# Strategic Implementation of ICT in Agriculture Information Dissemination: A case of Gulmi District

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**Abstract:** Strategic implementation of ICT in agriculture information dissemination requires decision making on suitable ICT tool and level of usage of ICT in the implementation area. This research sought to find the priority of influential attributes that should be considered while implementing ICT in agriculture information dissemination. Suitable ICT alternative and priority of multiple attributes were found out from multi criteria decision making (MCDM) method called Analytic Hierarchy Process. Similarly the level of ICT usage was found from farmers' survey of four Village Development Committees of Gulmi District. Based on the findings from MCDM process and farmers' survey, an implementation framework was proposed for using ICT in agriculture information dissemination in Gulmi district.

From the experts' importance level, community radio was identified as the most suitable for agriculture information dissemination followed by television, mobile, call centers and internet kiosks/web portals. Infrastructural support was identified as the most influential criteria for implementing ICT in agriculture information dissemination followed by technical, socio-economic and cultural criteria. On the other hand it was identified that highest almost 96 percent of the farmers possess mobile followed by radio, television and internet. Almost 50 percent of the respondents indicated that they have an internet user in their house. The likert scale analysis (on importance level of 5) was performed among farmers and it was identified that technical criteria was the most influential criteria for using ICT in agriculture information access. At the same it was observed that usage of modern ICT equipment such as computers, internet kiosks or mobile phones for agriculture information dissemination was very low at institutional or governmental level. The study indicated that highest number of farmers sell maize and buy rice. The farmers also indicated that transportation and market information was the major problems faced while trading agriculture commodities. Schools and Colleges were identified as most influential sub criteria by experts out of 15 such sub criteria. Similarly ICT centers were rated as high importance sub criteria by farmers. All the findings from AHP and that from survey have been incorporated to develop an implementation framework for agriculture information dissemination for Gulmi district which is the primary objective of this paper.

**Keywords:** Strategic Planning; Agriculture Information Dissemination; ICT; AHP; Farmers' survey

## Introduction

Information is considered as one of the most vital resources for development. The main challenge of our age is not producing information or storing information, but getting people to use information (Ommani & M, 2008). Timely availability of relevant information is vital for effective performance of managerial functions such as planning, organizing, leading, and controlling (Ommani & M, 2008). Information and knowledge are two of many significant factors for rural development. Realizing the growing importance of information in agricultural development, the Agriculture Information Section (AIS) became operational in 1965 as a separate unit in the Department of Agriculture in Nepal. This section was renamed as Agriculture Communication Division (ACD) in 1990. In course of restructuring of the Ministry of Agriculture Development in 2000, it was given its current name of Agricultural Information and Communication Center (AICC) and was attached to the Ministry as one of its central units with greater role and responsibility. AICC is a professional wing of the Ministry of Agriculture Development entrusted to produce agricultural information relevant to farmers, traders, entrepreneurs and professionals and to communicate the information through Radio, Television and Print media. The Center also bears the additional responsibility and challenge of managing and using digital information generated recently by the growing application of personal computer, internet and mobile telephone in modernizing agricultural development in the country. In spite of the significant efforts made by extension system, however, there are still several problems and issues that require attention to perform its function more efficiently and effectively. One of the major challenges for agricultural extension system is how to serve the majority of rural poor and socially disadvantaged groups who had long been neglected by extension and other services (Sharma N. K., 2011). Other problems are inadequate linkage among research and extension, education, farmers and other stakeholders, poor infra-structural development, insufficient number of extension personnel etc. to

carter diversified agricultural services (Sharma N. K., 2011).

The existing knowledge and information management system does not embrace regular experimentation, reflection and learning for the improvement in the service delivery system in agriculture in Nepal. There are several good practices visible with farmers groups which are published and broadcast through radio and television programmes but are seldom internalized and replicated (FAO, 2010). A framework for managing and using digital information for agriculture information dissemination by creating a strong linkage between research, extension, education, farmers and other stakeholders which will serve the majority of rural population is the major challenge of agriculture extension service of Nepal. ICT for rural development, environment and rural development is not a new issue in Nepal. Since ICT encompasses traditional radio to modern day smart gadgets, approaches of ICT implementation for agriculture information dissemination are significant in case of Nepal.

## Need

It is usual to have a strategic planning before implementing any technology. The strategic planning for the selection of suitable and effective ICT for agriculture information dissemination should include the information or contents that farmers seek for. Strategic planning of ICT implementation includes decision making about the most suitable form of implementing elearning on different levels (Divjak & Begcevic, 2006). Agriculture Information and Communication Center (under Ministry of Agriculture Development, Nepal) in their Organizational Objective have stated "To fulfill the information needs of agricultural practitioners and farm communities through the use of modern information and communication technology" as one of their strategy for agricultural information dissemination. But the strategic plan of implementing ICT as a medium is vague in the actual practice as there are many factors or criterion which needs consideration before decision making. Radio and television still dominates the ICT usage for information dissemination. Decision making on implementing ICT for agriculture information dissemination depends on many factors such socio-economic conditions of the area, cultural factors, technical factors and infrastructural support factor to name some. Hence there is a need for the strategic planning of ICT implementation. Agriculture extension is an integral component for agriculture development. Many extension systems and approaches were adopted in the past. Donor assisted projects had their own model of extension approaches and methods. It is a fact that most of the systems and approaches adopted have definitely contributed to the evolution of the extension system, but none could sustain the needed momentum in the long run (Agri. Business and Trade Promotion Multi-Purpose Co-operative Ltd, 2007).

Dissemination of information along with new concepts and farming techniques can bring novel opportunities to the farmers (Khanal, 2011). The study done by Jenkins and his contemporary in northern California has shown that the mass communication has provided much useful knowledge related to agriculture and the experience was quite meaningful (Khanal, 2011). There are, however many challenges on delivering agriculture information. Shortage of qualified agriculture officers/experts is one of them. People may live in scattered communities in rural areas. The current market demands the workforce with diverse knowledge over the specific knowledge. Such challenges encourages the use of ICT for information dissemination as it requires less human resources and is able to cater larger area or community in terms of agriculture information access.

All these factors and issues discussed above have highlighted many criteria which should be considered or at the least have some significance in decision making process of ICT implementation for agriculture information dissemination. To fulfill the information need of the agriculture practitioners and farm communities through the use of ICT equipment (which is the desired-end state of AICC), a strategic planning is required taking into account the socio-economic status of the farmers, cultural challenges, technical challenges and the infrastructural support In the holistic approach the success of integrating information and communication technologies into the agriculture system largely depends on the skill and knowledge of farmers, the infrastructure on with information and communication technologies depend and the ability and willingness of the learners. So it is utmost necessary to develop a decision model which will incorporate farmers, infrastructure, environment, content of information and manpower for deciding which alternative strategy is suitable for implementing e-learning.

## Significance of the study

This study aims to define a framework for the strategic planning for using ICT in agriculture information dissemination to farmers in Nepal. Information and communication technologies will be utilized to deliver information in easily understandable formats to rural groups. Nepalese farmers and their families may thereby become aware of the usefulness of information

and communication technologies for enhancing their access to the information that will assist them to improve productivity and enhance the sustainability of their farming.

While information supporting agriculture production and processes is provided by different government organizations, NGO, INGO and private organizations in Nepal, the farmers are not being able to exploit the advantages of ICT for information access. Learning new techniques and more profitable agricultural production methods through using ICT tools may encourage farmers to adapt their practices and to improve their agricultural processes. Disseminating agricultural information effectively to farmers in formats that they find easy to use will be a suitable approach for this study. In order to do so, research activities including data collection, data analysis, framework development and actual field implementation are necessary. This study may inspire and encourage Nepalese farmers to acquire valuable information and eventually adapt their rural lifestyle. As a result, farmers' livelihoods may be enhanced and agriculture will become more sustainable.

## Problem Statement

Information and communication technologies hold tremendous potential for rural development in Nepal in the areas of agriculture, health, education and industries. The productivity in agriculture is largely attributed to availability of relevant and timely information to farmers. The modern society demands intervention of ICTs in agriculture information dissemination rather than traditional methods. The planning of information dissemination through the use of ICTs would require decision making on the suitable framework for information dissemination. The information dissemination model should incorporate all the factors that are associated with the process of disseminating agriculture information. The availability of ICT equipment at farmers' end, the infrastructural support of the location and the information need of the farmers significantly alters the decision of suitable ICT alternatives for information dissemination. The impact of ICT based agriculture information system in the neighboring countries and those far off have shown significant improvement in the farming practices and productivity. In India for example, information exchange by electronic means has revitalized the role of extension services in providing information, education and decision-making assistance to agricultural producers. (Boateng, 2012). But according to (Anurag & Kumar, 2012) there still exists a gap on the information provided and need of the farmers. While studying IFFCO Kissan Sanchal Ltd., Market Light and Fisher Farmers Mobile Access initiatives (Anurag & Kumar, 2012) found that farmers are more comfortable with voice mode than text mode because of the problem of illiteracy/ language barriers. In most of the cases the information provided is one way and from top to bottom. Similarly they also found that illiteracy among farmers is one of the major drawbacks for accessing information through the Internet. The major problem was the lack of farmers' database (farm and farm details) which resulted in the poor coordination between farmers and experts. A study by (Babu, Glendenning, Kwadwo, & Govindarajan, 2012) on farmer's information need and search behavior concluded that farmers are rarely consulted about their needs and preferences before the design of information dissemination system. These study indicate that implementation of ICT along is not adequate enough to ensure timely and relevant information. The information need of the farmers and their perception of different factors should also be accounted for designing ICT enabled information dissemination system. A study done by (Chauhan, 2010) on the famers' perception about ICT implications indicated that 95 percent of the respondents preferred Panchayat building as the choice for Community ICT Center. Similarly the respondents also ranked Government on top for bearing the expenses of Community ICT Center followed by village Panchayat, Co-operative Dairy and by collecting charges from user. Such perceptions of famers clearly indicate that there could be differences in prioritizing the decision variables by farmers and experts. The perception on the criteria (economic, cultural, technical and infrastructural) of farmer is solely individualistic but the same of the experts is generalized to a location or group of famers or a farmer's community. This paper also sought to explain and analyze the differences that exist between farmers' choice of information dissemination system and that of experts'.

In spite of the advantages of implementing ICTs for agriculture information dissemination, farmers are unable to get the benefits out of it. This problem that this paper is trying to address is the lack of suitable ICT framework for disseminating relevant and timely information to famers. A framework that takes into account the socio-economic conditions of the farmers, cultural beliefs of the farmers, technical barriers and infrastructural support is of uttermost important for selection of suitable method of agriculture information dissemination. The framework should also incorporate the linkage between research and extension for authenticity and long run supply of information.

## Objectives

The primary objective of this study is to contribute to development of a strategic planning model for implementing ICT in agriculture information dissemination in Gulmi District, Nepal.

The specific objectives of this study are given below:

- To investigate the ICTs currently implemented for agriculture information dissemination.
- Review the key facts and major trends concerning the problem and identify factors that influence the selection of suitable ICT alternative for agriculture information dissemination.
- To identify alternatives, criteria and subcriteria for modeling the decision making process
- To understand farmers' perception on the importance of decision variables and construct a model based on the findings.

## Research Questions

The central research question of this study may be specified as follows:

- What are the important criteria and subcriteria that influence decision making of implementing ICTs for agriculture information dissemination?
- What could be the best suitable alternative method of disseminating agriculture information?
- Is there any difference between experts' and farmers' perception on decision variables that construct the decision support model?

## Research Hypothesis

The following hypotheses were thought of

- From experience in other countries, it is hypothesized that there is a significant difference in farmer's perception of decision variables and expert's perception of decision variables in implementation of ICT for agriculture information dissemination.
- There is a significant relationship between farmers' possession of ICTs and his perception on the effectiveness of ICTs for agriculture information.

## Limitations

The study was limited to Gulmi District in Nepal. Therefore, it may not be appropriate to generalize the results to whole country. The perception on ICTs and its effectiveness differ from farmer to farmer and that is accountable to many factors/criteria. It was expected that language was a limitation in this study. This is because the questionnaire was designed in English and during the survey, the items were translated into Nepali for farmers and their responses translated back to English for data analysis. As such, this may have caused loss of information during the process.

## Literature Review

In Nepal some subsectors such as dairy processing, poultry, tea, vegetable seed and fisheries show dynamism, but overall, these positive signs are not yet sufficient to lift a large number of people engaged in agriculture out of poverty and make a dramatic dent in reducing malnutrition and assure food security of the nation (Goletti, 2013). At present Nepalese agriculture has to address several issues and challenges emerging around mainly due to the changing context. One of the emerging areas is the organic farming (Directorate of Agriculture Extension, 2006). Conventional agriculture system has accepted the higher use of agro-chemicals and chemical fertilizers in our agricultural practices in order to increase the crop production and productivity (Directorate of Agriculture Extension, 2006). Knowingly and unknowingly, several agro-chemicals and nitrogenous fertilizers have been used by farmers beyond the discipline of recommendations made by concerned agencies which have accelerated the animal and human health hazards (Directorate of Agriculture Extension, 2006). Majority of the farmers are unaware of pesticide types, level of poisoning, safety precautions and potential hazards on health and environment. According to the latest estimate, the annual import of pesticides in Nepal is about 211t a.i. with 29.19% insecticides, 61.38% fungicides, 7.43% herbicides and 2% others (Sharma, Thapa, Manandhar, Shrestha, & Pradhan, 2012). Limited access of information on weed control has led to intensive tillage for weed control. Mostly, tillage leads to depletion of organic matter and proneness to erosion in inclined geography (Baral, 2012). Inefficient marketing service in agriculture sector is another problem where farmers are getting low price while the consumers are paying high price. The marketing margin is higher in the farm to wholesale market as compared to the wholesale to retail market (Shrestha, 2012). According to (Shrestha, 2012) the marketing cost, wholesale price of rice, retail prices of rice, and market information to the farmer

significantly influence the marketing margin. Different forms of media like radio, telephone, television and publications should help disseminate the market information regularly (Shrestha, 2012). He also suggested that policies should be focused especially on the farm to wholesale marketing services such as transportation, handling, packaging, and milling to reduce the marketing margin. In the hills of Nepal, the practice of intercropping is common, particularly amongst smallholder farmers who have to optimize their use of limited land. Additionally, supplies of external inputs are limited due to poor access to transportation and the physical barriers imposed by living in a mountainous terrain. The long duration of maize at mid- and high hill altitudes (typically 125 to 135 days at 1200m to 2000 m above mean sea level) makes it difficult to grow sequential crops (Prasad & Brook, 2005). The features of Nepalese agriculture are unique in the sense of its complex nature of farming systems that are intertwined among the multiplicity of enterprises of crops, livestock, poultry, vegetables, fruits, spices, fisheries, agro-forestry and non-timber forest products. To this day, majority of the Nepalese farmers produce what they consume and consume what they produce (FAO, 2010).

Despite the fact that ICTs are becoming increasingly universal, the question of access and usage remains important—especially for developing countries, given their need to narrow the digital divide (Bilbao-Osorio, Dutta, & Lanvin, 2013). According to the report "The Global Technology Report 2013" published by World Economic Forum, Nepal is ranked at 126 out of 144 in Networked Readiness Index 2013. Deloitte in its report 'Global Mobile Tax Review 2006-2007' estimates that with every 10% increase in mobile penetration, the GDP growth increases by 1.2%. This proven fact makes it all the more necessary why poor and underdeveloped countries like Nepal need to work much harder for the development of telecom sector (Nepal Telecommunications Authority, 2010). Use of Information and Communication Technologies (ICT) in education has been considered as one of the strategies to achieve the broader goals of education (Government of Nepal, Ministry of Education, 2013). Similarly, The IT Policy (2067), SRRP (2009-2015) and Three Year Plan (2011-1013) of the GON have included some policies and strategies in order to develop and integrate ICT in education (Government of Nepal, Ministry of Education, 2013). ICT in education has been identified as an innovative and effective means of teaching and learning. Students of schools in urban areas have easier access to ICT whereas those students who are studying in remote areas have hardly any access to these technologies, which eventually is creating a digital divide. More specifically, ICT has been considered as an effective tool for educational transformation through improved teaching learning process making learning horizon wider (Government of Nepal, Ministry of Education, 2013).

The advantages of telephones and mobile phones lie in the adaptability and capability of transferring both data and voice at gradually decreasing cost. For example the mobile based Agri Advisory services (through text, voice or video message) farmers of Kerala can get their answers on mobile phones. The project has made certain positive impacts, such as 'Kissan Kerala' has improved the extension and communication competence among the Departmental officers. Timely assistance by the 'Kissan Kerala' programme, agricultural production has increased, thus, attracted the youth and women for agricultural sector (Banerjee, 2011). As an information platform to receive text messages – SMS or voice-message information –, mobiles provide the ability to get connected to new knowledge and information sources not previously available with the possibility of real-time, highly tailored information delivery (Mittal & Mamta, 2012). According to (Mittal & Mamta, 2012) most of the farmers reported that they use mobile phones mainly for social communication but later they have increasingly started using it to get connected with people like traders and other farmers who have agricultural activities related information. Most of the small farmers reported that there is some increase in convenience and cost savings from using their mobile phones as basic communication devices to seek information, such as input availability or on market prices. Some other benefits which farmers listed were that farmers benefited from improved access to information including seed variety selection, best cultivation practices, protection from weather-related damage and handling plant disease (Mittal & Mehar, 2012). The complexity in the process of generating and delivering relevant content in the real challenge. In fact, the most frequent criticism that farmers in India had regarding information provided through mobile phone services was that the information was generic and was considered old and routine (Glendenning & Ficarelli, 2012). Similarly gap analysis by (Anurag & Kumar, 2012) found that in most of the mobile based initiatives both text message and voice message should be provided. It was also found that farmers are more comfortable with voice mode than the text mode because of problem of illiteracy/language barriers. In most of the cases the information provided is one way and from top to bottom (Anurag & Kumar, 2012). Dissemination of information through the mobile alone is not sufficient; it should compile with other extension services e.g. follow-up visits by the crop

experts coupled with quality farm inputs (Anurag & Kumar, 2012). A study by (Jayathilake, Jayaweera, & Waidyasekera, 2008) indicates that usage of mobile phone is very common in tea and poultry sector. The use of mobile phone is high compared to other ICT application such as Internet, WWW, e-mail and DSS. Low cost ICTs for agriculture information needs such as mobile phones have promising usability for increasing agricultural productivity and farming practices (Jayathilake, Jayaweera, & Waidyasekera, 2008).

For geographically remote locations, connectivity through computer networks may be an appropriate way to provide information to farmers. For example, each village centre could communicate with the outside world, nearby villages, other countries or other continents, via several types of communication tools, such as dial-up telephone connections, wireless networks or a satellite communication system called very small aperture terminal (VSAT) (Tantisantisom, 2012). The Internet's popularity, its efficiency in communication and the reducing price of hardware have resulted in the implementation of Internet connectivity in several projects such as the iKisan.com project, the TARAhaat project and the e-Choupal project in India (Tantisantisom, 2012). ICT enables vital information flows by linking rural agricultural communities to the Internet, both in terms of accessing information and providing local content (Jayathilake, Jayaweera, & Waidyasekera, 2008). In Philippine there are lots of portals, e-commerce applications and innovative technologies use to provide relevant agricultural information in country specifying the rural areas specially, e- AGRIKultura, e-Consortia, e-Farm & KAgriNet place a major role among them (Tantisantisom, 2012). In Thailand a multi-lingual Internet portal, Agricultural Information Network (AIN) enabling Thai farmers, field officers, policy-makers and government to communicate and access relevant and useful agricultural information (Tantisantisom, 2012). Farmers in India use e-Choupal one of the portals to setting up a kiosk network that provides mediated access to them.

## Research Design/Methodology

As per the nature of study, both qualitative and quantitative methods have been used. The lack of ICT implementation plan in agriculture information dissemination was recognized as one of the central decision problems. Based on these problems a goal of strategic planning for implementing ICT in agriculture information dissemination has been set. Rigorous literature review was done to find out criteria and sub-criteria for the decision making of suitable form of implementation of ICT in agriculture information dissemination. The research examined the level of using ICTs, socio-economic, cultural and technical challenges affecting the use of ICTs and thus the dissemination of agricultural information. The study is focused on farmers in Baletaksar, Purtighat, Khadgakot and Thulo Lumpek of Gulmi District. Decision making on the suitable ICT-enabled alternative was done using ExpertChoice (Version 11.5) software. Similarly the priorities for criteria and sub-criteria have also been set using the same. Farmers' survey of 196 was carried out find the information need and level of usage of ICT for information access. The findings were incorporated in the implementation framework. The selected criteria and subcriteria were also prioritized by farmers. The Table below shows the model for strategic planning for using ICT in agriculture information dissemination. The variables have been constructed from different literature on agriculture information dissemination. The justification for the selection of criteria and subcriteria has been done through literature review which has been included in the section below.

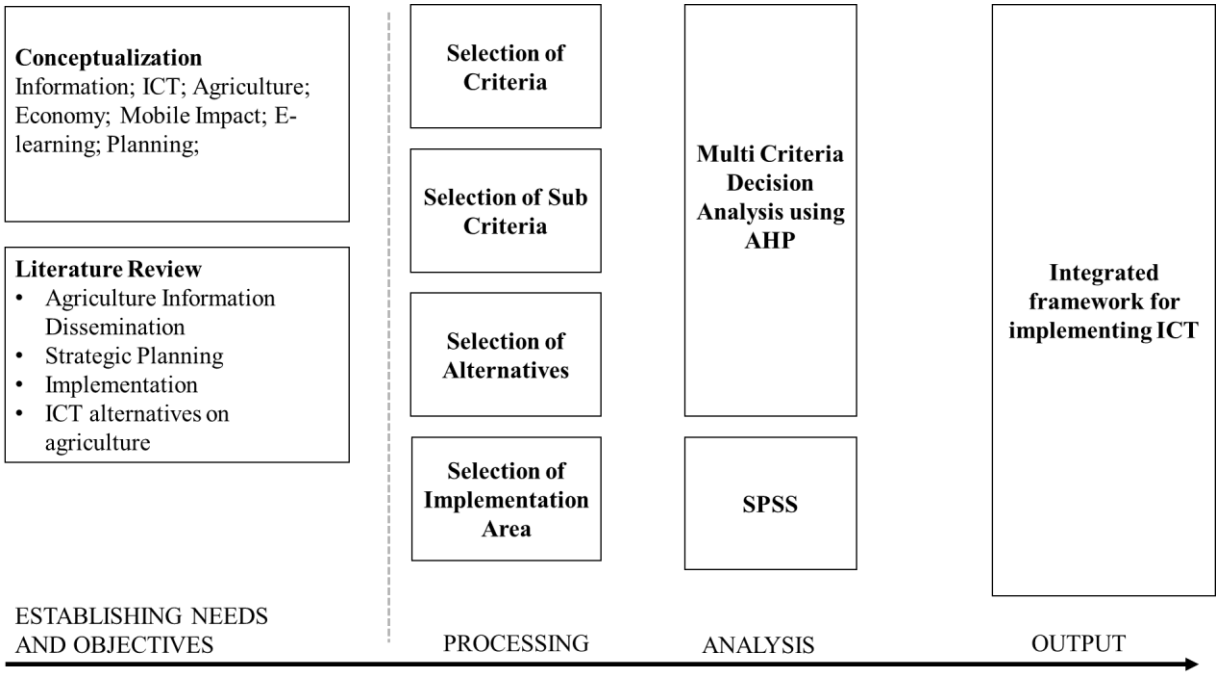


**Figure 1: Research Design**

## Findings and Data Interpretation

### *Ranking of Criteria and Sub Criteria*

From the experts' survey it was identified that infrastructural support is the most influential criteria which needs consideration for implementing ICT for agriculture information dissemination in any location. Similarly Technical Constraints, Socio-economic challenges and cultural challenges were subsequently ranked by the experts. Schools and colleges in particular was most prioritized by experts among all the sub criteria what were compared.


**Figure 2: Ranking of Criteria by experts**

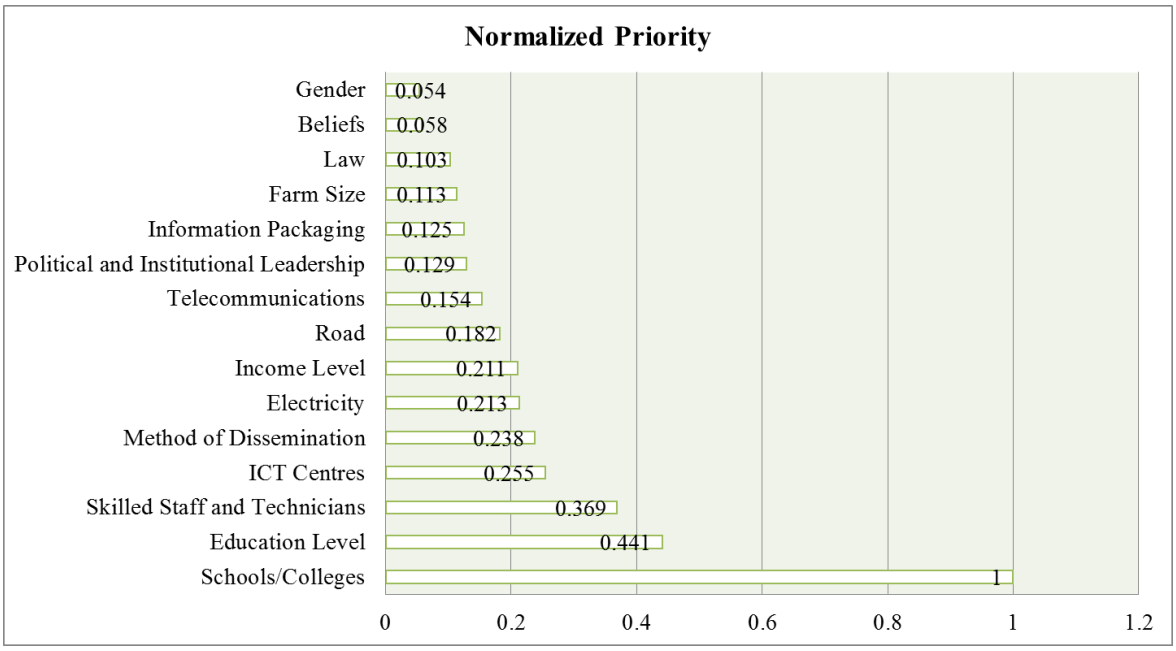


**Figure 3: Normalized Priority of Sub Criteria by experts**

### *Sensitivity Analysis*

The purpose of our sensitivity analyses is to graphically see how the alternatives change with respect to the importance of the objectives or sub-objectives. Each sensitivity analysis can be performed from the Goal or from a selected objective or sub-objective. In all cases, there must be at least two levels below the selected node. These levels can be comprised of at least one level of objectives and alternatives or two levels of only objectives. If you think an objective might be more or less important than originally indicated, drag that objective's bar to the right or left to increase or decrease the objective's priority and see the impact on alternatives. For example, as the priority of one objective increases (by dragging the bar to the right) the priorities of the remaining objectives decrease in proportion to their original priorities, and the priorities of the alternatives are recalculated.

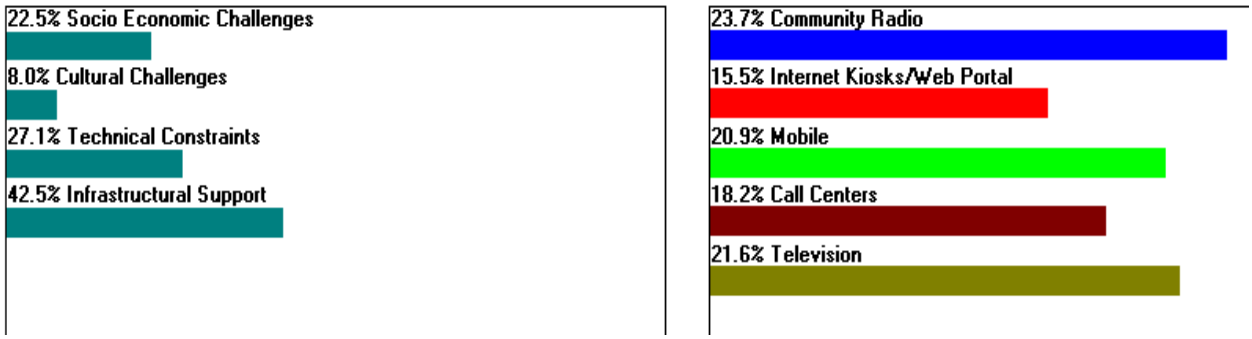


**Figure 4: Sensitivity Analysis**

### *Ranking of Criteria and Sub Criteria by Farmers*

Along with priority set by experts, farmers' perception on the importance of constructed criteria and sub criteria were also analyzed and found that technical challenges are the most influential criteria. It was followed by Socio-economic conditions, cultural challenges and infrastructural challenges. The table 1 below represents the same. Table 2 represents the ranking of 15 sub criteria where ICT centers have been perceived as the most influential sub criteria for agriculture information dissemination.

**Table 1: Ranking of main Criteria by farmers**

| Rank | Priority of Criteria |
|---|---|
| 1 | Technical Challenges |
| 2 | Socio-economic Conditions |
| 3 | Cultural Challenges |
| 4 | Infrastructural Support |

**Table 2: Ranking of Sub Criteria**

| Rank | Sub Criteria |
|---|---|
| 1 | ICT centers |
| 2 | Skilled technicians |
| 3 | Telecommunication |
| 4 | Education level |
| 5 | Income of the Family |
| 6 | Road |
| 7 | Information Packaging |
| 8 | Schools/Colleges |
| 9 | Electricity |
| 10 | Beliefs |
| 11 | Methods of Dissemination |
| 12 | Farm size |
| 13 | Political and Institutional Leadership |
| 14 | Law |
| 15 | Gender |

## SWOT Analysis

SWOT analysis is a strategic planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or in a business venture. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieve that desired end-state (objective). SWOT (Strength, weakness, opportunities and threats) analysis has proved to be a general tool at the preliminary stages of policy making and strategic planning of an organization and at a later stage as well, while analyzing the performance and planning for further development and progress of the organization (Sharma & Singh, 2010). This research paper intends to define an implementation framework of ICT for agriculture information dissemination. Hence to achieve this objective, SWOT analysis has been used to analyze the strengths, weaknesses, opportunities and threats of Gulmi district with regards to the objective of implementing ICT for agriculture information dissemination. SWOT analysis helps decision makers decide whether the objective is attainable or not, given the SWOT analysis.

The aim of the SWOT analysis in this research paper is to identify the key internal and external factors that are important to achieving the objective of ICT implementation for agriculture information dissemination in Gulmi. The internal factors may be viewed as strengths and weakness while the externals factors may be viewed as opportunities and threats. Most of the internal factors have been derived from observation and statistical inferences with few from literature review. Similarly for external factors (opportunities and threats) literature review and observation are the main sources of the information. All the factors stated below are analyzed from the perspective of implementing ICT for agriculture information dissemination which is the objective for SWOT analysis.

### *STRENGTHS*

Following are the strengths of Gulmi District for implementing ICT in agriculture information dissemination.

- According to the Ministry of Local Development's Minimum Conditions and Performance Measures (MCPM) assessment, Gulmi was the 4th-best-performing district in Nepal in 2010/2011 (Root, 2014).
- According to (Root, 2014) the 3 or 4 political parties in Gulmi are viewed to be relatively cooperative.
- Well-equipped District Agriculture Development Office at Gulmi with 4 technical sections (Planning, Plant Protection, Agricultural Extension and Horticulture). DADO Gulmi has 6 Agriculture Service Centers (ASC) and a total of 47 employees and running agriculture development programs in all 79 VDCs (Government of Nepal, 2014).
- All the four VDCs under the study were connected via road. Literature review indicate that
- Statistical findings indicate that almost 75% of the farmers (respondents) fall in the age group of (20-50) years old which indicate the strength of farmers' capability of receiving agriculture information at faster rate.
- Statistical findings also indicate that maximum numbers of farmers are educated with few

exceptions (around 3 percent). This represents the ability of farmers to grasp agriculture information.

- More than 66 percent of the farmers (respondents) have farming experience of more than 10 years which also indicate the strength of Gulmi district for agriculture information dissemination.
- More than 95 percent of the farmers possess mobile phone which indicates the strength of possibility of the two way communication for agriculture information access.
- Availability of radio with more than 80 percent of the respondents indicates the strength of mass communication of agriculture information. Similar is the case with television which is available to more than 67 percent of the farmers.
- 50 percent of respondents know or have someone in the family who knows how to use internet for information access.

***WEAKNESS***

- Almost 40 percent of the farmers responded the yearly household income of less than Nepalese rupees 180,000 and 27 percent responded the yearly income of above Nepali rupees 180,000 and below Nepali rupees 360,000. This indicates the weakness of lack of buying power of the modern ICT equipments for agriculture information access.
- Almost 87 percent of the farmers have farm size of less than 10 ropanis. This indicates that most of the farmers of Gulmi are engaged in subsistence farming rather commercial.
- Around 50 percent of the farmers do not know how to use internet. Lack of internet usage capability of farmers indicates the weakness of implementing ICT for agriculture information dissemination.
- Around 65 percent of the farmers reported that they were not associated with any farmers' group. The same has been identified as weakness as (Agri. Business and Trade Promotion Multi-Purpose Co-operative Ltd, 2007) stated that farmers' group approach has been found highly effective in many cases particularly in information and technology dissemination.
- From the observation if was found that there is lack of ICT equipments at DADO Gulmi for agriculture information dissemination.
- According to (FAO, 2010) frequent transfer of trained human resources and placement not in accordance with "the right man in the right place" has been identified as the one of the weaknesses of agriculture extension. Hence lack of skilled human resources has also been identified as weakness for implementing ICT for agriculture information.
- Availability of relevant content for information dissemination.
- Transportation has been identified as the major weakness as few vehicles ply. The findings of the research also indicate that most of the farmers, around 60 percent reported that lack of vehicles and market has been a major issue for commercialization.
- There are all together 5 FM stations including Radio Nepal's FM relay station that broadcast agriculture information but are seldom internalized and replicated according to (FAO, 2010).

***OPPORTUNITIES***

- Improving market access
- Capacity Building and empowerment
- Enhancing agricultural production

***THREATS***

- Changing socio-economic characteristics of the farmers is a threat because the targeted population (famers) is viable to change their income generating activities.
- Policy interventions due to political and institutional leadership
- Farmers' perception of ICT
- Lack of support and funding for future development
- Weak coordination among related departments and ministries as reported by (FAO, 2010) has also been identified as the weakness for implementing ICT for agriculture information dissemination.

## Conclusion and Recommendations

The purpose of this study was to develop a decision support models for strategic planning. The decision support models as shown in the above chapter have been constructed by experts' and farmers' survey. The area of study was Gulmi District, Nepal. Hence this chapter presents the conclusions and recommendations suitable for implementing ICT for agriculture information dissemination in Gulmi District of Nepal. The decision support model as reported from the expert survey (by use of AHP) is not generic to any location. Hence, this expert's model will also support the decision making process for implementing ICT for agriculture information dissemination.

### *Conclusions*

Based on the findings of the study it can be concluded that:

- There is an immense potential in using ICTs for disseminating agricultural information, thereby allowing small scale farmers to share knowledge and experience through radio, TV stations, mobile, print media, tele-center and other ICT driven communication devices. Around 96% of the respondents possess mobile phone. The most appropriate tool in disseminating agricultural information in Gulmi district in Nepal is mobile phones since majority of farmers have access to it and it is affordable.
- The strength of radio as a tool for agriculture lie in its ability to reach illiterate farmers and provide them with information relating to all aspects of agriculture production in a language they understand. Statistically, majority of farmers have access to radio too. Findings indicate that 82.1% of the respondents possess radio. Hence it can be concluded that a community radio station which promotes the participation of the community (territorial or geographic) in this radio will be an effective usage of radio as ICT for agriculture information dissemination.
- The findings indicate that around 67% of the respondents have access to television. The availability of the television is highly accountable to economic conditions. Literature review indicated that the effect in the productivity of agriculture sector is contributed highly by the information provided through television as a regular program or a documentary movie too. Hence it can also be concluded that agriculture information should also be available in video format for effective usage of ICTs.
- Socio economic challenges such as income level significantly influenced the availability of ICTs in disseminating agricultural information. The findings indicated that farmer's perception of the importance of different ICT's for access of agriculture information significantly differed on the availability of ICTs. Hence it can be concluded that strategic planning of ICT implementation for agriculture information dissemination should consider the socio-economic status of the farmers for effective information dissemination.
- Cultural factors such as laws, beliefs, political and institution leadership significantly influenced the use of ICTs in disseminating agricultural information. This is because people had difficulties in moving from the logic of perceiving the world based on oral tradition and the physical proximity of objects, places and persons, to a logic in which the world is converted into texts, files and windows that are closer to the idea of virtual reality.
- Farmers' survey indicates that technical challenges significantly influenced the use of ICTs in disseminating agricultural information. The findings indicated that limited ICT centers and lack of skilled technician are the major issues that need immediate attention. Poor methods of communication and packaging of information are the technical challenges influencing dissemination of agricultural information. The findings indicated that if hardware and software are user-friendly, then they might be adopted successfully for the delivery of course materials. In addition lack of compatibility in ICT with individual needs may negatively affect the individual's ICT use.
- The experts have prioritized infrastructure support for dissemination of agriculture information followed by technical challenges, socio-economic conditions and cultural barriers at the end. Farmers' survey indicated that technical challenges are the top priority challenges that they face. Hence it can be concluded that there is a significant difference in assessing the importance of many challenges/criteria for decision making by farmers and experts.
- It was identified from the survey that most of the VDCs of Gulmi district was connected via road with few exceptions. All the four VDCs under the study were found to be connected with road and social services like drinking water, communication and electricity were available. According to (Central Bureau of Statistics, 2007) 57 VDCs were connected via road. Hence it can be concluded that

availability of infrastructural support in Gulmi district might have caused the difference in famers' priority list compared to that of experts.

### *Recommendations*

The following general recommendations were made based on the findings of the study.

- On the basis of 9 experts survey results, AHP based decision model was constructed for making decision on suitable ICT to be implemented for agriculture information dissemination. Infrastructural support that includes road, electricity, transport and schools/colleges was recognized as the most influential criterion for ICT implementation. At the same time it can be identified as the weakness of most of the information system, since strategic planning of ICT information systems has been systematically neglecting. Hence it is recommended that any planning of ICT implementation in agriculture information dissemination should consider the availability of infrastructural support such as road, electricity, transport and schools as the first priority.
- On the basis of 196 survey results of farmers and performed frequency and skewness analysis, technical challenges were most influential. At the same time it was identified that lack of adequate ICT equipped information centers and skilled technician for agriculture information dissemination was the weakness of Gulmi District. The decision support model as constructed from experts' survey indicated that community radio will be an effective ICT implementation for agriculture information dissemination. From the findings it is recommended that radio programs that include participation of the local community will be an effective ICT implementation. Study indicated that there is just a single community radio station in Gulmi district. It is therefore recommended to utilize the same radio station for information dissemination.
- The successful implementation of ICTs in agriculture information dissemination largely depends on the availability of the ICT at the farmers' end. The study found that 95.4% of the farmers have access to mobile phones. Hence it is recommended to utilize the applications (voice, short message and interactive voice response) of mobile phone for information dissemination purpose.
- The study also indicated that more that 80% of the farmers have access to radio and more than 67% of the farmers have television for information access. Similarly, the survey indicated that around 70% of the farmers rated video format as effective format for information dissemination. Hence it is recommended that agriculture information be disseminated through radio and television too in the respective format.
- The survey results indicate that most of the farmers ranked information on diseases and their solution as high priority information content. On the other hand they ranked video format as effective format of information dissemination. Hence it is recommended that a suitable video demonstrating the types of diseases and their solution will be an effective use of ICT for agriculture information.
- Trade (buy and sell) information from the survey results indicated that more than 80 percent of the farmers sell wheat followed by millet, potato, maize and other (vegetable and livestock). Hence it is recommended that information of disease and its solution with market price information of the crops mentioned above be given through mobile, radio and television with priority to mobile as most of the farmers have access to it.
- The findings indicate that for long term supply of information, the system should be owned by the government. Hence it is recommended that ownership must be given to Nepal Government for sustained information system.

### *Strategic implementation framework of ICT in agriculture information dissemination for Gulmi District*

From the literature review it has been found that information and communication technologies have become popular and effective in India and neighboring countries for agriculture information dissemination. The research indicated that farmers' information needs can be addressed by the combination of push pull technologies such as mobile phones, radio, television and internet. Keeping in mind the availability of the ICT equipment present at farmer's premise, information need of the farmers and decision making criteria for ICT implementation, the following multimodal ICT dissemination system has been recommended. There is requirement for an integrated approach which would address information needs in using ICT applications.

This framework could be implemented and maintained under the supervision of government agricultural bodies, such as the Department of Agricultural Extension or the Ministry of Agriculture, or run by academic institutes, such as agricultural colleges or

departments of agriculture in universities, which are sources of accurate and credible agricultural information. The framework below is developed from the statistical findings, observations and the success stories of ICT implementation in neighboring countries. This framework is a composite system for delivering on time farm information to farmers through push and pull technology. It uses a combination of the Internet, basic phones, smart phones and IVRS for disseminating information, and has a centralized database containing multimodal content. The major features of the system are:

***Web, mobile and IVRS based system***

The findings indicate that 50 percent of the households have member who can use internet. Similarly 95.4 percent of the farmers possess mobile and are more comfortable with audio and video information rather text. Hence the proposed strategic framework will be composed of an integrated system of web application, mobile (voice) and interactive voice response (IVR) system.

***Multimodal content format (audio, video and text)***

This research sought to find the mode of information that is comfortable with the farmers. The findings indicate video format is preferred more than video followed by text mode.

***Multilingual***

The proposed framework will have the features of accessing information in Nepali, local language and English language. The findings indicate that farmers have preferred Nepali language over local language followed by English.

***Multi-platform: web based backend and a mobile interface and IVRS for the frontend***

The strategic framework for ICT implementation in agriculture information will have a central component based on web backend and will be integrated with mobile and IVRS at the frontend. The central system also consists of call center as the experts have prioritized call centers as one of the suitable alternatives for information dissemination. Call center will be responsible for addressing farmer's queries and the queries will be recorded in the central system for future analysis.

***Domain: Agriculture (Maize)***

The findings indicate that most of the farmers are engaged in agriculture domain with few in horticulture and animal husbandry. Hence this framework will primarily focus on the agriculture domain. The findings indicate that out the common agriculture commodities (Rice, maize, millet, barley, wheat, potato and oil seeds), maize is sold by almost 44 percent of the farmers followed by others* (vegetables, livestock and dairy products) and potato. Hence the content of the information will focus mainly on maize.

***ICT Center for agro learning management***

The findings indicate that lack of ICT center is a major issue for information access through ICT media. The findings also indicate the ICT centers have been prioritized by farmers as one of the important subcriteria of technical challenges to be considered for agriculture information access. Hence ICT center is also considered as a major component in the proposed framework. The ICT center located at the research areas will serve as training and learning platform for agriculture domain especially of maize. With the introduction of ICT center, the capacity building of the farmers or the users is anticipated. The ICT center will offer an on time multimodal solutions to Gulmi farmers irrespective of functional literacy, language and other socio-economic conditions.

This research attempted to build a system that offers an on time multimodal solution to Gulmi farmers irrespective of their geographical location, functional literacy and language. Increasingly, ICT initiatives are required to prove their effectiveness through more sophisticated, technology driven methods. This paper seeks to introduce the Strategic framework as an inexpensive, fast and robust information dissemination system for farmers and farming organizations operating in Gulmi. The strategic framework would be able to deliver benefits to farmers more effectively in both online and offline modes vis-à-vis a traditional web or mobile based application.

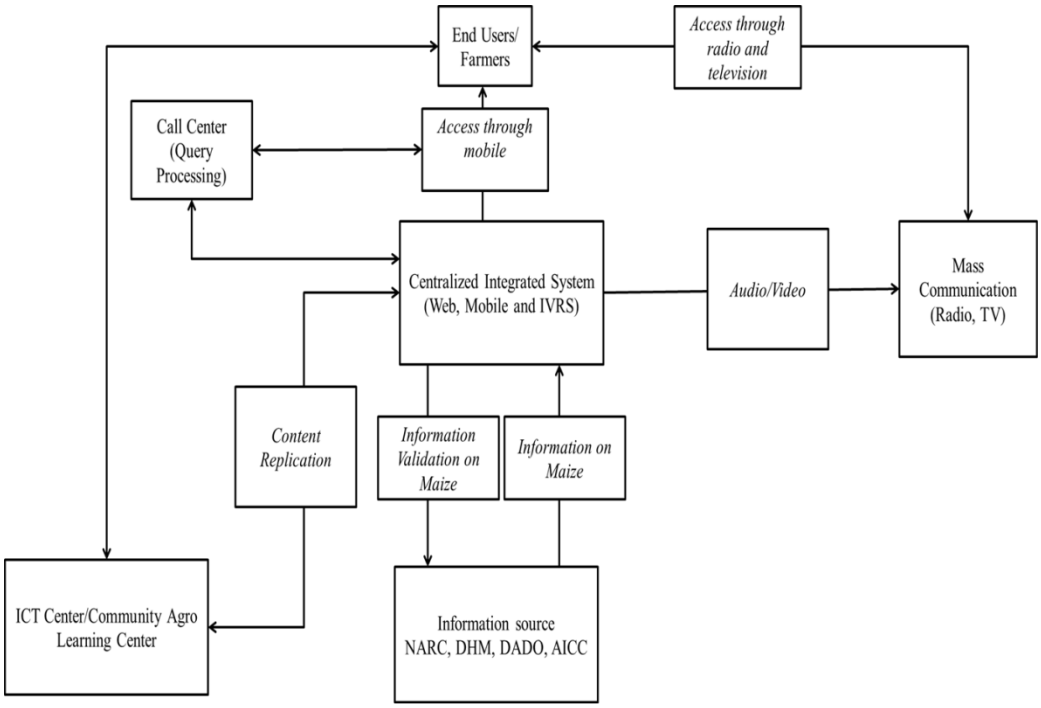


**Figure 5: Strategic framework for ICT implementation for agriculture information access in Gulmi District**

## References


Abdon, B., Raab, R., & Ninomiya, S. (2008). eLearning for international agriculture development: Dealing with challenges. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 4*(1), 80-94.

Agri. Business and Trade Promotion Multi-Purpose Co-operative Ltd. (2007). *The Impact Study on Farmer's Group Approach Adopted in Agricultural Extension System of Nepal.*

Anurag, T. S., & Kumar, S. (2012). Interactive Information Dissemination System: Architecture for Disseminating Information to Farmers. *Information Technology in Developing Countries*.

Anurag, T. S., & Kumar, S. (2012). *Interactive Information Dissemination System: Architecture for Disseminating Information to Farmers.*

Babu, S. C., Glendenning, C. J., Kwadwo, A.-O., & Govindarajan, S. K. (2012). *Farmers' Information Needs and Search Behaviors.* International Food Policy Research Institute.

Banerjee, A. (2011). THE ICT IN AGRICUTTURE: BRIDGING BHARAT WITH INDIA. *Global Media Journal – Indian Edition/ISSN 2249-5835*.

Baral, K. R. (2012). Weeds Management in Organic Farming through conservation agriculture practices. *The Journal of Agriculture and Environment*.

Central Bureau of Statistics. (2007). *District Profile of Gulmi.*

Chauhan, N. M. (2010). Farmers' Perception about ICT Application :A Case study of Gujarat state. *Indian Res. J. Ext. Edu.*

Cook, J., Kalu, I. L., & Adhikari, D. L. (2012). *Preparation of the Nepal Agricultural Development Strategy.*

Directorate of Agriculture Extension. (2006). Proceedings of a First National Workshop on Organic Farming. Directorate of Agriculture Extension.

Divjak, B., & Begcevic, N. (2006). Imaginative Acquisition of Knowledge - Strategic Planning

FAO. (2010). *Agriculture Extension Services Delivery System in Nepal.* Pulchowk: Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization. (2011). *E-learning Methodologies, A guide for designing and developing e-learning courses.*

Glendenning, C. J., & Ficarelli, P. P. (2012). *The Relevance of Content in ICT Initiatives in Indian Agriculture.*

Government of Nepal. (2014, 05 26). *About Us*. Retrieved from District Agriculture Development Office Gulmi: http://dadogulmi.gov.np

Government of Nepal, Central Bureau of Statistics. (2012). *National Populatio n and Housing Census 2011 (National Report).* Government of Nepal, National Planning Commission Secretariat, Central Bureau of Statistics .

Government of Nepal, Ministry of Education. (2013). *ICT in Education Master Plan 2013-2017.* Ministry of Education.

Jayathilake, ,. H., Jayaweera, B. P., & Waidyasekera, E. C. (2008). *ICT Adoption and Its' Implications for Agriculture in Sri Lanka.*

Kalinga, E. A. (2008). *Development of an Interactive e-Learning Management System (e-LMS) for Tanzanian Secondary School.* Blekinge Institute of Technology.

Khanal, S. R. (2011). Role of radio on agricultural development: A review. *Bodhi: An interdisciplinary Journal*.

Meitei, L. S., & Devi, T. P. (2009). Farmers information needs in rural Manipur: An Assessment. *Annuals of Library and Information Studies*.

Ministry of Higher Education, Kingdom of Saudi Arabia. (2009). E-Learning and Distance Education. Riyadh.

Mittal, S., & Mamta, M. (2012). How Mobile Phones Contribute to Growth of Small Farmers? Evidence from India. *Quarterly Journal of International Agriculture*, 227-244.

Mittal, S., & Mehar, M. (2012). How Mobile Phones Contribute to Growth of Small Farmers? Evidence from India. *Quarterly Journal of International Agriculture*.

Musa, N. S. (2011). *CHALLENGES OF USING INFORMATION AND COMMUNICATION TECHNOLOGIES TO DISSEMINATE AGRICULTURAL INFORMATION TO FARMERS IN SUDAN.*

Pazek, K., & Rozman, C. (2005). *APPLICATION OF ANALYTICAL HIERARCHY PROCESS IN AGRICULTURE.*

Porcari, E. (2010, 8 21). *Why communication and knowledge sharing in our Megaprograms?* Retrieved from ict-km: http://ictkm.cgiar.org/2010/08/21/why-communication-and-knowledge-sharing-in-our-megaprograms/

Root, C. (2014). *Agricultural Service Responsiveness in Nepal.* NC: RTI International.

Saravanan, R. (2013). *ICTs for Agricultural Extension in India: Policy Implications for Developing Countries.*

Sejuwal, K. (2014, 2 14). *e-Agriculture project boon to Surkhet farmers*. Retrieved from Republica: http://www.myrepublica.com/portal/index.php?action=news_details&news_id=69596

Sharma, D. R., Thapa, R. B., Manandhar, H. K., Shrestha, S. M., & Pradhan, S. B. (2012). USE OF PESTICIDES IN NEPAL AND IMPACTS ON HUMAN HEALTH AND ENVIRONMENT. *The Journal of Agriculture and Environment, 13*.

Sharma, D., & Singh, V. (2010). ICT in the Universities of the Western Himalayan Region of India II: A Comparative SWOT Analysis. *IJCSI International Journal of Computer Science Issues*, 62-72.

Sharma, N. K. (2011). *Country Paper on National Agriculture Extension Systems in Nepal An analysis of the System Diversity.* Lalitpur: Nepal Economic, Agriculture & Trade (NEAT) Activity.

Shrestha, R. B. (2012). FACTORS AFFECTING PRICE SPREAD OF RICE IN NEPAL. *The Journal of Agriculture and Environment*.

Siraj, M. (2012). *A model for ICT based services for agriculture extension in Pakistan.* Rawalpindi: CABI South Asia.

Tantisantisom, K. (2012). *Information Dissemination for Farming Communities in Thailand.*

United Nations Development Programme. (2013). *Human Development Report 2013*. New York: United Nations Development Programme.