels for fertilizers, which prevailed in the season prior to the research, were higher than expected. In Tigrai, however, for 1/3 of the respondents, the price levels were as expected. For the other regions, such interface with expectations were at 17.9%, 14.4% and 8.9% for Amhara, Oromi and SNNPR respectively [Table 5.8].

Table 5.8 Expected and Actual Price Level of Fertilizer

Regions	As Expected		Above Expected		Below Expected		Total	
	No.	%	No.	%	No.	%	No.	%
Tigray	85	35.8	132	60.2	2	0.7	219	100.0
Amhara	42	17.9	191	81.6	2	0.5	234	100.0
Oromia	27	14.4	160	85.5	-	0.00	187	99.9
SNNPR	27	8.9	275	90.4	2	0.7	304	100.0
Total	181	19.1	758	80.2	6	0.7	944	100.0

In addition to the volume, availability and timely delivery, the prevailing actual price levels are bound to have impact on the amount of use or non-use at all of the new inputs to adjust cost to the price of input. In this respect, Tigrai is out of step with the rest of the other regions in not only having more farmers expecting prices as they happened later but also in having a relative inelastic demand for fertilizers. As shown in Table 5.9 below, whereas 72.7%, 58.1% and 53.7% of the reporting households in SNNPR, Amhara and Oromia respectively bought less fertilizer because of higher than expected prices, only 15.2% did so in Tigrai. Overall, nearly 1/3 bought the same amount but more than half [54.4%] bought less. Only 8.1% refrained from any amount of purchase.

Table 5. 9 Decisions When Price of Input Was Above Expected Levels

Regions	Bought Less		No Change		Bought Nothing		Other		Total	
	N	%	N	%	N	%	N	%	N	%
Tigrai	22	15.2	84	57.9	21	14.5	18	12.4	145	100
Amhara	125	58.1	83	38.6	1	0.5	6	2.7	215	99.9
Ormia	89	53.3	53	31.7	23	13.8	2	1.2	167	100
SNNPR	202	72.7	51	18.3	20	7.2	5	1.8	278	100
Total	**438**	**54.4**	**271**	**33.7**	**65**	**8.1**	**31**	**3.8**	**805**	**100**

5.3 Repayment

Discipline in repayment is essential not only to sustain the credit system from the supply end but also important as a revolving fund to engage non-adopters in the course of the dissemination process. In this respect, the experience in many African countries is dismal. As shown in the following table, the case in Ethiopia appears to be better. That is in spite of the removal subsidy on inputs and the colossal price fall of maize during the study which is the crop with highest response for fertilizer.

Overall, nearly 80% paid the loans in full reaching to as high as 94% in Tigrai. When the partial payers amounting to 13.1% are included, the overall repayment rate rises to as high as 93% reaching to nearly 98% and 95% in Tigrai and Amhara respectively. With only 48.1% full and 24.6% partial repayment, SNNPR has not only problem of access and timely delivery, but also repayment [Table 5.10] perhaps reflecting poor service and limited access to credit.

Table 5.10 Status of Payment of Loan for Fertilizer 93/94 E.C.

Regions	Yes, in Full		Yes, Partial		No, in Full		Other		Total	
	N	%	N	%	N	%	N	%	N	%
Tigrai	151	93.8	6	3.7	4	2.5	-	-	161	100.0
Amhara	166	83.8	22	11.1	9	4.5	1	0.6	198	100.0
Oromia	126	71.6	30	17.0	15	8.5	5	2.8	176	99.9
SNNPR	25	48.1	36.5	24.6	6	11.5	2	3.8	52	99.9
Total	468	79.7	77	13.1	34	5.8	8	1.4	587	

Table 5.11 Sources for the Repayment of Loans

Sources of Repayment	Tigray		SNNPR		Oromia		Amhara		Total	
	N	%	N	%	N	%	N	%	N	%
Sale of grain	154	42.2	51	38.1	154	42.2	219	60.3	578	47.1
Sale of ox	36	9.9	16	11.9	36	9.9	33	9.1	121	9.9
Sale of other livestock	69	18.9	27	20.1	69	18.9	66	18.2	231	18.8
Income from non-farm activity	26	7.1	8	6.0	26	7.1	10	2.8	70	5.7
Hiring out self	14	3.8	6	4.9	14	3.8	2	0.5	36	2.9
Help from friends and relatives	29	7.9	7	5.2	29	7.9	4	1.1	69	5.6
Renting out land	5	1.4	7	5.2	5	1.4	3	0.8	20	1.6
Borrowed from local sources	10	2.7	6	4.5	10	2.7	5	1.4	31	2.5
Others	21	5.7	6	4.5	21	5.8	21	5.8	69	5.6
Total	365	100	134	100	365	100	363	100	1227	100

Between 38% in SNNPR and 60% in Amhara averaging nearly half, households finance their loan of inputs from the sale of grain. With almost equal distribution among the regions, a significant 18.8% do so from the sale of non-oxen livestock. With similar distribution, nearly 10% in all the regions sold oxen for repayment. Livestock sale including oxen make up slightly less than 1/3 of the total sources of loan repayment. At an average of 5.7% of the cases, income from non-farm activity is also an important source of repayment. Help from friends and relatives is also of similar importance. In both cases, except for the Amhara region, the distribution among the others is similar. Incomes from wages and borrowing from local sources are the other avenues for the repayment of loans [Table 5.11].

Table 5.12 Reasons for Failure to Repay Loans Problems

Regions	Tigrai		Amhara		Oromia		SNNPR		Total	
	N	%	N	%	N	%	N	%	N	%
Low price of output	9	26.5	21	75.0	30	48.4	40	85.1	100	58.48
No increased output	10	29.4	1	3 6	6	9.7	2	4.3	19	11.11
High cost of produce	4	11.8	4	14.3	2	3.2	1	2.1	11	6.43
Used for other unexpected expenses	5	14.7	1	3.6	5	8.1	1	2.1	12	7.02
Bad harvest	5	14.7		0.0	11	17.7	1	2.1	17	9.94
Others	1	2.9	1	3.6	7	11.3	2	4.3	11	6.43
Total	34	100	28	100	62	100	47	100	171	100

Of the 171 households who offered the reasons for their inability to pay their loans, 85% in SNNPR and 75% in Amhara attributed it to low prices of output. Whereas nearly half also gave the same reason in Oromia, in Tigrai much less number of households said so. In the latter two, bad harvest and low incremental benefit are also reported as major reasons. Nearly ¼ each in Tigrai and SNNPR and 1/3 each in the other regions [Annex Table 5.2], of those who failed to pay their loans were dealt with by the creditors in the following ways.

Table 5.13 Steps Taken against Non-repayment of Loans

Region	Lending Suspended		Forced to sell food		Forced to sell Livestock		Forced to sell Other Property		Imprisonment		Other		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Tigray	2	6.7	10	29.4	8	21.6	10	83.3	14	23.3	3	23.1	47	25.3
Amhara	10	33.3	12	35.3	23	62.2	-	-	21	35.0	4	30.8	70	37.6
Oromia	9	30.0	7	20.6	5	13.5	1	8.3	15	25.0	1	7.9	38	20.4
SNNPR	9	30.0	5	14.7	1	2.7	1	8.3	10	16.7	5	38.5	31	16.7
Total	30	16.1	34	18.3	37	19.9	12	6.4	60	32.2	13	7.0	186	99.9

Of the 186 reported cases [9.7% of the total households in the study] against whom steps were being taken, nearly 1/3 were imprisoned, the rest were forced to sell all forms of property. The highest cases where steps were taken were in the Amhara region [37.6%] followed by Tigrai [25.3%]. Although by far with the highest rates of failure to pay, the lowest number of steps was taken in SNNPR [16.7%]. Low output price is by far the most frequent reason mentioned in terms of problems associated with credit followed by collateral and the failure to convince as to the reason of inability to pay [Table 5.14].

Table 5.14 Problems Associated With Credit

Region	Collateral		Low output price		Convincing Reason		No negotiation		Not enough.		Other		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Tigray	59	36.0	67	15.6	13	20.6	1	5.3	9	40.9	28	26.4	177	22.0
Amhara	29	17.7	108	25.2	33	52.4	10	52.6	6	27.3	32	30.2	218	27.1
Oromia	22	13.4	124	28.9	9	14.3	1	5.3	3	13.6	24	22.6	183	22.8
SNNPR	54	32.9	130	30.3	8	12.7	7	36.8	4	18.2	22	20.8	225	28.0
Total	164	20.4	429	53.4	63	7.8	19	2.4	22	2.7	106	113.2	803	100

Household heads in the study were asked their preferences in the management of credit and inputs to serve their best interest. As shown in the following Table 5.15, nearly half each of the households opted for cooperatives and Extension for fertilizer and to a lesser extent for seed. This is in spite of the fact that today, these institutions are only go betweens with the actual suppliers of inputs and credit. The study also asked farmers to compare private and public provision of inputs in two related ways – for those who access inputs from private sources, what the advantages were and the reason for their choice.

Table 5.15 Outlets Preferred to Buy Seed & Fertilizer

	Fertilizer		Seed		Total	
	#	%	#	%	#	%
Coop	441	46	268	39	709	43
Extension	431	45	322	47	753	46
Market	32	3	42	6	74	5
Retailer	20	2	21	3	41	2
Agent & Companies	24	3	15	2	39	2
Farmer	7	1	7	1	14	1
Other	8	1	7	1	15	1
Total	**963**	**101**	**682**	**99**	**1645**	**100**

The criteria of timeliness, friendliness, flexibility, low interest, no collateral, more sympathetic etc were cited. Most of these are the hallmarks of a competitive market led economy. In the light of the poor qualities of input and credit provisions services stated under section 4.3, it is worth considering a policy which provides social protection within a competitive within marketing framework for the inputs.

6. PERFORMANCE EVALUAITON OF EXTENSION SERVICE DELIVERY INSTITUTIONS

Household heads in the study were asked to evaluate the institutions they come in contact with which are engaged directly and indirectly in delivering the extension services. They were asked to rank them as A for being excellent, B for very good, C for satisfactory, D for poor and E for very poor. The respondents were also asked to provide the reasons for categorizing them as they did. The aim was:

1. To document the relative performance between the service delivery agencies within the regions, zones *wereda* and PAs and by doing so provide information for managers and implementing staff to recognize their comparative position and take measures for improvement

2. Make available to federal institutions dealing with rural development the comparative information among the regions as reported by their stakeholders, the farmers

In order to appraise the responses via the social proximity and degree of relevance and therefore weighting to be accorded to the result of the survey in this regard [decreasing as one moves form 1 to 3 below with less and less direct engagement with farmers], the institutions may be classified into three:

1. **Direct extension institutions** – this is the DA office which has day to day contact in disseminating information to farmers at training centers and demonstration farms and coordinating with the institutions under 2 & 3 below. The *wereda* agricultural office is the further removed but directly involved office.
2. Support Service Delivery Institutions[16] – these are the input and related institutions which supply/facilitate credit for inputs including coops

Indirectly engaged institutions – the *kebele* and *wereda* administrations

Table 6.1 Ranking of Service Delivery Institutions [%]

Region	Grades	Credit Instit'n	Input instit'n	Coops	*Wereda* agri off	*Kebele* DA office	*Wereda* admin	*Kebele* adm
Tigray	A	27.6	36.4	34.6	17.4	62.4	29.3	--
	B	31.6	18.2	33.1	55.2	28.8	39.4	0.6
	C	33.3	18.2	22.8	10.0	2.0	8.5	49.1
	D	5.7	27.3	7.1	6.5	2.9	8.0	47.4
	E	19.7	--	2.4	10.9	3.9	14.9	2.9
	Total	99.9	100.1	100.0	100.0	100.0	100.0	
Amhara	A	18.7	13.1	33.0	5.7	58.3	7.7	--
	B	32.3	39.2	44.8	53.8	25.2	52.1	--
	C	33.5	27.7	16.7	28.8	14.9	28.4	48.6
	D	12.3	16.2	4.5	9.4	1.7	6.7	29.1
	E	3.2	3.8	0.9	2.4	--	5.2	22.3
	Total	100.0	100.0	99.9	100.1	100.1	100.1	100.0
Oromia	A	27.6	20.7	4.6	9.9	51.3	6.3	--
	B	48.3	62.1	23.1	52.9	38.2	42.9	--
	C	17.2	6.9	16.9	20.9	6.3	21.5	36.3
	D	6.9	5.2	49.2	13.6	4.2	19.9	38.8
	E	--	5.2	6.2	2.6	--	9.4	25.0
	Total	100.0	100.1	100.0	99.9	100.0	100.0	100.1
SNNPR	A	29.4	21.9	32.5	13.0	63.4	8.7	0.7
	B	11.8	22.8	38.7	56.5	22.1	60.7	--
	C	29.4	15.6	15.3	8.6	4.0	7.3	65.6
	D	29.4	26.4	9.2	20.3	10.2	22.3	23.3
	E	--	13.3	4.3	1.7	0.3	1.0	10.4
	Total	100.0	100.0	100.0	100.1	100.0	100.0	100.0

[16] Their full list is provided in Section 4.1.

All the regions accord their highest ranking to the *kebele* Development Agent Office. This is the grass-root level contact and the most important in the dissemination of innovation. The DA office is ranked A and B ranging from 99% in Tigrai to 83% in the Amhara region. Next in the ranking order are cooperatives. They are positioned with ranks of A and B by 83% in Oromia, 78% in Amhara, 71% in SNPPR and the lowest but still respectable 63% in Tigrai. Except in Oromia which rates its credit and input institutions almost as highly as extension and cooperatives, in the Amhara and Tigrai regions, at mid-fifties percentage rankings of A and B, the credit and input institutions lag far behind. In the SNPPR, the credit and input institutions earned less than 50% rankings of A & B.

Among the indirectly involved, *wereda* administration and extension offices also earned commendable rates of A and B. The lowest evaluation in all regions with less than 1% ranking of A and B in Tigrai and SNPPR, with none at all in Oromia and Amhara are the *kebele* administration which is the administrative machinery nearest to the farmers. About 64% in Oromia, 51% in Amhara, 50% in Tigrai and 33% in the SNPPR rated their *kebele* administrations as poor and very poor. Why this is in complete contrast to the adjacent lowest tier agricultural office, DA is worth investigating further.

Table 6.2 Reasons for Good [A&B] Performance by Regions*

Region/type of institution	Timely	Polite	Efficient	Know duty well	Proxi mity	Costless	others	Total
Tigray								
N	178	295	375	272	323	95	8	1546
%	12	19	24	18	21	6	1	101
Amhara								
N	291	359	420	397	415	214	39	2096
%	14	17	20	19	19	10	2	101
Oromiya								
N	486	331	372	315	382	151	7	2044
%	24	16	18	15	19	7	1	100
SNNPR								
N	395	425	512	437	499	403	36	2707
%	15	16	19	16	18	15	1	100
TOTAL								
N	1350	1410	1679	1421	1619	863	90	8432
%	16	17	20	17	19	10	1	

* *The responses are more than the number of farmers because of multiple reasons*

For those graded A & B, in giving reason for the ranking, the respondents were asked to choose from promptness, being polite, efficient, knowing duty well, nearness, costing less and other specify. For those which scored D and E, the obverse of the above were provided. As shown in the Table above, the reasons attributed for good performance are equally distributed except for costlessness which scored half those for others. The distribution for causes of poor performance are the obverse of good performance and their distribution is also similar [Table 6.3]

Table 6.3 Reported Causes for Poor Performance by Institutions and Region

Region/type of institution	Delaying	Not Polite	Inefficient	Irresponsible	Poorly trained	Expensive	others	Total
A. Tigray								
Input supply	8	29	29	6	17	9	3	
Technology transfer	5	24	18	18	24	10	1	
Agric office	7	8	25	24	13	18	5	
Administration	9	9	23	21	20	13	4	
B. Amhara								
Input supply	8	15			23	8	46	
Technology transfer	3	18	15	21	17	15	12	
Agric office	11	7	36	20	10	10	6	
Administration	12	11	16	19	17	13	11	
C. Oromiya								
Input supply	17	15	18	17	17	8	7	
Technology transfer	18	12	20	11	20	10	8	
Agric office	16	15	20	15	15	14	6	
Administration	22	14	20	13	15	12	5	
D. SNNPR								
Input supply	25	13	20	12	20	8	1	
Technology transfer	19	12	18	17	19	10	4	
Agric office	13	13	26	21	14	12	1	
Administration	7	18	15	18	16	16	9	

7. CONCLUSIONS AND POLICY IMPLICATIONS

7. 1 Technology adoption is a dynamic aspect of an innovation process of dissemination

and diffusion of knowledge and hardware component of a technology. For increased adoption and resulting significant impact to be registered on farm households, a synergy between policy, technical and institutional

innovations are required. This conclusion attempts to pull together the preliminary implications of the findings for such policy innovations to enhance the tempo, productivity, profitability and equity in the process of technology adoption and dissemination.

7.2 Current adopters have more labour, land and education. Proportionately, less of
female headed and poor households are adopters. There is inequity in the educational level of farmers with significant lag in some regions. Policy ought to be geared towards drawing more farmers who are resource poor and those with less social capability. Given the critical requirement of labour for sustainable diffusion of the technology, the implications of varying rural ideologies expressed in the different
faiths in the realm of reproduction and the mobilization of available labour needs to be examined.

7.3 Due to additional land operated through renting in and share cropping arrangement,
the size of land operated in most cases is greater than the size of land owned. Such indigenous land transaction institutional innovations by the farmers themselves emanate from the local social and agro-ecological conditions. The pattern of the subsequent balancing of the supply of resources [land, labour and oxen power] and demand need to be further studied with the aim of coming up with frameworks about the ways and means of formalizing them at regional and national levels. In the light of the contemporary national dialogue on land tenure expressed in many forums, such a study will have immense policy relevance.

7.4 Overall just over 1/3 of the households, 47% adopters and 24% non-adopters, did not have any oxen power [which is another critical input like labour] of their own. To attain the maximum spread and deepening of the technology, innovative policy towards the capitalization of such farmers and/or substitution of oxen power by other means need to be deliberated upon.

7.5 In all the regions, there is a very high level of awareness of the existence of development service providers and the more so of Development Agents, credit and input providers. Far less than those who are aware about the existence of the extension services have been contacted by Extension. While contact by extension is less than awareness by farmers, contact of extension by farmers is even far less than contact by

extension. There is virtually no extension contact with research. For research to appraise the actual opportunities and constraints faced by farmers in their specific social and agro-ecological context, there needs to be a continuous channel of communication with farmers interfaced by the Development Agent.

7.6 The two most important inputs in extension services promoted and adopted in Ethiopia are artificial fertilizers in the form of Urea and DAP and improved seeds of maize and to a much lesser extent wheat and *teff* together with associated management practices in ploughing, planting, weeding, harvesting and storage. Overall, 63% of the households had tried one or more of the new inputs but nearly 25% of the total households or about 40 % of those who had tried them interrupted using them and only 1/6th of those who had exited restarted.

7.7 When the three suggested measures of diffusion are taken together, the spatial and temporal spread and the accompanying exposure [nearly 70% when the dis-adopters are included] have been phenomenal. However, because of exit and very low rate of return to the technology in some years, the rate of the adoption of the new input per household and per unit area have been shallow.

7.8 While price [high of input and low of output], shortage of complementary inputs and inadequate extension service are cited as the major constraints for adoption, their obverse are said to promote adoption. The reigning price trend did not drive farmers to graduate upwards in terms of intensification of the already used inputs and expanding to others which would have otherwise ushered in the term Green Revolution to describe diffusion of at least maize. Price stabilization at reasonable level of return to farmers could be an important policy instrument to curb exit and instead transit from transitory adoption to sustained diffusion and possibly "green revolution"

7.9 Another main issue which emerges from the study is the extension strategy of Lateral Expansion versus Intensification of services. Farmers travel an average distance of close to 3 km to reach the development agents, 4.8 km to home agents, 7.8 km to credit service, 7 km to input service, 4 km to demonstration farms and 20 km to research centers. There is no significant difference among the regions in terms of accessibility to development agents. Among others, this suggests whether the lateral expansion of similar services by the development agents is worth the

resources allotted to their training and the cost of further employment or that time is ripe for

other strategies of knowledge dissemination while strengthening the capacity and capability of the already existing agents.

7.10 Provided that the technology is profitable and sustainable, credit is beneficial both to the users and lenders. While the borrowers benefit from increased incomes and the expansion of their knowledge base, creditors earn interest and servicing cost. At consumption levels of 43 and 70 kgs of fertilizer and seed per adopting household respectively, the mean purchase of fertilizer and seed are well below the recommended levels of inputs. However, even at such low level of per household and per hectare consumption, there is a considerable complaint about the actual weight, the quality of fertilizer and timeliness in delivery. In the light of the poor qualities of input and credit provisions services and the associated problems reported by farmers, it might be worth considering a policy which provides social protection for farmers within a competitive input marketing system.

7.11 When the partial payers amounting to 13.1 % are included, the overall repayment rate of loans rises to as high as 93% reaching to nearly 98% and 95% in Tigrai and Amhara respectively. Given that the rate could even be higher subsequently with part of the remaining likely to pay after the date of the interview in this research, this is a remarkable rate of repayment. Nevertheless, of the 186 non-paid cases [9.7% of the total households in the study] against whom steps were being taken for non-payment, nearly 1/3 were imprisoned. The rest were forced to sell all forms of property including oxen. For the genuinely unable to pay, there is a need to arrest de-capitalization which could otherwise further their inability to repay in due course.

7.12 Under performance evaluation of service delivery institutions, all the regions accord their highest ranking to the *kebele* Development Agent Office. Conversely, in all the regions, most ranked the *kebele* administration as poor and very poor. The reason for the good and poor performance rating of DAs and the *kebele* administrations were similar. In the light of the Civil Service Reform for higher tier government institutions, the dismal rating of *kebele* administrations need closer scrutiny for reform.

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Annexes

Annex Table 1.1 Regions, Zones, *Wereda* and Peasant Associations in the Study

Region	Zones	Adoption Status	Wereda	Adoption Status	Farmers' Associations	Adoption Status
1.Tigray	1.1 Western Zone (Shire)	HADZ	1.1.1 Tselemiti	LADW	1.Mai Ayni	**HAPA**
					2.Sekotamariam	LAPA
			1.1.2. Medbai- Zana	HADW	3.Adi Kebdi	LAPA
					4.Embatsaed	HAPA
	1.2. Eastern Zone (Adigrat)	ADZ	1.2.1 Ganta - Afeshum	HADW	1.Ala Genhat	LAPA
					2. .Gahigoti	HAPA
			1.2.2 Wukuro	LADW	3.Mai Quiha	LAPA
					4.Gemad	HAPA
2. Amhara	2.1 East Gojjam (Gonder)	HADZ	2.1.1 Hulet Eju Anebise	HADW	1. Addis Zemen	HAPA
					2. Beza Bizuhan	LAPA
			2.1.2 Enebise Sar Midir	LADW	3.Goffa Tidma	LAPA
					4.Kil Meda	HAPA
	2.2 South Wollo (Dessie)	LADZ	2.2.1. Jamma	HADW	1.Fagi*./Kebele 09/	HAPA
					2.Degelo	LAPA
			2.1.2. Ambasel	LADW	3.Robit*/Kebele 03/	LAPA
					4.Gulbo*/Kebele 04/	HAPA
3. Oromiya	3.1 East Wollega (Nekemt)	HADZ	3.1.1 Jimma Horo	HADW	1.Sambo Deede	HAPA
					2.Godanne	LAPA
			3.1.2 Abe Dengoro	LADW	3.Tulumotti	LAPA
					4. Eddo Kussa	HAPA
	3.2 West Harerge (Chiro)	LADZ	3.2.1.Chirro	LADW	1.Garanigussie	HAPA
					2.Woligali	LAPA
			3.2.1Tullo (Hirnna)	HADW	3.Tarkanfata	HAPA
					4.Rakatafura	LAPA
4. Southern NNPRS	4.1 Kambata, Alaba and Tambaro (Durame) [KAT]	HADZ	4.1.1 Angecha	HADW	1.Gondana	HAPA
					2.Hawora	HAPA
			4.1.2 Omosheleko	LADW	3.Debub Ambokena	HAPA
					4.Sigazo	LAPA
	4.2 North Omo (Arbaminch)	LADZ	4.2.1 Boreda	HADW	1.Zafine Manuka	HAPA
					2.Dega Awsanto	LAPA
			4.2.2 Arbamich Zuria	LADW	3.Kola Shelle	HAPA
					4.Channo Chelba	LAPA
4	8		16		32	

Annex Table 1.2: The Distribution of the Studied by Households by Status of Adoption, Gender of Household Head and Socio-economic Status

TIGRAI REGION

Zones, *Wereda* and Peasant Associations	Status of Adoption		Gender		Socio-economic status			OVER ALL
	AD	NAD	MHH	FHH	PO	AV	BO	TOTAL
High Adopter Zone (HAZ): Western Zone	111	129	169	71	182	53	5	240
High Adopter Woreda (HAW): Medebay Zana	70	50	76	44	86	32	2	120
High Adopter PA (HAPA): Emba Tse'di	41	19	42	18	45	15	0	60
Low Adopter PA (LAPA): Tsa'da Leke	29	31	34	26	41	17	2	60
Low Adopter Woreda (LAW): Tselemt	41	79	93	27	96	21	3	120
High Adopter PA (HAPA): May A'yni	2	58	48	12	53	6	1	60
Low Adopter PA (LAPA): Sek'ot'a Marym	39	21	45	15	43	15	2	60
Low Adopter Zone (LAZ): Eastern Zone	118	122	152	88	177	61	2	240
High Adopter Woreda (HAW):Ganta Afeshumu	72	48	72	48	87	32	1	120
High Adopter PA (HAPA):Gahigotl	60	0	40	20	41	18	1	60
Low Adopter PA (LAPA):Gola'-Genaht	12	48	32	28	46	14	0	60
Low Adopter Woreda (LAW):Klte Awila'lo	46	74	80	40	90	29	1	120
High Adopter PA (HAPA):Gemado	25	35	36	24	44	16	0	60
Low Adopter PA (LAPA):My-kiha	21	39	44	16	46	13	1	60
TOTAL	229	251	321	159	359	114	7	480

2. AMHARA REGION

Zones, *WEreda* and Peasant Associations	Status of Adoption		Gender		Socio-economic status			OVER ALL
	AD	NAD	MHH	FHH	PO	AV	BO	TOTAL
High Adopter Zone (HAZ):East Gojjam	193	47	206	34	146	81	13	240
High Adopter Woreda (HAW):Hulet Ej Enesie	120	0	108	12	79	39	2	120
High Adopter PA (HAPA):Beza Bizuhan	60	0	54	6	40	20	0	60
Low Adopter PA (LAPA):Addis Zemen	60	0	54	6	39	19	2	60
Low Adopter Woreda (LAW):Enesie Sar Medir	73	47	98	22	67	42	11	120
High Adopter PA (HAPA):Kill Meda	48	12	49	11	14	36	10	60
Low Adopter PA (LAPA):Guffu Tidema	25	35	49	11	53	6	1	60
Low Adopter Zone (LAZ):North Wollo	59	181	184	56	157	57	26	240
High Adopter Woreda(HAW):Jamma	59	61	90	30	81	19	20	120
High Adopter PA (HAPA):Fagi	43	17	43	17	44	14	2	60
Low Adopter PA (LAPA):Dogolo	16	44	47	13	37	5	18	60
Low Adopter Woreda (LAW):Ambasel	0	120	94	26	76	38	6	120
High Adopter PA (HAPA):Gulbo	0	60	49	11	38	17	5	60
Low Adopter PA (LAPA):Robit	0	60	45	15	38	21	1	60
TOTAL	252	228	390	90	303	138	39	480

3. OROMIA REGION

Zones, *WEreda* and Peasant Associations	Adoption Status		Gender		Socio-economic status			OVER ALL
	AD	NAD	MHH	FHH	PO	AV	BO	TOTAL
High Adopter Zone (HAZ):East Wallaga	**120**	**120**	**209**	**31**	**137**	**85**	**18**	**240**
High Adopter Woreda (HAW):Jimma Horro	**72**	**48**	**102**	**18**	**73**	**37**	**10**	**120**
High Adopter PA (HAPA):Kombolcha Chancho	44	16	54	6	51	6	3	60
Low Adopter PA (LAPA):Gudatu Jimma	28	32	48	12	22	31	7	60
Low Adopter Woreda (LAW):Abe-Dongoro	**48**	**72**	**107**	**13**	**64**	**48**	**8**	**120**
High Adopter PA (HAPA):Iddo-Kussa	28	32	50	10	36	20	4	60
Low Adopter PA (LAPA):Tullumoti	20	40	57	3	28	28	4	60
Low Adopter Zone (LAZ):West Hararghe	**64**	**176**	**207**	**33**	**124**	**106**	**10**	**240**
High Adopter Woreda (HAW):Tullo	**41**	**79**	**107**	**13**	**49**	**67**	**4**	**120**
High Adopter PA (HAPA):Garanugus	26	34	53	7	18	38	4	60
Low Adopter PA (LAPA):Walargi	15	45	54	6	31	29	0	60
Low Adopter Woreda (LAW):Chiro	**23**	**97**	**100**	**20**	**75**	**39**	**6**	**120**
High Adopter Woreda (HAPA):RakataFura	19	41	48	12	45	13	2	60
Low Adopter PA (LAPA):Tarkanfata	4	56	52	8	30	26	4	60
TOTAL	**184**	**296**	416	64	261	191	28	480

4. SNNP RIGION

Zones, *Wereda* and Peasant Associations	Adoption Status		Gender		Socioeconomic status			OVER ALL
	AD	NAD	MHH	FHH	PO	AV	BO	TOTAL
High Adopter Zone (HAZ):KAMBATA-TIMBARO	***235***	***5***	***201***	**39**	**203**	**31**	**6**	**240**
High Adopter Woreda (HAW):ANGECHA	120	0	*109*	11	95	21	4	120
High Adopter PA (HAPA):GONDANA	60	0	*56*	4	49	9	2	60
Low Adopter PA (LAPA):HAWARA	60	0	*53*	7	46	12	2	60
Low Adopter PA (LAW):OMO SHELEKO	115	5	*92*	28	108	10	2	120
High Adopter PA (HAPA):Sigazo	60	0	*48*	12	56	3	1	60
Low Adopter PA (LAPA):Debub Ambokena	55	5	*44*	16	52	7	1	60
Low Adopter Zone (LAZ):NORTH OMO	***97***	***143***	***219***	**21**	**141**	**65**	**34**	**240**
High Adopter Woreda(HAW):BOREDA	70	50	*104*	16	46	44	30	120
High Adopter PA (HAPA):ZAFINE MANUKA	60	0	*45*	15	23	26	11	60
Low Adopter PA (LAPA):DEGA AWSATO	10	50	*59*	1	23	18	19	60
Low Adopter Woreda (LAW):ARBAMINCH	27	93	*115*	5	95	21	4	120
High Adopter PA (HAPA):KOLLA SHELL	21	39	*60*	0	44	13	3	60
Low Adopter PA (LAPA):CHANO CHELBA	6	54	*55*	5	51	8	1	60
TOTAL	332	148	*420*	60	344	96	40	480
OVERALL TOTAL	**997**	**923**	**1547**	**373**	**1267**	**539**	**114**	**1920**

Annex Table 3.1a: Size of Land Holding per Household, Per Capita, Per Adult Household Member and Per Adult-male Household Member

	Per household			Per capita			Per adult person			Per adult male			Sample size		
	NAD	AD	All	NAD	AD	All	NAD	AD	All	NAD	AD	All	NAD	AD	All
Region															
Tigray	.78	.92	.85	.23	.20	.21	.42	.39	.41	.65	.71	.68	251	224	475
Amhara	.79	1.18	10	.21	.26	.23	.39	.52	.46	.61	.91	.78	211	251	462
Oromia	.90	1.36	1.10	.19	.22	.20	.40	.48	.43	.68	.90	.77	265	194	459
SNNPR	.78	1.74	1.45	.15	.30	.26	.34	.60	.52	.46	.99	.83	142	332	474
Zone															
W. Tigray	.87	1.13	.99	.26	.24	.25	.46	.44	.45	.74	.76	.75	132	107	239
E. Tigray	.68	.73	.70	.19	.16	.17	.38	.34	.36	.54	.66	.60	119	117	236
KAT	.90	.69	.69	.14	.10	.10	.60	.19	.20	.83	.38	.39	5	232	237
N. Omo	.77	4.18	2.21	.15	.77	.41	.33	1.54	.84	.44	2.49	1.30	137	100	237
E. Welega	1.42	1.87	1.66	.31	.30	.30	.65	.65	.65	1.17	1.18	1.17	105	118	223
W. Hararg	.56	.58	.57	.11	.11	.11	.23	.24	.23	.40	.47	.42	160	76	236
E. Gojam	1.11	1.12	1.12	.26	.25	.25	.54	.50	.51	.76	.89	.87	43	191	234
S. Wollo	.71	1.36	.88	.19	.29	.22	.35	.60	.42	.56	.96	.68	168	60	228
Total	.82	1.34	1.10	.20	.25	.23	.39	.51	.46	.61	.89	.77	869	1001	1870

NAD= Non-adopters, AD = Adopters

Annex Table 3.1b: Distribution of households[%] by Size of Land Operated, Size of Land Under Crops and Size of Land Owned by Region (hectares)

	Tigray			Amhara			Oromiya			SNNPR		
	NAD	AD	Total	NAD	AD	Total	NAD	AD	Total	NAD	AD	Total
Land operated												
None	5.8	2.7	4.2	2.8		1.2	-	-	-	-	-	-
001-0.10	20.9	23	22	19.7	4.7	11.2	39.9	23.7	33.1	45.3	50.8	49.1
0.101-0.10	36.7	31.1	33.8	39.9	30.5	34.5	29.1	28.5	28.8	39.4	23.2	28.1
0.201-0.10	17.3	20.3	18.8	23.6	30.9	27.7	12	21.5	16	8.8	7.3	7.7
0.301-0.10	7.9	10.8	9.4	5.6	20.2	13.9	5.8	14	9.2	4.4	2.5	3.1
0.401-HI	11.5	12.2	11.8	8.4	13.7	11.4	13.2	12.4	12.8	2.2	16.2	11.9
Total	100	100	100	100	100	100	100	100	100	100	100	100
Sample	139	148	287	178	233	411	258	186	444	137	315	452
Land under crops												
None	0.5	1.4	0.9		-	-	-	-	-	-	-	-
001-0.10	29.2	32.7	30.9	18.6	3	9.4	39.4	25.8	33.9	44.5	52.1	49.9
0.101-0.10	36.5	33.2	34.9	44.1	28.2	34.7	29.2	29.7	29.4	40.6	22	27.5
0.201-0.10	12.3	17.1	14.7	23.6	35	30.4	11.4	19.8	14.8	7.8	6.8	7.1
0.301-0.10	8.2	7.6	7.9	6.2	18.4	13.4	5.3	8.8	6.7	4.7	4.2	4.3
0.401-HI	13.2	8.1	10.7	7.5	15.4	12.2	14.8	15.9	15.2	2.3	14.9	11.2
Total	100	100	100	100	100	100	100	100	100	100	100	100
Sample	219	211	430	161	234	395	264	182	446	128	309	437
Land owned												
None	1.2	0.4	0.8	0.9	0.4	0.6	0.8	-	0.4	-	-	-
001-0.10	25.5	31.3	28.2	26.1	4.4	14.3	41.1	26.8	35.1	48.6	49.1	48.9
0.101-0.10	39	36.6	37.9	36.5	48.2	42.9	29.1	29.9	29.4	34.5	25.9	28.5
0.201-0.10	12.4	14.3	13.3	24.2	26.3	25.3	13.6	22.7	17.4	9.9	4.8	6.3
0.301-0.10	8	9.4	8.6	4.3	11.6	8.2	6	7.7	6.8	2.8	2.4	2.5
0.401-HI	13.9	8	11.2	8.1	9.2	8.7	9.4	12.9	10.9	4.2	17.8	13.7
Total	100	100	100	100	100	100	100	100	100	100	100	100
Sample	251	224	475	211	251	462	265	194	459	142	332	474

Annex Table 3.1c: Distributions of Households by Ownership of Livestock by Type, Adoption Status and Region

	Oxen				Cows			Shoat				Donk			Boy							Pack		
Sample	0	1	2	3	0	1	2	0	1	2	3	0	1	2	0	1	2	3	4	5	6	0	1	2
Total																								
N																								
NAD	427	272	187	19	488	272	145	667	69	78	91	785	99	20	266	137	160	132	73	60	77	776	101	28
AD	246	342	345	84	382	403	230	648	111	106	150	689	244	80	115	154	164	196	141	78	187	635	254	128
Total	673	614	530	103	870	675	375	1315	180	184	241	1474	343	100	381	271	324	328	214	138	264	1409	355	156
%																								
NAD	47.18	306	20.66	2.10	53.92	306	162	73.70	7.62	8.62	106	86.84	10.95	2.21	29.39	15.14	17.68	14.59	87	6.63	8.51	85.75	11.16	39
AD	24.24	33.69	33.79	8.28	37.64	39.70	22.66	63.84	10.94	10.44	14.78	682	249	7.90	11.33	13.20	16.16	19.31	13.89	7.68	18.42	62.36	252	12.61
Total	35.50	31.98	27.60	5.36	45.31	35.16	19.53	68.49	9.38	9.58	12.55	76.89	17.89	5.22	19.84	14.11	16.88	178	11.15	7.19	13.75	73.39	18.49	8.13
Tigray																								
NAD	105	80	63	4	129	79	44	185	8	18	41	210	35	7	74	35	45	31	30	23	14	208	35	9
AD	49	76	95	8	88	90	50	149	9	8	62	137	72	19	33	25	37	46	39	14	34	132	71	25
Total	154	156	158	12	217	169	94	334	17	26	103	347	107	26	107	60	82	77	69	37	48	340	106	34
NAD	41.67	31.75	250	1.59	51.19	31.35	17.46	73.41	3.17	7.14	16.27	83.33	13.89	2.78	29.37	13.89	17.86	12.30	11.90	9.13	5.56	82.54	13.89	3.57
AD	21.49	33.33	41.67	3.51	38.60	39.47	21.93	65.35	3.95	3.51	27.19	609	31.58	8.33	14.47	10.96	16.23	20.18	17.11	6.14	14.91	57.89	31.14	10.96
Total	32.8	32.50	32.92	2.50	45.21	35.21	19.58	69.58	3.54	5.42	21.46	72.29	22.29	5.42	22.29	12.50	178	164	14.38	7.71	100	70.83	228	78
Amhara																								
NAD	113	71	41	1	166	52	8	168	13	21	24	189	28	8	84	52	45	22	14	3	6	187	29	10
AD	35	84	118	17	113	108	33	148	14	39	53	141	85	27	22	36	43	57	42	22	32	135	72	47
Total	148	155	159	18	279	160	41	316	27	60	77	330	113	35	106	88	88	79	56	25	38	322	101	57
NAD	500	31.42	18.14	0.44	73.45	231	3.54	74.34	5.75	9.29	10.62	840	12.44	3.56	37.17	231	19.91	9.73	6.19	1.33	2.65	82.74	12.83	4.42
AD	13.78	337	46.46	6.69	44.49	42.52	12.99	58.27	5.51	15.35	20.87	55.73	33.60	10.67	8.66	14.17	16.93	22.44	16.54	8.66	12.60	53.15	28.35	18.50
Total	30.83	32.29	33.13	3.75	58.13	33.33	8.54	65.83	5.63	12.50	164	694	23.64	7.32	228	18.33	18.33	16.46	11.67	5.21	7.92	678	214	11.88
Oromia																								
NAD	134	80	57	12	105	107	73	202	33	31	17	246	32	5	55	35	49	50	21	28	45	242	32	9
AD	40	56	75	26	51	63	83	123	31	28	15	141	36	20	13	21	22	27	23	20	71	124	43	30
Total	174	136	132	38	154	170	156	325	64	59	32	387	68	25	68	56	71	77	44	48	116	366	75	39
NAD	47.35	28.27	20.14	4.24	36.40	37.81	25.80	71.38	11.66	10.95	61	86.93	11.31	1.77	19.43	12.37	17.31	17.67	7.42	9.89	15.90	85.51	11.31	3.18
AD	20.30	28.43	387	13.20	25.89	31.98	42.13	62.44	15.74	14.21	7.61	71.57	18.27	10.15	6.60	10.66	11.17	13.71	11.68	10.15	364	62.94	21.83	15.23
Total	36.25	28.33	27.50	7.92	328	35.42	32.50	67.71	13.33	12.29	6.67	80.63	14.17	5.21	14.17	11.67	14.79	164	9.17	100	24.17	76.25	15.63	8.13
SNNPR																								
NAD	75	41	26	2	90	34	20	112	15	8	9	140	4		53	15	21	29	8	6	12	139	5	
AD	122	126	55	33	130	142	64	228	57	31	20	270	51	14	47	52	62	66	37	22	50	242	68	26
Total	197	167	81	35	220	176	84	340	72	39	29	410	55	14	100	67	83	95	45	28	62	381	73	26
NAD	528	28.47	186	1.39	62.50	23.61	13.89	77.78	10.42	5.56	6.25	97.22	2.78		36.81	10.42	14.58	20.14	5.56	4.17	8.33	96.53	3.47	
AD	36.31	37.50	16.37	9.82	38.69	42.26	195	67.86	16.96	9.23	5.95	80.60	15.22	4.18	13.99	15.48	18.45	19.64	111	6.55	14.88	722	20.24	7.74
Total	414	34.79	16.88	7.29	45.83	36.67	17.50	70.83	150	8.13	64	85.59	11.48	2.92	20.83	13.96	17.29	19.79	9.38	5.83	12.92	79.38	15.21	5.42

Annex Table 4.1 Average Distances [kms] of Households From Major Rural Development Service Centers by Zone and Region

	Develop. Agent		Home agent		Credit service		Input service		Demonstr. Farm		Research station	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Zone												
W. Tigray	4.4	155	5.9	81	13.9	172	15.6	165	5.5	38	7.7	8
E. Tigray	6.0	210	4.2	151	7.4	181	8.7	153	6.7	21	10.0	1
KAT	3.5	189	4.0	9	4.4	66	3.5	109	2.5	30	-	-
N. Omo	4.5	176	4.6	79	2.8	50	1.2	32	1.2	21	-	-
E. Welega	3.4	208	8.6	14	7.1	131	6.6	151	3.7	44	10.0	1
W. Hararg	3.7	166	7.0	3	5.2	46	5.3	63	2.2	12	0.6	2
E. Gojam	3.1	214	0.5	1	4.8	140	3.6	200	3.8	97	32.3	20
S. Wollo	3.1	181	4.7	32	10.1	81	4.0	124	5.7	83	6.9	5
Region												
Tigray	5.3	365	4.8	232	10.6	353	12.3	318	6.0	59	6.9	9
Amhara	3.1	395	4.6	33	6.8	221	3.7	324	4.3	180	27.2	25
Oromiya	3.6	374	8.2	17	6.5	177	6.2	214	3.4	56	0.7	3
SNNPR	3.7	365	4.4	88	3.7	116	3.0	141	2.0	51	-	-
Total	3.9	1499	4.8	370	7.8	867	6.9	997	4.7	346	20.1	37

Annex Table. 4.2 Extension Contact Between Farmers and Non-Government Development Agencies [%]

Regions/Zones	NAD	Sample	AD	Sample
Tigray	0.9	226	1.9	207
Amhara	2.2	178	1.6	184
Oromiya		250	2.3	177
SNNPR	1.3	78	6.5	217
W. Tigray		116	1	99
E. Tigray	1.8	110	2.8	108
KAT	20	5	7.3	179
N. Omo	--	73	2.6	38
E.Welega	--	102	1.8	109
W. Hararg	--	148	2.9	68
E. Gojam	3	33	0.7	140
S. Wollo	2.1	145	4.5	44
Total	1.0	732	3.2	785

Annex Table 4.3 Average Rate of Use of Major Inputs [kilograms per hectare] by Crop, Region and Zone and Type of Plot [fertilized and unfertilized]

Crops	Selected seeds			Local seeds			Chem. Fertilizer		Manure		
	Fer.	Unf	Tot	Fer.	Unf	Tot	Dap	Urea	Fer	Unf	Tot
A. Wheat											
Tigray	44 (10)	37 (36)	38 (46)	42 (68)	37 (30)	40 (98)	15 (62)	15 (61)	111 (34)	146 (10)	119 (44)
Amhara	104 (4)	51 (21)	60 (25)	40 (99)	48 (103)	44 (202)	37 (123)	35 (121)	605 (7)	6 (2)	472 (9)
Oromiya	5 (2)	46 (12)	40 (14)	33 (102)	49 (22)	36 (124)	52 (32)	47 (9)	73 (2)	101 (2)	87 (4)
SNNPR	60 (1)	59 (96)	59 (97)	18 (8)	43 (17)	35 (25)	29 (113)	21 (92)	–	134 (3)	134 (3)
Total	54 (17)	52 (165)	53(182)	38 (277)	46 (172)	41 (449)	31 (330)	26(280)	189 (43)	122 (17)	170 (60)
B. Maize											
Tigray	9 (3)	9 (10)	9 (13)	12 (115)	9 (42)	11 (157)	16 (48)	19 (48)	269 (70)	294 (17)	274 (87)
Amhara	–	9 (56)	9 (56)	9 (22)	11 (57)	10 (79)	30 (95)	28 (103)	144 (4)	79 (10)	97 (14)
Oromiya	5 (10)	10 (85)	10 (95)	10 (151)	15 (16)	10 (167)	40 (96)	72 (78)	271 (24)	167 (3)	259 (27)
SNNPR	14 (5)	17 (45)	17 (50)	13 (101)	25 (48)	17 (149)	96 (82)	61 (39)	114 (8)	94 (5)	106 (13)
Total	8 (18)	11(196)	11(214)	11 (389)	15 (163)	12 (552)	48 (321)	44(260)	253 (106)	193 (35)	238 (141)
C. Teff											
Tigray	20 (5)	17 (10)	18 (15)	15 (138)	13 (61)	15 (199)	20 (72)	22 (72)	94 (23)	58 (6)	86 (29)
Amhara	177 (3)	18 (24)	35 (27)	14 (147)	34 (173)	25 (320)	57 (198)	34 (170)	221 (6)	2 (2)	166 (8)
Oromiya	64 (10)	26 (2)	57 (12)	44 (204)	46 (68)	44 (272)	52 (74)	28 (6)	51 (3)	—	51 (3)
SNNPR	–	9 (4)	9 (4)	7 (21)	25 (95)	22 (116)	42 (98)	41 (21)	–	–	—
Total	70 (18)	17 (40)	34 (58)	26 (510)	31 (397)	28 (907)	47 (442)	31 (269)	114 (32)	44 (8)	100 (40)
D. Sorghum											
Tigray	13 (4)	1 (1)	11 (5)	19 (97)	15 (25)	18 (122)	24 (31)	21 (31)	187 (10)	200 (6)	192 (16)
Amhara	0 (1)	20 (1)	10 (2)	5 (78)	33 (2)	6 (80)	27 (3)	21 (2)	196 (7)	–	196 (7)
Oromiya	7 (5)	5 (1)	7 (6)	7 (180)	7 (7)	7 (187)	21 (5)	22 (2)	440 (23)	200 (1)	430 (24)
SNNPR	2 (3)		2 (3)	4 (89)	5 (1)	4 (90)	–	—	600 (1)	—	600 (1)
Total	7 (13)	9 (3)	8 (16)	9 (444)	14 (35)	9 (479)	23 (39)	21 (35)	340 (41)	200 (7)	320 (48)
E. Barley											
Tigray	48 (5)	28 (2)	42 (7)	47 (93)	36 (27)	44 (120)	13(2)	13 (27)	79 (39)	63 (4)	77 (43)
Amhara	313 (4)	33 (2)	220 (6)	32 (47)	48 (66)	41 (113)	19(62)	17 (53)	733 (3)	143 (4)	396 (7)
Oromiya	69 (3)	—	69 (3)	48(143)	100 (1)	48 (144)	30 (1)	—	140 (3)	—	140 (3)
SNNPR	1 (1)	40 (9)	36 (10)	6 (30)	34 (11)	14 (41)	12 (15)	10 (10)	2 (4)	100 (1)	21 (5)
Total	131(13)	37 (13)	84 (26)	41(313)	44(105)	42 (418)	17(106)	15 (90)	116 (49)	103 (9)	114 (58)

Annex Table 4.4 Average Land Under Crops by Fertilizer Application Status, Crop, Region and Zone (hectares)

A. Regions	Wheat			Maize			Teff			Sorghum			Barley			Other			Total		
	Unft	Fert	Tot	Unft	Fert	Tot	Unft	Fert	Tot	Unft	Fert	Tot	Unf	Fert	Tot	Unf	Fert	Tot	Unf	Fert	Tot
Tigray	.6480	.3259	.5153	.3504	.4735	.3862	.3819	.4063	.3895	2717	.3856	1.7517	.3120	.3527	.3214	.4049	.3877	.4005	.7578	.5046	.6708
Amhara	.4148	.9818	.7093	.2644	.3695	.3481	.4017	.5644	.4911	.4402	.2500	.4342	1.2511	.2823	.7276	.4036	.2995	.3983	.9738	3.1990	1.8771
Oromiya	.3802	.4297	.3912	.2909	.4342	.3439	.5950	.7314	.6282	.3333	.2143	.3286	.3755	.2500	.3746	.4830	.2083	.4784	.9561	.6098	.8565
SNNPR	.4423	.6000	.5853	.5798	1.2643	.8618	.4368	.9070	.8197	.3891	.7500	.3928	.5120	.1792	.4047	.5701	.2379	.4909	.9589	19.905	1049
Zones																					
W. Tigray	.8750	.5000	.8214	.3670	.3286	.3572	.4813	.4430	.4664	2.3320	.4224	2192	.4167		.4167	.4319	.4317	.4319	.9019	.6370	.8196
E. Tigray	.6312	.3230	.5001	.1977	.9323	.5650	.2435	.2452	.2438	.2679	.2857	.2738	.3085	3527	.3190	.3297	.2589	.3120	.5558	.3708	.4847
KAT	.5625	.6000	.5988	.2750	.3227	.3087	.3542	.4316	.4279	.3624	--	.3624	.2500	.1792	.1826	.2546	.2251	.2388	.4597	26.825	17.655
N. Omo	.3889	–	.3889	.6021	1.5504	.9489	.4476	1.4352	1.1402	.6160	.7500	.6282	.5184	--	.5184	.6825	.6600	.6823	1.2293	2.6045	1.6265
E. Welega	.4025	.5227	.4156	.3493	.4959	.4130	.7305	.7314	.7307	.4479	--	.4479	.4085	.2500	.4072	.5397	.2500	.5376	1.3859	.7619	1.1717
W. Hararg	.2893	.3810	.3341	.2398	.3368	.2688	.2091	–	.2091	.3237	.2143	.3190	.2183	--	.2183	.2867	.1875	.2819	.4857	.2918	.4440
E. Gojam	.4352	.3590	.3903	.2578	.3695	.3543	.3953	.5703	.5372	.4167	.2500	.3333	.3939	.2823	.3259	.4153	.3036	.4086	1.2779	3.8908	2.7170
S. Wollo	.3974	1.9639	1819	.2750	–	.2750	.4035	.5415	.4372	.4410	–	.4410	3.8839	--	3.8839	.3869	.2900	.3833	.7462	.9056	.7807
Total	.4647	.6819	.5761	.3971	.6633	.5124	.4749	.6523	.5539	.7789	.3520	.7476	.5235	.2812	.4613	.4715	.3024	.4452	.9101	7.3581	3.3513

Figures in parenthesis refer to the number of sample farmer households.

Figures in parenthesis refer to the number of cases and totals are weighted averages

Fer = Fertilized Unf = Unfertilized

Annex Table 4.5 Distribution of Value of Fertilizer Input by Region

	Value of Fertilizer									
	1-100 Birr		101-200 Birr		201-300 Birr		301 and Above Birr		Total	
Region	N	%	N	%	N	%	N	%	N	%
Tigray	84	48.5	52	30.1	31	17.9	6	3.5	173	100.00
Amhara	21	8.5	54	21.9	68	27.6	103	41.9	246	100.00
Oromiya	50	30.1	54	32.5	23	13.9	39	23.5	166	100.00
SNNPR	122	39.9	92	30.1	29	9.5	63	20.6	306	100.00
Total	277	31.1	252	28.3	151	17.0	211	23.7	891	100.00

Annex Table 4.6 Distribution of Value of Improved Seeds by Regions

	Categorized Values of Seeds									
	1-100 Birr		101-200 Birr		201-300 Birr		301 and Above Birr		Total	
Region	N	%	N	%	N	%	N	%	N	Percentage
Tigray	22	66.7	9	27.3	2	6.1	-	0. 0	33	100. 0
Amhara	61	82.4	9	12.12	3	4.0	1	1.4	74	100.0
Oromiya	59	86.8	7	10.3	2	3.0	-	0.0	68	100.0
SNNPR	141	81.5	19	11.0	9	5.2	4	2.3	173	100.0
Total	283	81.3	44	12.6	16	4.6	5	1.44	348	100.0

Annex Table 5.1 Number of Farmers who Took Loan to Buy Input

	Yes		No		Total	
	N	%	N	%	N	%
Tigrai	19	25.3	56	74.7	75	100
Amhara	82	77.3	24	22.7	106	100
Ormia	93	84.5	17	15.5	110	100
SNNPR	35	18.6	153	82.4	188	100

Annex Table 5.2 Steps Taken for Non-payment of Loan

	Yes		No		Total	
	N	%	N	%	N	%
Tigrai	35	24.6	107	75.4	142	100
Amhara	59	32.7	121	67.3	180	100
Ormia	28	30.8	63	69.1	91	100
SNNPR	24	23.8	77	76.2	101	100
Total	146	28.4	368	71.6	514	100

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