INDIRA GANDHI NATIONAL OPEN UNIVERSITY

SCHOOL OF GRADUATE STUDIES

STUDY ON FACTORS AFFECTING AGRICULTURAL EXTENSION FOR AGRICULTURAL TECHNOLOGY DISSEMINATION AND ADOPTION IN BACHO DISTRICT, OROMIA REGIONAL STATE OF ETHIOPIA

THE CASE IN MICRO IRRIGATION TECHNOLOGIES

MA. Thesis Research Report

By

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Declaration

I hereby declare that the Dissertation entitled STUDY ON FCTORS AFFECTING AGRICULTURAL EXTENSION FOR AGRICULTURAL TECHNOLOGY DISSEMINATION AND ADOPTION IN BACHO DISTRICT, OROMIA REGIONAL STATE OF ETHIOPIA, THE CASE IN MICRO IRRIGATION TECHNOLOGIES submitted by me for the partial fulfillment of the M.A. in Rural Development to Indira Gandhi National University, (IGNOU) New Delhi is my own original work and has not been submitted earlier either to IGNOU or to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated in this report from any earlier work done by me or others.

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Chapter 1

1. Introduction

1.1. Agricultural Extension Approaches

In some African countries, even in a situation where there is a wide range of agro climatic zones with extensive water resources; there is limitation in exploitation for sustainable agricultural development. This is principally because of the poorly developed agricultural system, which is still traditional and very limited use of technologies (Arokoye, 1996).

Agricultural Extension has different modalities for the last 50 years according to most publications. There are no universally accepted approaches and modalities. Some of the modalities during different periods of years are; to help rural families help themselves by applying science to the daily routines of farming (1949^{th}); system of out-of-school education for rural people (1965^{th}); a service or system, which assist farm people through educational procedures, in improving farming methods to increase production efficiency (1973^{th}). It is assistance to farmers to help them identify, analyses their production problems, and become aware of the opportunities for improvement (1982^{th}); it is professional communication intervention developed by an institution to induce change in voluntary behavior with a presumed public utility (1988^{th}). It is an organized exchange of information and the purposive transfer of skills and facilitates interplay

and nurture synergies within a total information system involving agricultural research, agricultural education and a vast complex of information providing businesses (1999th). More recently, it is a series of embedded communicative intervention that to develop or induce innovations, which supposedly help to resolve problematic situations (2004th) *(www.en.wikipedia.org/wiki/agricultural...).*

Facilitation is to describe any activity, which makes tasks for other easy. A person who takes on such a role is a facilitator. Hence, facilitators are those individuals who arrange for efficient adoptions.

"African farmers would be quite willing and technically able to carry out the revolution required in agriculture through technologies, provided that they are seen in a different light and finally taken for what they are. They are not children who must be constantly pressured to change their ways, but responsible adults with a wealth of their own experience, who ask that the new methods suggested to them demonstrably appropriate" (Belloncle, 1989).

Ethiopia, like most developing countries in Africa is Agricultural. Agriculture is the dominating economic sector that accommodates 85% of

labor forces and sustain livelihood of the majority. It has wide range of agro ecology that suites diversified productivity, and potential of water resources that enable multiple production per a year from the same plot of land than looking for natural rainfall, provided that efficient adoption of agricultural technologies like micro irrigation technologies. To make sure this, there should be an organized and effective agricultural extension that can address and well manage its own efficiency factors. Hence, different extension factors were hypothesized and tested for their significance after indicative information were collected from representative sample of population.

1.2. Agricultural Technology Dissemination and Adoption

Technology is the making, usage and knowledge of tools to solve a problem or perform a specific function. The word comes from Greek word, which means “Techne” meaning art, skill and craft and “Logia” meaning study. Technology significantly affects human as well as other animal species’ ability to control and adapt to their environment. For human and farm communities, this is possible by teaching using effective extension approaches or agricultural extension.

Agricultural technologies especially micro Irrigation Technologies together with other components are very important to increase productivity per

limited land resources. This increment in productivity can realizes agricultural development lead industrialization that Ethiopia is chasing currently. Micro Irrigation Technologies are technologies, which can be utilized by smallholder households. Majority of Ethiopian rural communities are smallholder farmers. Hence, there is no potential alternative than increasing productivity across those rural majorities to transform agriculture. This is possible through utilization of appropriate agricultural technologies like micro Irrigation technologies.

Some organizations like SG2000 and International Development Enterprise (iDE Ethiopia), started promotion of micro irrigation technologies for dissemination and adoption across farmers. At this study area, Becho district, those two organizations, disseminated about 1000 micro irrigation technologies starting from 2006 to present (2012).

The two organizations followed different modalities and extension approaches for promotion of the technologies. SG2000 promotes through government or district level office of agriculture and rural development partners by subsidizing focal person assigned for the purpose. They subsidized farmers for the technology and even half payment was functioned as back payment.

iDE Ethiopia uses different approaches from SG2000 to promote and facilitate adoption of the technologies in such a way that, no free hand out, credit facilitation for needy households, establishment of manufacturer and technology client linkage, technical training for technology owners and focusing at driving benefit from the technology at household level than simple technology distribution.

1.3. Statement of the Problem

Resistance was common across rural smallholder households to adopt Micro Irrigation Technologies despite of longer effort by extension workers in teaching advantages of the technologies. With an increasing in population, it is not possible to add even parcel of land to increase productivity and insure food security in developing countries like Ethiopia. Nevertheless, probably the only possible means to increase productivity is using agricultural technologies. However, there is high micro irrigation technology adoption resistance in different parts of the region including at Bacho District, South-west Showa Zone of Oromia Regional state, Ethiopia. Unless the technology adoption resistance could broken at rural communities and rural farm households intensively use micro irrigation technologies and produce multiple production per a year; it is difficult to attain food security. Agricultural extension is the means by which rural farm communities are advised to use agricultural technologies and transform agriculture from subsistence to commercialization. Hence, there found important, to point out

Agricultural Extension factors that contributed to agricultural technology adoption resistance.

1.4. Objectives

The objective of this study is to identify important factors affecting extension approaches for micro irrigation technologies dissemination and adoption in central Ethiopia and recommend promising approaches that can hasten the technology dissemination and adoption across rural farmers.

Chapter 2

2. Review of Literature

2.1. Trends of Agricultural Extension in Ethiopia

According to Belay (2003); agricultural extension focusing Agricultural technology adoption started in 1950 following the establishment of the Imperial Ethiopian College of Agriculture and Mechanical Arts (IECAMA, now Haramaya University) with the assistance of the United States of America. The academic program of the College was modeled on the Land Grant College system with three fundamental but related responsibilities; training high level manpower; promoting agricultural research and disseminating appropriate technologies. 'The role played by the IECAMA in developing the agricultural extension system is considerable. In fact, when the College was founded it was given the mandate to develop and deliver a national program in agricultural extension. To this end, in October 1954, it employed two Ethiopians who had graduated from Ambo Agricultural School. During that, the responsibility for agricultural development in Ethiopia was vested in the Ministry of Commerce, Industry and Agriculture.

According to Huffnagel, (1961), coated in Belay, (2003), from the beginning; extension service efforts were made to obtain men who had, at least, a basic knowledge of Ethiopia's agriculture. An eighth grade education was the minimum requirement for the first selected groups of agents and trainees.

The major extension activities were concentrated in areas where the college had experimental stations. These included the main campus at Alemaya, the central experiment station at Debre Zeit and the Jimma Agricultural and Technical School.

By 1963, seventy seven extension posts had been established with a total of 132 nationals servicing the various areas. These agents were actively engaged in demonstrating and helping farmers use new techniques in tools and machinery, insect and disease control and improved practices in the production of livestock and crops; paying regular visits to individual farmers; organizing meetings and field days and encouraging the formation of agricultural youth clubs. In August 1963, the imperial government transferred the mandate for agricultural extension from the College to the Ministry of Agriculture, with the suggestion that the IECAMA concentrate its outreach efforts to help farmers in the vicinity of the College. Since this time the Ministry of Agriculture has been responsible for national extension activities.

Up until the middle of the 1960, policy makers paid little attention to the development of peasant agriculture. For instance, during the First Five- Year (1957-1961) and the Second Five-Year (1963-1967) development plans, despite its importance to the national economy, agriculture received only 13.7 per cent and 21.3 per cent of the total investment, respectively. Even

worse, almost all the investment allotted to the agricultural sector was channeled to the expansion of large-scale commercial farms engaged in the production of cash crops for export and raw materials for local industries.

Following the increased realization of the continued stagnation of agriculture and pressure from international aid donors, it was only in its Third Five-Year development plan (1968-1973) that the government gave formal recognition to the peasant sector and made attempts to modernize it. However, considering the fact that the countries trained manpower, material and financial resources were insufficient to modernize peasant agriculture in all areas of the country simultaneously; the government opted for the comprehensive package approach. This involved the removal of barriers to production by concentrating efforts in a strategic way.

In Ethiopian context, the comprehensive package approach involved the coordinated application of different but fundamentally related strategies, such as improving the existing infrastructure, dispensing better and well organized social service and providing effective transportation, marketing and credit services, as well as popularizing appropriate, well-tested and locally-adapted improved agricultural technologies. The rationale for the comprehensive package approach was that progress made in selected sites would have multiplier effects on the surrounding areas by way of demonstration and as a result of social interaction.

The first comprehensive package project, the Chillalo Agricultural Development Unit (CADU) was established as an autonomous entity in the Arsi region south of Addis Ababa in September 1967 and was financially backed by the Swedish International Development Authority (SIDA). CADU aimed at a general socioeconomic development. Towards this end it integrated planning, credit and marketing facilities, price stabilization, and mechanization, research into inputs and intermediate technologies and training local project employees.

The method CADU adopted in reaching the peasants was basically that of demonstration. The project region was divided into extension areas where agricultural extension agents and model farmers demonstrated the effects of new agricultural techniques. The extension agents cultivated demonstration plots. The model farmers, selected by the peasants in the neighborhood, were provided with fertilizers, improved seeds and improved farm implements and were instructed by the agents. Field days were held frequently on the agents' demonstration plots and on fields of the model farmers so that the rest of the peasants could then compare the yield from their own traditional methods with the yield resulting from the new techniques applied by the project.

Based on the experience gained from CADU, in the following years, other autonomous comprehensive package projects with varying objectives and approaches were initiated with the financial assistance obtained from

different countries. These included the Welamo Agricultural Development Unit; the Ada District Development Project; the Tach Adiatlq and Hedekti Agricultural Development Unit in the northwest of Tigray; the Southern Region Agricultural Development Project in the vicinity of Hawassa town; and the Humera Agricultural Development. However, it was only CADU that was fully operational until it was phased out in1986. It was soon realized that the comprehensive package projects failed to serve the very people for whom they were intended. Most importantly, the principal beneficiaries were landlords and commercial farmers who reaped almost all the services rendered. In evaluating the experience from CADU, Schulz (1981), underlined the fact that the distribution of CADU loans between tenants and landowners has always been biased in favor of owners and so, proportionately, there have been roughly only half as many tenants on the credit list as there are in the target population. Other authors have shown that, by encouraging the process of mechanization in larger commercial farms, the package projects accelerated the eviction of tenants

It also became apparent that the comprehensive package projects were too expensive, both financially and in terms of trained manpower requirements, to warrant replication in other areas of the country as a result, in 1971 the government, in co-operation with SIDA designed an alternative strategy envisaged to be compatible with the availability of resources called the Minimum Package Project I (MPP-I). MPP-I was prepared for the 1971-

1974 period and was designed to provide small-scale farmers with services considered to be the minimum essential elements for agricultural development (Mengisteab, 1990). It is then that small holder farmers are best considered for technology adoption to transform Ethiopian agriculture.

These included provision of agricultural credit, marketing and extension advice, including the dissemination of innovations such as fertilizers and high yielding hybrid seeds.

It was also in 1971 that the government established the Extension and Project Implementation Department (EPID) in the Ministry of Agriculture. EPID was commissioned to administer the minimum package projects and supervise the activities of comprehensive package projects. The MPP-I was supposed to reach a large number of farmers by making use of the technologies generated and tested by the comprehensive package projects. As to its method of technology transfer, it employed an individual farmer extension approach, where both model farmers and extension agents demonstrated the importance of improved techniques of production. An extension agent under MPP-I was expected to cover an extension area of about 10 to 15 km along an all-weather road and about 3 to 5 km (but sometimes up to 10 km) on both sides of the road un like today, that is covered by three extension agents just to give effective services to farmers.

Each extension area had a marketing center and a crop demonstration plot and agents sold fertilizer and seeds on credit. Five extension areas constitute a full-fledged MPP area. Each MPP area, which extends over 75 km, was designed to serve about 10,000 farm families. Though EPID was able to provide agricultural services in 280 of the 580 districts and some improvements were made in terms of the adoption of improved inputs, MPP-I failed to have a significant impact on the agricultural sector because the government was reluctant to put in place the necessary reform measures in the areas of land tenure, tenant landlord relationships and the organizational and administrative systems of the different institutions entrusted with agricultural development of the country (Harbeson, 1990).

For instance, the quality and extent of research work aimed at developing technological packages adapted to the different ecological zones of the country fell below expectations still today and this is why this study needed and conducted. Moreover, as extension activities were concentrated in areas where mixed farming system prevails; MPP-I made a very marginal contribution to those farmers in the lowland areas engaged in animal production. In the case of comprehensive package projects, the principal beneficiaries of the MPP-I were wealthy farmers who had access to modem inputs. Hence, this study focused and analyzed economic base extension approach to communities.

Under the military regime

Following the 1974 revolution, the new military regime enforced land reform dated March 1975. The land reform proclamation banned the private ownership of rural lands and declared that land would be distributed to the tillers without compensation to farmer owners. It also limited the size of land to be allotted to any single family that is to a maximum of 10 hectares. Moreover, it prohibited the transfer of land by sale, exchange, succession, mortgage, lease or other means. The proclamation contains provisions for the establishment of peasant associations, the basic instrument for implementing the land reform.

The Peasant association is a territorial organization encompassing 800 hectares or more. The average Peasant Association membership is 250-270 families (households).

It was planned that, at the end of the MPP-I period, MPP-II would be undertaken over the 1975/6-1979/80period. This was done to efficiently deliver agricultural extension and transform agriculture besides its strong aim to collect government tax and enforcement of administrative strategies.

However, because of the political instability and major structural changes in the rural areas, including the formation of peasant associations and producers' cooperatives as well as the implementation of the land reform, it

was not possible to carry out this plan. There was not much organized and coordinated extension work in the country, therefore, until the beginning of the 1980s and it was only in 1981 that MPP-II was started. MPP-II had the same objectives as MPP-I. However, MPP-II was envisaged to cover 440 of the total 580 districts and reach as many farmers as possible. One major difference between the two was the channel employed in the transfer of technology. Under MPP-II the peasant associations and co-operatives were used as the focal points through which improved inputs, techniques of production and advice were channeled to the member farmers.

As EPID was dissolved following the reorganization of the Ministry of Agriculture in 1979, the extension service, formerly less than one umbrella, was split up and its activities were taken over by the line departments of the Ministry. The principal extension activities carried out by different departments of the Ministry during MPP-II were in soil and water conservation, crop production and protection, livestock and fisheries and forestry. Given the fact that the extension services had been disintegrated, different extension agents representing the interest of the different departments could approach one and the same farmer, leading to the duplication of efforts and at times misuse of the limited available resources (Tesfai, 1975) Cited in Belay, (2003).

MPP-II was assisted by the World Bank, the International Fund for Agricultural Development (IFAD) and, to a small extent, by SIDA. During its implementation (1981-1985), the MPP-ll did not attain its stated objectives because the very limited number of extension agents available in the country was made to cover as wide an area as possible without adequate facilities and logistical support.

The same agents were overloaded with different assignments, such as collecting taxes, promoting producers' co-operatives, collecting loan repayments and mobilizing labor and resources on the part of public authorities, which were, at times, not in their domain of responsibility (Task Force on Agricultural Extension 1994).

The poor research-extension linkage was another factor responsible for the ordinary performance of the extension service of MPP- II. Most importantly, the country did not have the capacity and resources to develop innovations suitable to its socially and ecologically varied regions. Moreover, as compared to the MPP-I, in the course of implementing MPP- II the Ministry was compelled to work under a very limited budget.

The MPP-II was phased out in 1985 and replaced by another strategy called the Peasant Agriculture Development Extension Program (PADEP). PADEP was designed to bring perceptible changes in peasant agriculture through

concerted and coordinated efforts in the areas of agricultural research and extension. The strategy was based on a critical evaluation of past extension strategies and underscored the importance of stratifying the country into relatively homogeneous zones, decentralizing the planning and execution of agricultural development activities and empowering and giving considerable attention to zones which were to be the centers of development efforts. Accordingly, on the basis of resemblances in climatic conditions, cropping patterns, natural resource endowments and geographical proximity, the country was divided into eight agricultural development zones. The program had different objectives for the different agricultural development zones. However, the principal ones were: increasing food production at least to the level of self-sufficiency; developing the production of cash crops for export and raw materials for domestic industries; increasing rural sector employment opportunities; supporting and encouraging the development of rural co-operatives; preventing further soil depletion and introducing suitable farming system in erosion prone areas of the country.

It was initially planned to concentrate the program on high potential areas so as. To raise their production and productivity by channeling the limited resources and extension services towards them. To this end, 148 surplus-producing districts were selected out of the total 580. PADEP employed a modified Training and Visit (T & V) extension system. In the selected districts an extension agent was assigned to serve 1300 peasant households

through contact farmers organized into groups (the conventional T & V system recommends one extension agent for 800 farmers) and 2500 farmers in all other areas (non-surplus producing areas). Moreover, extension agents were trained monthly instead of fortnightly and zonal subject matter specialists were trained quarterly instead of monthly, as proposed by the conventional T &V system. In each district there was one extension co-coordinator for 10 extension agents and the co-coordinator visited the agents once a week. Each extension agent worked with 48 contact farmers. The agent made regular visits of four days a week and on each day six contact farmers, who had each 26 follower farmers, were visited for a period of 30 minutes each. Each contact farmer was therefore visited twice a month.

As the poor research-extension linkage was considered to be an essential factor affecting the efficiency of extension work, Research Extension Liaison Committees were formed in 1986 both at the national and zonal levels. The committees were established to serve as a formal linking mechanism between research and extension and were mandated to review and approve research proposals submitted by research institutes.

They were also to serve as a forum where the views of extension workers were taken into account in identifying research problems for the formulation of research topics.

This was thought to help ensure that both researchers and development agents address the real problems that farmers face. However, the committees did not live long enough to be of practical use for two reasons. On one hand, some of the newly-created agricultural zones had no research stations and, on the other, the committees had no budget and were not backed up by the public authorities concerned.

The activities of the committees were interrupted in 1991 because of the change in government, which resulted in the dissolution of the zonal agricultural offices and the transfer of their roles to the new Regional Bureau of Agriculture.

Like many of its predecessors, PADEP was designed as a foreign aided project (the principal donors for the PADEP were the European Economic Commission, IFAD, Italy, African Development Bank, Sweden and the World Bank). Consequently, its implementation had to be postponed pending the government's compliance with the conditions laid down by donor organizations. More specifically, donor countries and organizations had been pressing the government to abandon its agricultural policy, which was biased in favor of state and collective farms, to liberalize agricultural marketing and to give considerable emphasis to small-scale farmers.

Even then, only six out of the eight PADEP programs secured funding from both donors and government and were in operation. Even in areas where extension activities were undertaken it was not possible to bring together farmers and extension workers. Extension messages were not entirely devoid of political objectives and agents were seen by the farmers as government spokesmen rather than development workers.

On all counts the extension approach was defective, not only because it was not participatory, but also because of its inflexible and top-down nature. The principal factor responsible for the inefficiency of extension work during 1975-1991 was the government's agricultural policy, which favored the development of state and collective farms. Although the 1975 radical land reform put an end to the tumultuous tenant-landlord relationships, the collectivization and village formation policies pursued by the Marxist government and its commitment to increasing public ownership contributed greatly to the low performance of the agricultural sector in the 1980s.

A number of empirical studies on the Marxist government Agricultural development strategy concluded that the state and collective farms, which accounted for less than 10 per cent of the total cultivated area, received the lion's share of subsidized agricultural inputs (agricultural credit, fertilizers, improved seeds and so on), extension services, farmers' training and the government's investment in agriculture, to the detriment of the private farms,

which accounted for more than 90 per cent of the total agricultural production. Paradoxically, state and collective farms have proved disappointing in terms of productivity, employment creation and environmental protection (Mengisteab, 1990). In general, in the 1980s extension activities were obstructed by the government's selective agricultural policy and the non-surplus producing regions had not received enough attention.

The current situation following the change in government in 1991, the T & V extension approach was adopted as a national extension system with major government financing until its replacement by the Participatory 4 with the change in government in 1991, the country was divided into nine administrative regions, a federal capital (Addis Ababa) and one special administrative division (Dire Dawa). At present, extension activities are the entire responsibility of regional agricultural bureau. The extension division of the federal Ministry of Agriculture has the task of coordinating inter-regional extension work, providing policy advice on nationwide agricultural extension issues, advising regional bureau of agriculture in the area of extension management and administration, developing extension training materials and organizing training programs in agricultural extension for regional extension personnel. The regions are given full autonomy in the planning, execution, monitoring and evaluation of extension programs.

Demonstration and Training Extension System in 1995 the latter was adopted from the SaSakawa Global 2000 (SG 2000) extension strategy, initiated in Ethiopia in 1993 by the SaSakawa Africa Association and Global 2000 of the Carter Centre. The extension agents play a facilitating role in the management of the plots. The agents also use the EMTPs to train both participating and neighboring farmers so that they can put into practice the entire package of recommended practices. The size of each EMTP is usually half a hectare and adjacent farmers can pool their plots to form an EMTP if they cannot meet the half-hectare requirement individually.

The SG 2000 extension activities started by assessing available agricultura1 technologies in the country with the support of the national research and extension on the basis of the availability of improved varieties and recommendations of the research and extension experts, in 1993 technology packages for maize and wheat production were defined and demonstrated to 160 farmers residing in seven districts of the Oromia National Regional State and the Southern Nations, Nationalities and Peoples Regional State. In 1994 the SG 2000 extension program expanded its extension activities both in terms of area coverage and technology packages. More specifically and sorghum technology packages were included in the program, the number of participating farmers rose to 1600 and the program was expanded to some districts of the Amhara National Regional State and the Tigray National

Regional State. However, possible to say still know; our rural communities are lagging behind to accept improved technologies.

In 1995 good weather conditions, coupled with the material and technical support that participating farmers received from SG 2000, resulted in substantial yield increments be impressive yield increments obtained by- the participating farmers persuaded the Ethiopian government that self-sufficiency in food production could be achieved by adopting the SG 2000 extension approach. Consequently, in 1995 the government took the initiative to run the program on its own and launched the participatory demonstration and training extension system (PADETES), as the national agricultural extension system.

PADETES was developed after a critical evaluation of the past Extension approaches and the experience of SG 2000. Its major objectives include increasing production and productivity of small-scale farmers through research-generated information and technologies; empowering farmers to participate actively in the development process; increasing the level of food self-sufficiency; increasing the supply of industrial and export crops and ensuring the rehabilitation and conservation of the natural resource base of the country.

The system gives special consideration to the package approach to Agricultural development initially, PADEIF promoted cereal production According to government officials, an important element of the PADETES approach is the promotion of the active participation of rural communities in problem identification, analysis, planning, implementation and evaluation. Packages and the beneficiaries were mainly those farmers who live in high rainfall areas of the country. Over the years, however, the packages have been diversified to address the needs of farmers who live in different agro ecological zones of the country. Currently, PADETES promotes packages on cereals, livestock (dairy, fattening and poultry), high economic value crops (oil crops, pulses, vegetables and spices), and improved post-harvest technologies (handling, transport and storage), agro-forestry, soil and water conservation and beekeeping developed for different agro ecological zones (highland mixed farming system, highland-degraded and low moisture, lowland agro-pastoralist and lowland pastoralist zones). The major elements of the extension package are fertilizer, improved seeds, pesticides and better cultural practices mainly for cereal crops (teff, wheat, maize, barley, sorghum and millet). PADETES uses EMTPS and a technology transfer model which, in principle, nurtures linkages between research, extension, and input and credit distribution. Under PADETES the major tasks of extension agents include organizing demonstration trials, assisting farmers in obtaining agricultural inputs and channeling farmers' problems to the relevant organizations, particularly to the district agricultural office. The

PADETES approach is meant to improve access to inputs by providing credit in kind. As farmers cannot borrow from banks due to collateral problems, extension credit is guaranteed by the regional governments and administered jointly by them and the two government banks (the Development Bank of Ethiopia and the Commercial Bank of Ethiopia). Loans are taken up by the regional governments and channeled into the district administration offices. Farmers participating in the new extension system, input supply and credit are dealt with in one transaction. The procedures involved in input loan disbursement are as follows. The regional government borrows directly from the banks and relies on its administrative machinery and peasant organizations to disburse and collect the loan. Farmers have to apply via the service cooperatives, which submit applications for credit to the district agricultural office. The district finance office is also involved. The service cooperative collects a 25 per cent down payment.

In PADETES then receive credit in kind, via the district agricultural and finance offices. Participants agree to allocate land for a demonstration plot and pay a 25 per cent down payment on the input package at the time of planting, with the balance due after harvest. The participants pay a 10.5 per cent interest rate on the input loan. In 1995- 1996 the Ethiopian government sponsored the establishment of about 36,000 half-hectare on-farm demonstrations. In the 1996-1997, 1997-1998 and 1998- I999 production years, the number of government-sponsored demonstration plots was

600,000, 2.9 million and 3.8 million; respectively (MOA 1997, 1998, 1999).The trend is for this number to keep growing. Likewise, the number of farmers participating in the new extension program increased from 35,000 in 1995- 1996 to 3.7 million in 1998-1999.

As to the number of extension personnel in the country, the author's discussion with a senior extension expert in the Ministry of Agriculture in September 2001 revealed that this is estimated at little more than 14,000. Most hold certificates and diplomas but lack adequate and appropriate technical and communication skills. This figure is too small, even by the standards of sub Saharan Africa, when viewed in relation to the number of farmers the extension personnel have to serve.

The best way to handstand poverty and tackle against is, to have long conversation with poor people in the place where they live, work, and dream, and to listen to what they have to say. This means talking to a farmer who lives on less than a dollar a day, and walking with them through their field (Polak, 2000). Appropriate extension is to make real, minds of rural communities has changed and influenced to technologically desired mode of production by using agricultural technologies. This is possible by being together and understands the real situation of rural communities.

Rural households have resources like land, labor and water. However, they are living centuries, generation after generation, earning below one dollar per day which is not enough even for subsistence in developing countries like Ethiopia. Professionals with different discipline lapsed their time since longer to change life of poor rural households from subsistence to commercial and sustainable agriculture. Here, it is the means, how those professionals try to address poverty problem and how rural resources are arranged at local level in order to be, converted to asset that made poverty persistent.

Rural resources namely land, labor and water better organized in a systematic manner to change life rural poor efficiently. This efficiency can be, obtained by utilizing agricultural technologies like micro irrigation technologies. Those technologies can create maximum return per effort of rural households that can generate more income and utilized for further asset creation.

Agricultural extension was, once known as the application of scientific research and new knowledge to agricultural practices through farmer's education. The field of extension now in composes a wider range of communication and learning activities organized for rural people by professionals from different discipline like agriculture, marketing, health and business studies. It is how to communicate, when to communicate, to whom

to communicate, and with what condition to communicate to rural people that affects our communication effectiveness that this study addressed after analyzing different extension factors.

Extension practitioners can be, found through the world, usually working for government agencies represented by several professional organizations. Those organizations are working towards changing livelihood of poor farmers any way. This can be possible if extension recipients or rural farmers are influenced to the desired direction by extension communication. This research addressed the extension communication factors that hinder and affect rural extension for micro irrigation technology, dissemination and adoption.

To improve agricultural efficiency, there should be an increase in utilization of agricultural technologies and increase number of innovative farmers who can utilize the technologies. Hence, there should be efficient agricultural extension given to rural farming communities for their efficient agricultural technology adoption and increase in productivity (Ethiopian Environmental Protection Authority, 2011).

Ethiopia has pursued a range of policies to boost agricultural production and productivity by utilizing improved agricultural technologies through proper extension services for small-scale resource poor farmers.

Extension services were, first introduced in 1950; since the 1980, Ethiopian extension system has followed a training and visit system that was, introduced under PADETES program. Over the last five decades, extension program has been traditionally financed and provided almost entirely by the public sector, representing almost two percent of agricultural GDP in recent year has increased the number of public extension staff almost three fold to nearly 47500 development agents in 2008, and in addition established Farmers Training Centers (FTC). However, real progress in terms of impact on productivity and poverty has mixed. Although many farmers seems to have adopted the packages promoted by the extension system, up to a third of the farmers who have tried a package have discontinued its use. The expected impact of DAs and FTCs remain unclear, to the near absence of any rigorous impact evaluation.

There was problem that, success of the extension services has been, traditionally measured in terms of numeric targets for physical input use, often at the cost of emphasizing the efficiency and profitability of inputs use. In addition, continued imposition of targets from above, and weak local capacity in extension management, have not yet permitted the emergence of a more dynamic system. It is this weak management system and extension limiting factors that this study addressed after analytically considered extension factors for agricultural technology adoption

2.2. MIT Adoption and Agricultural Extension in Ethiopia

Micro irrigation technologies are technologies that enable resource poor farmers use water resources efficiently for irrigation. It up lifts water form deep open well, river and ponds to make join gravity to meet crop soil water requirement by gravity that can be easily managed by household family members. Resource poor farmers are supposed to afford the price unlike motor pumps that are not affordable by resource poor farmers. These technologies are also supposed environmentally friendly and no fuel is used to operate, as the operation is mechanical. Hence, development partners who encourage efficient water resource utilization for irrigation to upgrade poor household's income; are supposed to promote the technologies.

For a country to maintain national food security over a longer term it is important that farmers individually or collectively know how to maintain and utilize their natural resources efficiently by using technologies; and to insure adoption of the technologies, there should be given appropriate agricultural extension services (Swanson, 2008).

According to World Bank, (2007), most production technologies are available and can be produced by innovative technology manufacturers. Research based technology manufacturing is not the end to attain food security; but utilization of the technologies for production and increase productivity. Hence as Agricultural extension is to teach farmers to adopt the

technologies, it is important to point out agricultural extension efficiency barriers.

Different organizations have been promoted micro irrigation technologies since 1995 and distributed significant amount of technologies. Among them, SaSakawa Global 2000, SIM Ethiopia and IDE Ethiopia are among the organizations besides Government effort to distribute and make farmers adopt the technologies.

As already described, micro irrigation technologies in this study material are technologies which are utilized by small holder farmers to utilize ground and river water resources to produce vegetable crop. Those micro irrigation technologies are relatively supposed as affordable to small holder farmers both technically and economically.

Those technologies are introduced to Ethiopia before 20 years; especially for rope and washer and pressurized Tridle pumps technologies. Government office of Agriculture and Rural Development as very doing since the year of 2005 and many non-government organizations are encouraged to disseminate the technologies to farm communities who can access water resources.

2.3. MITs and their Technical Characteristics

2.3.1. Rope and Washer Technology:

It is the type of micro Irrigation technologies that can be utilized at an individual household level on their open well, provided that the well has enough water column that is not less than two meter so that can be replaced after discharge of the water from the column. This can be, estimated by soil profile characterization while excavating the open well. If the well has four-meter aquifer through its profile below false water table, it is believed to replenish the discharged amount of water within the reasonable period which is one to two hours.

This technology can lift water from up to 30 meters water table with average discharge rate of 0.3-0.4 litter/second; for a period of nearly 45 minutes and period of recharge depends on the soil profiles' water bearing characteristics; which usually longs up to two hours at medium quality aquifer during peak period if frequently discharged. There found usual operation of 3-4 hours per day in Becho district at which this study has conducted.

From the above information, if one wants to find command area that can be cultivated by using this technology; fixing the discharge rate at 0.35 l/s; for three hours operation time per day for 90 days of vegetable total life span having effective stock of 747 mm; command area (CA) equals QT/ES where

Q=discharge rate (m^3/s), T=Time of discharge (s), ES=crop effective stock calculated from crop coefficient and physical factors (m). Hence, with the above realities; Rope and washer technology can irrigate command area of (CA) =QT/ES= ($0.00035m^3/s \times 972000s$) ÷$0.747m=455m^2$

With respect to its spare parts, rope and washer is composed of washers, PVC, guide box, stand having different components, nylon rope, outlet, tanker, reducer and T. Each spare parts has its own size depend on well depth; like washer and PVC size of 0.5, 0.75 and 1 inches that can be installed for well depth of up to 30 meter, 20 meter and 10 meters respectively.

2.3.2. Suction Only Triedle Pump

This type of micro irrigation technology is also a household technology that can lift underground water from up to 6-meter ground depth of vertical height. This technology is very important especially where there is low water table and soil collapse is a serious problem to utilize open wall for either irrigation or domestic purpose. The technology is, operated by pedaling system and can be operated by all nearly active age groups of labor force.

It can be installed in such a way that bore wall is excavated by manual wall drilling system using simple sludge method. After having enough soil aquifer which is usually 4-5 meters, there installed casing in the bore wall provided that the casing PVC is well screened at matching height of soil aquifer in order that, the screen directly follows the draw down curve of the aquifer, so that purified water can infiltrate in to the casing screen and lifted up.

The technology can discharge water of 0.7-1 litter/second for almost one hour even if there is frequent pedaling, and nearly 30 minutes needed to replenish the amount discharged. According to surveys with regard to operation hours per day, there found 6 hours possibility of operating per day that the study area communities are using and explained.

With regard to command area that can be irrigated using the technology, with similar crop effective stock for rope and washer type, which is 747 mm and 90 days vegetable life span; but 6 hours operation time per day at discharge rate of 0.8 litter per second; CA=QT/ES; which is (0.0008 m^3 x 6 x 90 x 3600s) ÷ 0.747m= 2082 m^2 of land where CA stands for command area, Q stands for discharge rate, T stands for time of operation per 90 days and ES stands for crop effective stock during the period of 90 days.

Spare components of the technology are PVC, Suction Head, Piston, Valve, Pin, Pedals, Road and Stands. Except industrial materials, pedals and stands are, made from local resources, which is wood. Some spare parts like piston are exposed to wear when there is silt and sand sucked up and discharged with water.

2.3.3. River Type Suction Only Tridle Pump

This type of pump is similar to suction pump except that it sucks water from open wall and river of up to 6 meters vertical height and the suction part is extended by flexible hose or PVC arranged by any required bends and elbows. Discharge rate of this technology is similar to that of suction Tridle pump and even a bet greater if installed on very shallow open wall or river, and less number of bends in order to reduce friction lose.

Generally, there are also other technologies like pressurized suction Tridle pumps, drip irrigation using water holding tanks or simple water holding equipments that can create pressure difference because of height and weight of water. As this research focused on existing micro irrigation technology adoption by reducing extension barriers and concentrating on proper modalities identified; this micro irrigation is better to be considered as transition to other higher capacity irrigation technologies.

2.4. Socio Economic profile of the study area

This analysis was done during field assessment and communication with communities of the study area to indicate economic and social relation of communities that was hypothesized to have contribution for MIT dissemination and adoption. When we mean social profile of the study area, it is to mean that how communities interact in their day to day activities across different social segments like age group, kinship and gender issues. This mode of interaction among communities has observed to have significant impact on micro irrigation dissemination and adaption.

The study area has communities with different social interaction like formal and informal once. Formal social interaction is to mean that interaction of communities through legalized and authorized institutions like Idir (traditional social administrative structure), Peasant Association registrar, Court registrar and any other formal institutions. Informal interaction is to mean, interaction of communities among themselves through their indigenous leadership modalities. Communities are discussing about their issues of personal and development while they meet and through this informal discussion they created strong trust among themselves that can divert any communication they did not trust. Hence communities at the study area are discussing their social issues including ways to improve their productivity and technologies they could use to improve their soil productivity.

Communities of the study area are organized informally in to women group, youth group adult male group and elders. Youth groups are organized at their village to utilize natural resources in a sustainable manner which is selling of mineral resources like sand and stone; through proper watershed management program to protect silt deposition that can greatly damage sand collection from perennial rivers. Women groups are organized in to self-help group and engaged in to business activities. They are saving some amount of money every month as per their agreement and manage the amount informally and even revolve their amount of money by lending to their members at reasonable interest rate. Promoting such segregated communities separately for agricultural technologies has been found very effective. Elders are also among the community social segments that are managing some social issues informally and give close consultation to other community segments whenever important.

Iddir is the most indigenous informal social institutions that govern communities of the study area, which they are utilizing for their every social purpose. It is members from the same Iddir, which come together first whenever something good or bad happen among community members. Leaders of Iddir are among community members who have legal validity whenever conditions happen to take community issues to administrative bodies of different level. Communities under the same Iddir are best managed together for their development issues, they all discuses about any

social issues openly, if demonstration is needed up on technologies to be adopted, it is the right place and event to storm up on technology issues.

If something socially undesirable happen among communities, it is through this social institution that the guilty is investigated and given to formal administrative bodies to take corrective measures. Hence this social institution has a great impact to advice communities for development activities and the study area has ten to fifteen social institutions (Idir) per each peasant association that in composed communities from different age group and wealth classes.

There are also economic strata of communities at the study area, which is poor, medium and rich. 16% of community's members of the study area are poor, which means community members who earn less than a dollar per day. Communities of different economic strata are found very interactive among themselves. There is relation between the poor and rich in such a way that rich community members lend their money to poor community members who have no capacity to access credit from formal credit institutions because of collateral to pay back the credit. Hence, they devote their wage labor force during pick agricultural season for what they borrowed from rich community members. This is a type of bonded labor that poor community members serve rich community members accordingly for what they borrowed during their critical need of money.

There are community infrastructures like road, telecommunication and electricity, primary and secondary schools. Regional road authority is actively doing to make communities join as per their respective peasant association. Hence, there is dry weather road that joins communities of each peasant association at an average distance of eight kilo meter. This road infrastructure is found very important in alleviating both social and economic problems of the study area. Road facilities and telecommunication by mobile telephone has been found very important in alleviating community social and economic problems by alleviating problems from information barriers. As per the assessment, 70% of the community members have access to information by telephone and 30% of them have radios to update themselves with existing government news and other relevant information.

Lively hood of community is mostly based on agriculture which includes crop production and animal rearing; hence the area is possible to say agro-pastorals. They are producing teff, wheat, horse bean and barley. However, majority of their farm land is occupied by Eragrostis teff and there is two production seasons called autumn (March, April and May) and the main production session called winter (June, July and August). During their production season, social institutions are playing important role and all community members are interdependent through their social institutions to fully join what the production season needs to come up with best productivity per their respective plot of land.

With regard to livestock, there are cows, donkey, horse, mule, sheep, hen and goat. Communities are very using their livestock resources as source of income to buy agricultural inputs during critical need. Especially, goats, sheep and hens are utilized to overcome problems of agricultural input costs and save selling of hoofed animals like cows, donkey, and mule which are relatively expensive to have them again after once sold. Those hoofed animals have also economic and social values in that, community members who have livestock unit can get credit access and considered as faithful to pay back his credit in time and can access group collateral.

Family labor is the main source of labor force; most community members have family members of four, who are economically active and participate on agricultural labor force. Students are much utilized for their free period to look after livestock, collection of grain products after field harvest to an area to thresh grain and teff. Girl students are also very engaged in assisting their mother in food preparation for agricultural labor forces, milking of cows, and care after children. This is a gender issue and there tried to explain the existing situations and even there are extension activities on gender mainstreaming; this sex based activity division is still accepted and utilized among community members.

Chapter 3

3. Methodology

3.1. Description of the study area

3.1.1. Boundaries and Location

This study was conducted in Bacho District, South-west Showa Zone of Oromia Regional state in Ethiopia by taking sample of five peasant associations, namely Awash-Bune, Jato, Wasarbi-Abati, Kata-Insilale and Batu-Chiracha out of nineteen peasant associations found in the district.

It is bordered by Kokir district on the south, Ilu district on the North, Kobo and Simbiro-chirach peasant association of the Becho district on the west, Dawo district on the North and wasarbi-gna Peasant association of the Bacho district on the Est. The capital city where the districts' administrative unit found is Tulubolo located at 8^{o}35N and 38^{o}15E, and 80 km south-west of Addis Ababa.

3.1.2. Agro Ecology

Agro ecology of the study area is mostly midland that accounts about 97% of the total coverage, which is very suitable for wheat, Teff, horse bean, pea, bean and other middle land crops. It receives 900-1100 mm annual rainfall and an average minimum and maximum temperature of 12 and 26 degree centigrade respectively. Its topographic arrangement is very plain which accounts about 90% of the total setting. Its soil type is mostly clay that

accounts 85%; red soil 10% and clay loam 5%. Vegetable is also growing in the district, which includes cabbage, tomato, paper, onion, shallot, garlic, potato, carrot and beetroot.

3.1.3. Demography

Based on figures obtained from Bacho district office of Agriculture and Rural Development (2002), the study area has total households of 3762 and has an estimated total population of 18825, of whom 9225 are male and 9600 are female.

3.2. Research Design

The research is based on analytical descriptive research. Hence, it compared different extension approach factors, which are supposed to have significant impact for successful extension activities during Micro Irrigation Technology promotion to farmers. Each supposed factors has been described qualitatively and quantitatively for their significant impact on agricultural extension efficiency. Hence there provided a clear insight about effects of every supposed factors. The following diagram shows the supposed factors arranged around and MIT adoption status at the center up on which performance of each factors validated.

Figure 1 Factors supposed to have significant impact for MIT adoption

Chi-square analysis from descriptive statistics was used to compare and validate significance of those supposed factors.

3.3. Sampling Technique

Sample households were taken using non-probability sampling of purposive type. The study area has **1423** households who can use micro irrigation

technologies if properly promoted and demonstrated about the technologies (International Development Enterprise Base line survey, 2008). Since the universe is those households who have got promotion for micro irrigation technologies to create income opportunities, **81** households out of **1423** which is **6%** (as most social studies use the percent) were taken using systematic sampling.

3.4. Tools for data collection

Both primary and secondary data were collected using different tools of data collection. Primary data was collected from representative sample, using questionnaire, interviews, rating scale and attitude scale by enumerators. Secondary data was collected from documents of different important sources like office of Agriculture and Rural development of Bacho District, Peasant Administration office and Bacho District Administration office.

3.5. Data analysis

Statistical analysis to measure significance of each factors were used and an inference made using inferential models like Chi-square using SPSS software. In this method, each factor was described; compared and contrasted with respect to its contribution for agricultural extension efficiency. Chi-Square has been used to estimate the likelihood that some factor other than chance accounts for the observed relationship with the desired output.

Chapter 4

4. Result and Discussion

Table 1 indicates that the Impact of facilitation on Agricultural Extension showed significant difference between an extension with facilitation and without facilitation for MIT promotion. As sample respondents favored and respond for extension with facilitation, it is more efficient than extension without facilitation for MIT distribution and adoption at household level. Hence, facilitation is a factor that affects agricultural extension for MIT distribution and adoption at household level.

The same table also indicates that there is significant difference between economic classes (poor medium and rich) of communities of the study area for MIT adoption. Communities with middle economic class more adopt MIT than communities at both poor and rich economic class. Hence, household economy is a factor that affects agricultural extension for MIT distribution and adoption at household level.

Table 1 also showed there is significance difference between model farmer extension approach and blanket advice at village level" during working extension for MIT dissemination and adoption. As significant number of respondents favored and respond for model farmer extension approach than blanket advice at village level, model farmer extension approach is efficient than blanket advice at village level. So that, the way one approach or

organize technology adopters for teaching about MIT is a factor that affect agricultural extension for MIT dissemination and adoption.

Table 1 Frequency, Chi-square and P value of variables

No	Variables	Frequency Observed	Frequency Expected	Chi-square value	P value	Significance
1	Impact of facilitation on Agricultural Extension				P<0.05	Significant
	Facilitation done	58	40.50			
	No facilitation done	23	40.50	15.123		
2	Impact of household economic status				P<0.05	Significant
	Poor	13	27			
	Medium	43	27			
	Rich	25	27	16.889		
3	Impact of model farmer extension approach				P<0.05	Significant
	Model farmer approach used	50	40.50			
	Blanket advice used	31	40.50	4.45		

According to Beaujean (2012); after testing and identifying significance of once hypothesized variables for their importance as a factor affecting occurrence of a desired output, it is possible to further investigate additional factors that could affect well being of a desired output.

Hence, being testing the hypothesis and identify significance of the hypothesized variables, there needed to see further variables for their significance as a factor affecting agricultural extension for MIT distribution and adoption at household level. So that, factors which were supposed to have significant impact on agricultural extension were tested for their

significance as a factor affecting agricultural extension using Chi-square as follows.

Table 2 Variable's Chi-square and P value with indicated significance level

No	Supposed Extension Factors	Variability considered and compared	Chi-square value	P value	Significance
1	Household sex	Male*female	42.975	<0.05	Significant
2	Marital status	Married*Single	22.827	<0.05	Significant
3	Consultation with family	Consulted*Not consulted	42.975	<0.05	Significant
4	Wife agreement for technology	Agree*Disagree	45.938	<0.05	Significant
5	Role of influential family member	High*Medium*Low	32.519	<0.05	Significant
6	Technical feasibility of MIT	Feasible*Not feasible	42.975	<0.05	Significant
7	Economic feasibility of MIT	Feasible*Not feasible	10.383	<0.05	Significant

From Table 2 above, hypothesised extension factors for MIT dissimination and adoption at household level were identified for their probablity value along with their respective Chi-squair values. Those varibles whose of there diffirence between compared in variblity was significant; because of having probablity value of <0.05; and were found as factors affecting agricultural extension for MIT distribution and adoption at household level were; household sex, marital status of technology adiopters, consultation with family, wife agreement to have MIT, role of influntial family member, technical and economic feasiblity of MIT. Because of their probablity value which is less than 0.05 at their respective chi-squaire value, there observed significant diffirence between cases of listed varibles. Hence, they are among

factors affecting agricultural extension for agricultural technology distribution and adoption at household level.

Here also discussed findings and approaches that were pointed out by earlier studies and recent findings to indicate how each factor (primarily hypothesized and additionally considered one) is working properly and synchronized with one another, so that agricultural extension approach could better capitalized for agricultural technology promotion, distribution and adoption at household level.

4.1. Facilitation

Facilitation is any activity that makes tasks for others easy, or tasks that are assisted (Wikipedia.org). It is assisting community/groups/individuals to enable them join track of improvement in their career, so that their livelihood could be improved as they joined modern approach of livelihood intervention.

4.1.1. Scope of Facilitation

Facilitation ranges from simple interpersonal communication with individuals/group/community to inter/intra organizational synchronization trough rural marketing, supply chain and value chain for assisting them to meet their goal. It is an enhanced learning/change processes especially when we look from the angle of farm technology adoption. Facilitation needs involvement of private extension providers, agribusiness actors, ability to

bring on farm change by convincing, and totally to bring positive change on agriculture. In the process of evaluation of numerous extension programs, different approaches to facilitation of learning/change on farm have been examined. Facilitation in extension is a diversified activity to easily attain objective by farm communities (David, 2003).

Hence, facilitation in this study is to mean, the way of making extension transaction easy. This facilitation includes activities to ease any difficulties that might technology adopters face, like arrangement of credit facilities, awareness creation about technologies, arrangement and bring desired attitude to proper functioning of rural marketing, supply chain and value chain. This desired attitude in rural marketing, value chain and supply chain is believed to grant efficient facilitation that closely assists agricultural extension for MIT distribution and adoption. As seen from Table 3 below, out of thirty five individuals who were adopted micro irrigation technology, thirty of them have got facilitation and close consultation to have it. Only five small holder households adopted MIT without being facilitated for them. From the same Table 3, one can examine that out of eighty one respondents, forty-six of them have not adopted MIT out of which no-facilitation accounts for eighteen of them. For the remaining ten (28-18) not adopted MIT after being facilitated for them, other factors are extension factors are responsible.

Table 3 MIT Adoption cross tabulated with facilitation

	Status	Facilitation status for technology		Total
		Not facilitated	Facilitated	
Micro irrigation technology adoption status	Not adopted	18	28	46
	Adopted	5	30	35
Total		23	58	81

4.1.2. Facilitation in Rural Marketing

Market institutions transmit information, mediate transactions, facilitate enforcement of property rights and contracts, and manage competition. They also address market failures that arise due to asymmetric information, high transaction costs, and imperfectly specified property rights. Without supporting market institutions through rural marketing facilitation, rural markets tend to be thin and imperfect, leading to high marketing and transaction costs to adopt technologies. Important market players fail to undertake profitable investments, leading to coordination failures that further hinder market functions. Associated shocks and market risks also worsen imperfections and transaction failures. Institutional innovations that reduce transaction costs and enhance coordination of marketing functions in rural markets such as producer marketing groups (PMGs) that make use of collective action can help overcome these problems.

Today, numbers of studies have shown that most population in developing countries is living in rural areas. For improvement in living condition, dissemination of innovative technologies in to rural settings is essential to increase efficiency of production and enhance development of rural

communities. To make real, dissemination of especially agricultural technologies facilitation in rural marketing plays significant role. Hence, this study pointed out empirical model of facilitation from field observation and assessment.

As rural marketing is the processes of supplying and make adaptation of technologies manufactured outside of rural area in to rural areas, life of rural communities could be changed by utilizing the technologies. It is simply to mean that, the processes of disseminating and enhance adoption of technologies or industrial products deep in to rural settings to enable them produce efficiently.

In the case of micro irrigation technologies; the technology is manufactured in urban settings and extension activities with proper facilitation have been done to enhance their adoption at rural settings. Rural communities are expected to be organized to increase their bargaining power for the technology. During organizing rural farm communities to access them with technologies, there should considered important factors like ethnic group, economic status, age category, occupation and good relation among communities that were addressed qualitatively by respondents from technology owners, non technology owners and development partners who are doing extension for the technology adoption.

Ethnic group consideration is very important during organizing farmers to access them technology. Ethiopia is the ethnically diversified countries where everybody can interact without considerable limit. However, while organizing willful individuals in to dynamic economic community, it is very efficient to organize peoples with similar ethnic groups together or even have blood relation among themselves. Otherwise, there observed silent resistance to wards sustainable development and active participation to attain their common goal. Even after being organized and interred in to business; during the processes of organizing; heterogeneous communities are vulnerable of ineffective. Hence, it is very advisable to facilitate rural marketing by organizing rural communities by its maximum possible homogeneities or similarities with respect to age category, ethnic group, economic status, social occupation and other similar issues.

4.1.3. Facilitation in Supply Chain

Supply Chain is a chain of different actors from producers of different inputs in order to produce another output. For example, micro irrigation technologies were being manufactured by independent manufacturers in order to be sold and used by another end users or farmers. In order to link the technology, from manufacturers to farmers there are different actors to make ease the way that farmers could get the technologies. Among the actors; manufacturers, dealers, retailers other input suppliers and competitors manufacturers.

Facilitator with good facilitation skill starts from communicating with different potential actors to link them in to chain and make them develop an ethical trade behavior for their mutual benefit. Manufacturers are to be linked with loyal and quality row material suppliers to produce quality product and at the same time to be linked with customers of different level (end users, retailers and dealers) to sell their products.

4.1.4. Facilitation in Value Chain

The term ‘Value Chain’ was used by Michael Porter in his book "Competitive Advantage” Creating and sustaining superior performance" (1985). Value chain analysis describes activities that organizations perform and the way they are linked to their competitive position.

Value chain analysis describes the activities within and around an organization, and relates them to an analysis of the competitive strength of the organization. Therefore, it evaluates which value each particular activity adds to the organizations products or services. This idea was built upon the insight that an organization is more than a random compilation of machinery, equipment, people and money. Only if these things are arranged into systems and systematic activates it will become possible to produce something for which customers are willing to pay a price. Porter argues that the ability to perform particular activities and to manage the linkages between these activities is a source of competitive advantage.

Porter distinguishes between primary activities and support activities. Primary activities are directly concerned with the creation or delivery of a product or service. They can be grouped into five main areas: inbound logistics, operations, outbound logistics, marketing and sales, and service. Each of these primary activities is linked to support activities which help to improve their effectiveness or efficiency. There are four main areas of support activities: procurement, technology development (including R&D), human resource management, and infrastructure (systems for planning, finance, quality, information management etc) (www.themanager.org)

Geographical fragmentation of production also has created a new trade reality often referred as value chain or vertical specialization. This fragmentation depends on interdependency of trade relation and this interdependency created vibrant and dependable value chain. It is through this value chain that producers who are producing for market are granted to produce by using modern technologies (www.ide.go.jp/English/).

Value chain in this study is to mean a chain with different actors that can add value for end products like agricultural products. Usually vegetable products are very perishable unless timely facilitated for their suitable price. This value chain facilitation includes arrangements and getting conviction of different actors like vegetable producers, retailers, whole sellers and consumers in order to act faithfully in the transaction processes, so that

producers get competitive price for their agricultural product and more encouraged to produce more by using technologies.

In this facilitation, all parts are made came together and discus on chains and values from production to end consumption. Facilitators are expected to search all dynamic actors and arrange forum for discussion on how to act faithfully and ethically within marketing processes.

Generally, facilitation in rural marketing, supply chain and value chain in this study is mainly to clarify how all the three lines of facilitation are harmonizing one another for efficient access and utilization of micro irrigation technologies by farmers and rural communities, and farm communities who utilized the technologies are getting good benefit that outweighs their efforts during to get the technology and to produce by the technologies.

4.2. Household Economic Status

The decision to adopt an agricultural technology depends on a variety of factors including farm households' asset bundles and socio-economic characteristics. An 'asset bundle' comprises physical, natural, human, social and financial assets (Ade, 2009).

Physical/natural assets – The area of land under irrigation is expected to affect the adoption decision. Farmers with less than a hectare of irrigated

farm are expected to be willing to adopt MIT since the area is within the pump's capacity to irrigate. The size of irrigated land cultivated depends on availability and the financial capacity of the farm household for cultivation. It is therefore used as a proxy of the family's wealth status. Reliable access to water throughout the year is also considered a factor in whether or not the MIT will be adopted.

Human assets – The quality and quantity of household labor are expected to affect MIT adoption decisions. The quality of household labor is captured by the capacity to work peroxide by the age of farm household head, and the capacity to adopt peroxide by the level of education of household head. The quantity of household labor is captured by the household size and the ratio of family members that are not earning an income to those who earn (dependency ratio) and the number of household members who can assist in operating the MIT pump (those of 15 years and above). MIT adoption is expected to have a negative relationship with the age of household head and dependency ratio; MIT adoption is expected to have a positive relationship with the level of education of household head, household size, and household members above 15 years of age. The gender of the household head is included to examine its impact on adoption decisions, although no negative or positive relationships are hypothesized for this relationship.

Social assets – These are represented by membership in the farmers' cooperative society and frequency of extension visits. It is expected that

membership in the cooperative society and high frequency of extension visits will increase adoption. These variables are expected to improve the adequacy of the information obtained about the MIT, which will have an impact on the adoption decision.

Financial assets – This is peroxide by the farm household access to formal or informal credit. Access to credit has remained a constraint to adopting improved technologies in developing countries and it is expected that access to credit will affect the adoption decision positively.

Hence, household economy is a factor that affects agricultural extension for MIT distribution and adoption by small holder household. Communities or groups to be facilitated for technology adoption should be organized according to their economic class (poor, medium and rich). If communities with different economic classes are organized together for example for credit access, bargaining power and other facilitation tools; they soon or gradually loss interest of being together.

Table 4 below indicates that, out of thirty five individuals adopted MIT; nineteen of them were communities with medium wealth status. Similarly there also recorded high value for medium wealth class community members not adopted MIT, which are twenty four out of forty-six individuals. Hence, as qualitatively described above in this section, there is variation among communities according to their wealth class and communities could be

approached conditionally according to their economic potential for MIT adoption. So that household economic status is a factor that affects agricultural extension for MIT distribution and adoption.

Table 4 MIT Adoption cross tabulated with household wealth status

		Household economic status			Total
		Poor	Medium	Rich	
Micro irrigation technology adoption status	Not adopted	11	24	11	46
	Adopted	2	19	14	35
Total		13	43	25	81

4.3. Model Farmers Extension Approach

Model farmer extension approach is an extension approach utilized longer by purposely selecting some community members who are well-off and to make them a role model for others. Here, the drawback is that, those community members who were not selected as model a farmer assumes as there is a benefit relationship between model farmer selected and an extension worker. Hence, community members who were not selected as model farmer or persons who have a negative relationship with farmer selected as model farmer worry in a pessimist manner. Even, there observed as they agitate other farmers not to accept the technology despite of function of the technology. However, there found good to use model framer extension approach for efficient technology dissemination and adoption by potential users. Here the point is that, there should be selection criteria while selecting model farer to make them role model for others. The selection should be at

public with a clear understanding of other farmers than based on the good will and silent decision of extension worker or facilitator.

4.4. Economic and Technical Feasibility of MIT

The terms “low-cost” and “affordable” refer mainly to farmers need who have less initial capital when introducing the new technology, MIT in this case. Until now so-called low-cost systems are not widely reported in the literature, but FAO / IPTRID synthesized current knowledge in report made in 2001. The report concludes: “Low-cost systems attempt to retain the benefits of conventional systems whilst removing the factors preventing their uptake by poor smallholders: purchase cost, the requirement of a pressurized supply, the associated pumping costs and complexity of operation and maintenance. Importing, MIT kits in small numbers to satisfy small demand from abroad by plain increases the trading costs per unit of MIT. In addition farmers take over a risk of failure when testing the new technology. Therefore most kits were distributed at a subsidized price of half the total paid (Bisirat, 2003).

It is well known that, sustainability of technology depends on the extent at which the technologies are technically and economically affordable to end users. If the technology is not feasible both technically and economically, it is difficult to make the technology adaptable by users. Technical feasibility of the technology means ease of the technology to be operated and used by

domestic labor. Economic feasibility of the technology means affordability of the technology by end users of all economic class especially the poor and the middle economic class. Despite of the above coated idea, MIT is currently started to be manufactured in village by proper facilitation of rural marketing, supply chain, and value chain and manufactures are from local communities after intensive training to insure technical feasibility of the technology to household and village mechanics technical skill. From table 2 of this section, there observed significant difference between economic and technical aspects of MIT. Hence, technical and economic feasibility of MIT is a factor that affects its distribution and adoption at household level.

There considered different Agricultural extension factors affecting MIT distribution and adoption at smallholder household level and found significant. Now, the following Table 5 shows level of significance of extension factors for MIT adoption by their Chi-square value and their relative impact also indicated on figure 2 below.

Table 5 Importance of extension factors based on their Chi-square value

No	Variables Name	Chi-square value
1	Household sex	42
2	Marital status	22
3	Facilitation	15
4	Family consultation	42
5	Wife agreement	45
6	Role of influential family member	32
7	Household economy	16
8	Model farmer extension approach	4
9	Technical feasibility of MIT	42
10	Economic feasibility of MIT	10

From the above table, the following figure is to show and visualize relative importance of each variable as a factor affecting agricultural extension for MIT distribution and adoption at household level.

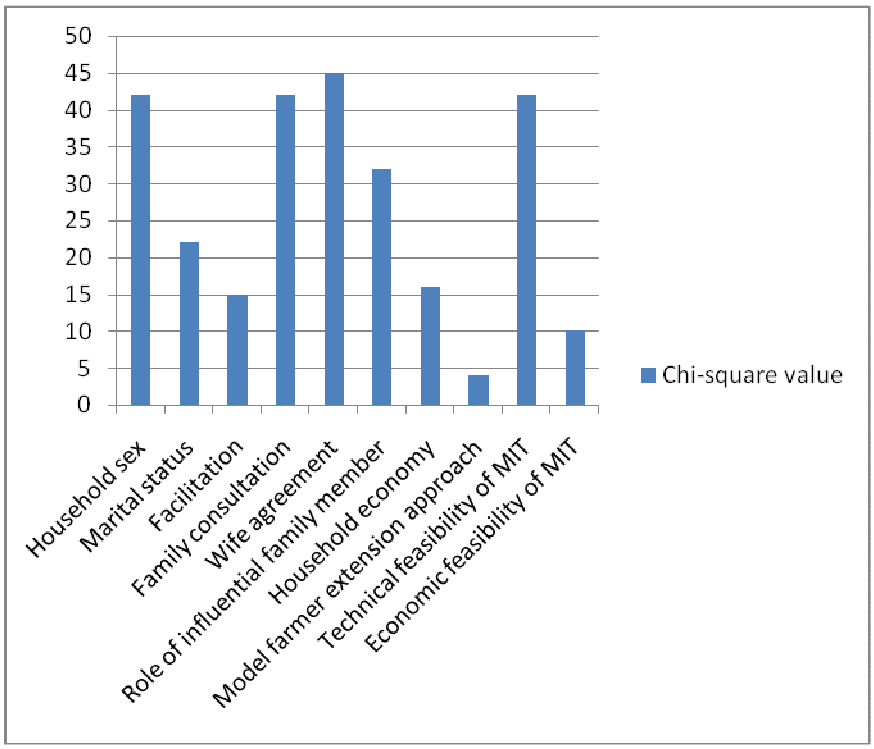

Figure 2 Level of Importance of Variables as Extension factors affecting MIT distribution

Chapter 5

4.5. Summary and Conclusion

4.6. Summary

The purpose of this study was to assess factors that are affecting agricultural extension for micro irrigation technology dissemination and adoption of smallholder farmers of Becho district, Oromia regional sate of Ethiopia. There done agricultural extension in Ethiopia since longer. However, still there faced resistance from the technology end users or farmers to adopt and use the technology that is micro irrigation technology in this study.

Hence, there hypothesized different variables as agricultural extension factors for their significance as a factor affecting agricultural extension while doing especially for micro irrigation technology promotion at small holder households. Among the hypothesized variables, extension with facilitation, technical and economic feasibility of micro irrigation technologies to be adopted at household level, house hold economic class based approach and model farmer extension approach utilization for micro irrigation technology dissemination and adoption are some of them.

After collecting information and data from eighty one sample respondents of the study area, those hypothesized extension factors were tested using Chi-square for their significance and found as follows.

1. Extension with facilitation by far increases efficiency of agricultural extension for micro irrigation technology adoption than extension without facilitation.
2. Model farmer extension approach can hasten our breadth of outreach while doing agricultural extension. However, care should be taken during selection of those model farmers as it negotiates sense of partiality across farmers and extension workers.
3. There also found difference among community members based on their wealth class to adopt MIT. Rich and poor community members less adopted the technology than communities at middle economic class. Because, rich community members resisted by looking at economic significance of the technology as opportunity cost of being producing by it is higher. For the poor community members, they afraid it because of technology risks or risk of new technology.

4.7. Conclusion;

There tested different hypothesized factors affecting agricultural extension for agricultural technology distribution and adoption at smallholder household level. The study found that, all hypothesized agricultural extension factors were found significant, and are affecting distribution and

adoption of MIT at household level. Hence, no single extension approach is effective by itself to make agricultural extension efficient. As, many factors found significant and are affecting agricultural extension for MIT distribution and adoption they could properly synchronized for efficient agricultural extension and best distribution of MIT at stallholder households.

Extension is best efficient if supported with appropriate facilitation and alleviation of important agricultural extension limiting factors. As facilitation is playing an enabling role, so that clients or technology adopters are to their best demand to have the technology. Rural community members should be well thought about the benefit that could be driven from the technology, so that they optimally utilize facilitation to have and adopt the technology believed appropriate for them by themselves.

Hence, from finding of this study, factors that are affecting agricultural extension were identified and enabling role is to be best practiced instead of simple recommendation of technologies to rural communities by extension workers.

Another important thing that this study would like to stress is, utilization of model farmers approach is very important to link technology to the entire

community members. However, care should be taken not to compromise benefits of other community members while to do with model community members.

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6. Abbreviations

- CA: Command Area
- CADU: Chilalo Agricultural Development Unit
- DA: Development Agent
- EMTP: Extension Management Training plot
- EPID: Extension and Project Implementation Department
- ES: Effective Stock
- FTC: Farmers Training Center
- GDP: Gross Domestic Product
- IDE: International Development Enterprise
- IECAMA: Imperial Ethiopian collage of Agriculture and Mechanical Art
- MIT: Micro Irrigation Technologies
- MOA: Ministry of Agriculture
- MPP: Minimum package program
- PADEP: Peasant agriculture development extension and program
- PADETES: Participatory demonstration and training extension system

- PMG: Producers marketing groups
- PVC: Poly vinyl chloride
- SG2000: SaSakawa Global 2000
- SIDA: Swedish International Development Authority
- SIM: Society of international Missionaries
- SPSS: Statistical package for social studies
- T &V: Training and visit

7. Appendix

Table 6 Chi square Distribution

d.f.	.995	.99	.975	.95	.9	.1	.05	.025	.01
1	0.00	0.00	0.00	0.00	0.02	2.71	3.84	5.02	6.63
2	0.01	0.02	0.05	0.10	0.21	4.61	5.99	7.38	9.21
3	0.07	0.11	0.22	0.35	0.58	6.25	7.81	9.35	11.34
4	0.21	0.30	0.48	0.71	1.06	7.78	9.49	11.14	13.28
5	0.41	0.55	0.83	1.15	1.61	9.24	11.07	12.83	15.09
6	0.68	0.87	1.24	1.64	2.20	10.64	12.59	14.45	16.81
7	0.99	1.24	1.69	2.17	2.83	12.02	14.07	16.01	18.48
8	1.34	1.65	2.18	2.73	3.49	13.36	15.51	17.53	20.09
9	1.73	2.09	2.70	3.33	4.17	14.68	16.92	19.02	21.67
10	2.16	2.56	3.25	3.94	4.87	15.99	18.31	20.48	23.21
11	2.60	3.05	3.82	4.57	5.58	17.28	19.68	21.92	24.72
12	3.07	3.57	4.40	5.23	6.30	18.55	21.03	23.34	26.22
13	3.57	4.11	5.01	5.89	7.04	19.81	22.36	24.74	27.69
14	4.07	4.66	5.63	6.57	7.79	21.06	23.68	26.12	29.14
15	4.60	5.23	6.26	7.26	8.55	22.31	25.00	27.49	30.58
16	5.14	5.81	6.91	7.96	9.31	23.54	26.30	28.85	32.00
17	5.70	6.41	7.56	8.67	10.09	24.77	27.59	30.19	33.41
18	6.26	7.01	8.23	9.39	10.86	25.99	28.87	31.53	34.81
19	6.84	7.63	8.91	10.12	11.65	27.20	30.14	32.85	36.19
20	7.43	8.26	9.59	10.85	12.44	28.41	31.41	34.17	37.57
22	8.64	9.54	10.98	12.34	14.04	30.81	33.92	36.78	40.29
24	9.89	10.86	12.40	13.85	15.66	33.20	36.42	39.36	42.98
26	11.16	12.20	13.84	15.38	17.29	35.56	38.89	41.92	45.64
28	12.46	13.56	15.31	16.93	18.94	37.92	41.34	44.46	48.28
30	13.79	14.95	16.79	18.49	20.60	40.26	43.77	46.98	50.89
32	15.13	16.36	18.29	20.07	22.27	42.58	46.19	49.48	53.49
34	16.50	17.79	19.81	21.66	23.95	44.90	48.60	51.97	56.06
38	19.29	20.69	22.88	24.88	27.34	49.51	53.38	56.90	61.16
42	22.14	23.65	26.00	28.14	30.77	54.09	58.12	61.78	66.21
46	25.04	26.66	29.16	31.44	34.22	58.64	62.83	66.62	71.20
50	27.99	29.71	32.36	34.76	37.69	63.17	67.50	71.42	76.15
55	31.73	33.57	36.40	38.96	42.06	68.80	73.31	77.38	82.29
60	35.53	37.48	40.48	43.19	46.46	74.40	79.08	83.30	88.38
65	39.38	41.44	44.60	47.45	50.88	79.97	84.82	89.18	94.42
70	43.28	45.44	48.76	51.74	55.33	85.53	90.53	95.02	100.43
75	47.21	49.48	52.94	56.05	59.79	91.06	96.22	100.84	106.39
80	51.17	53.54	57.15	60.39	64.28	96.58	101.88	106.63	112.33
85	55.17	57.63	61.39	64.75	68.78	102.08	107.52	112.39	118.24
90	59.20	61.75	65.65	69.13	73.29	107.57	113.15	118.14	124.12
95	63.25	65.90	69.92	73.52	77.82	113.04	118.75	123.86	129.97
100	67.33	70.06	74.22	77.93	82.36	118.50	124.34	129.56	135.81

CERTIFICATE

This is to certify that Mr. Misigana Hidata, student of M.A. (RD) from Indira Gandhi National Open University, New Delhi was working under my supervision and guidance for his project work for the course MRDP-001. His project work entitled STUDY ON FCTORS AFFECTING AGRICULTURAL EXTENSION FOR AGRICULTURAL TECHNOLOGY DISSEMINATION AND ADOPTION IN BACHO DISTRICT, OROMIA REGIONAL STATE OF ETHIOPIA, THE CASE IN MICRO IRRIGATION TECHNOLOGIES which he is submitting, is his genuine and original work.

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