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Agricultural information system and communication network: The case of BT corn growers in Amulong, Cagayan

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Abstract

The study was conducted to assess the agricultural information system and the communication network of corn growers in Amulong, Cagayan. Since there were multiple sources of farmer's information, these were categorized into three groups. The personal information sources (PIS) were composed of family members, relatives, friends and co-corn growers. The public information sources (PuIS) were the municipal agriculture technologists, extension agents, experts/researchers, company technicians and sales representatives. The mass media sources (MmIS) include the broadcast medium (TV and radio) printed materials (newspapers, leaflets, brochures, package of technology, and posters, the internet and cellphone). Results showed that the PIS recorded the highest mean value of 5.47 in terms of frequency of contact, indicating a once a week information sharing particularly with family members, relatives and friends. Information sharing with their co-corn growers (4.83) however occurred two to three times a month. As to the degree of usefulness of the information, both the technical and economic information generated from all the information sources were adjudged as *very useful*. It means that any available information that they get from various sources were considered to be useful in their corn farming. In terms of the total information score (TIS), the highest was recorded in PIS with a mean value of 224.25 IS. The mean score falls under the *strong* information contact. It is an indication that corn growers have more frequent information exchange between and among their family members, relatives, friends and co-corn growers. Total information scores obtained from the PuIs and MmIS were low indicating a weak information contact. Contact with PuIs is once to three times a year, while contact with MmIS ranges from once - two years and to no contact at all.

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Introduction

Corn (*Zea mays*) is second to rice as the most important crop in the Philippines. In Region 02, corn production is a major livelihood and source of income of farmers. A total of 414,449.30ha planted to corn, and about 96 percent is planted with yellow corn and the rest is planted with white corn.

Reports showed that corn production yield is used in the advancement of livestock and poultry industries. Out of these, 60 percent is used as feed and the remaining 40 percent is used for feed and other products. With the great demand in corn, there is a need to improve productivity. Agricultural information is an important component that influences agricultural productivity. Availability of information will aid in making wise decisions in the utilization and management of land, labor, crops or animals, capital. The inclusion of agricultural research, extension and training in government, non-government and private organization service paramount importance. This is a network mechanism whereby farmers are provided relevant and timely information that help them make decisions, to take advantage of market opportunities, and manage continuous changes in their production systems.

Deribe (2016) advances the idea that in order to bring substantial development in the agriculture sector, access to timely, reliable, and relevant agricultural information is a critical factor. Information can be in the form of farming practices, new innovation on a production technology, and the like. It has been pointed out by several studies that the transfer and utilization of agricultural information greatly help improve productivity. Samuel (2001) stresses that having adequate well-presented information will improve efficiency of rural development projects and programs. In this digital age and in the advent of climate change, the real challenge is not just producing information but getting people to use information.

Hence, for information and knowledge to be useful, these need to be efficiently transferred through communication. Such transfer can be called as communication flow from the source to the intended users like the farmers, or knowledge sharing among users.

Communication is the process by which an idea is transferred from a source to one or more receivers, with the intent of influencing the latter's attitude toward the idea. Continuous sharing of information creates and defines a relationship between and among individuals. Rogers and Kincaid (1981) pointed out that a communication structure and network emerges when interpersonal communication flow becomes patterned.

In the transfer of agricultural information and knowledge, two mechanisms are involved, the agricultural information system and the communication network. As cited by Demiryurek, *et al.*, 2008 in Demiryurek 2000, an agricultural information system consists of components (subsystems), information related processes (generation, transformation, storage, retrieval, integration, diffusion and utilization), system mechanisms (interfaces and networks) and system operations (control and management).

Furthermore, the analysis of the agricultural information system in a specific farming system may provide the identification of basic components and structure of the system, the different sources of information used by different components in the system, the understanding of how successfully the system works and how to improve system performance (system management). This approach is also useful to identify possible defaults and improves the coordination between components (i.e. information management). A communication network consists of interconnected individuals who are linked by patterned flows of information, and its analysis identifies the communication structure in a system (Rogers & Kincaid 1981). It was further emphasized that the exchange of information (communication) and its diffusion take place within a social system. Actors such as individuals, informal groups, organizations and subsystems are the members of the system and the structure of the social system and their actors or members' roles affect the diffusion process.

So far, there is no data on the corn growers' sources, access and usefulness of information especially in corn production. This study analyzed information system that would identify the most common information sources, usefulness of information and total information score of the corn growers. The total information score would define the strength of the information exchange among the actors. On the other hand, the goal of communication network analysis is to gather information about the structure of the network, and uncover patterns of information resource exchange between and among the sources and the receivers. Thus, this study would develop a clear understanding on the sources of information, the communication role performers and the communication strength developed among the sources and actors in the corn production, the case of Amulong, in the province of Cagayan. It would provide a framework to identify the strength and weaknesses of the corn growing information system, thus forwarding recommendations that would improve technology delivery systems.

Generally, this study established the agricultural information system and the communication network created in the corn production in Amulong, Cagayan. Specifically, it aimed to (1) identify the most common information sources of corn growers; (2) determine the degree of usefulness of the information generated and the information exchange mechanism expressed in the frequency of contact among the sources of information; (3). evaluate the information system (expressed in terms of total information score) and communication network (the communication role performers) in corn production.

Materials and methods

Research Design

A quantitative approach was used to gather data on sources of information and information generated among corn growers particularly relative to corn production. The dynamics of information seeking and sharing behavior will be described using qualitative approach. Personal interviews with key informants and focus group discussions were done to substantiate data generated from the quantitative method. This process revealed the information system and the communication network or structure of the corn growers in Amulong, Cagayan.

Population and Sampling

Population: From the list of corn growers in Region 02 generated from the Department of Agriculture, there were a total of 40 corn growers interviewed in the study.

Sampling Methodology

To determine the sample size, the Slovin's formula was be used at 95% level of confidence (0.05% margin of error). It was thus computed as follows:

$$n = N/(1+Ne^2)$$

where,

n = number of samples

N = total population

e = margin of error

Having determined the sample size, the study used the snowball or chain referral sampling technique to generate respondents of the study. This way, the "who to whom" data was satisfied.

Initial respondents were generated from the Municipal Agriculturist Officer (MAO) of the municipalities involved in the research. They comprised the initial set of respondents. The nominees were interviewed and at the same time were asked to name their closest friends who were the sources of information on corn production and that will compose their personal network.

A total of 40 corn growers were used as respondents of the study.

Research Instrument

A pre-tested structured questionnaire was used to collect quantitative data or information regarding the variables such as sources of information, extent of information utilization and information seeking and sharing behaviors of the respondents. The main questions focused on the information system of the farmers, that included the information generated and sources (whether personal, public or mass media

sources) related to corn farming, the extent of contact farmers had with the information sources, and degree of usefulness of the information generated.

Research Analysis

Agricultural Information System was analysed using the total information score (TIS). Information scores for each component of the farmers' corn production information system by multiplying the weights of information contact with degree of information usefulness. (TIS) is formulated as (Adopted from Demiryurek *et al*, 2008):

$$TIS = FC \times IU$$

Where, FC = the number of times farmers come in contact with information sources;

IU = the usefulness of information using the mean scale for each information

Obtained from the information source

The scale and weights will be given to each component according to the extent of information contact, were as follows:

Scale	Weights	Frequency of Contact/s
0	0	no contact
1	1	once a year
2	2	two or three times a year
3	4	four or five times a year
4	12	once a month
5	30	two or three times a month
6	52	once a week
7	130	two or three times a week and
8	365	contacts once a day

Similarly, the degree of usefulness of information sources was weighted as follows:

Scale	Range	Weights	Degree of Usefulness
1	1.0-1.75	0	not useful at all
2	1.76-2.50	0.01- 0.33	little useful
3	2.51 – 3.25	0.34 – 0.66	useful
4	3.26 – 4.0	0.67 – 1.00	very useful

The scores were calculated on the basis of percentages of farmers' reporting each level of use of the sources. Descriptive statistical tool was used to analyze quantitative data.

Results and discussion

Information Sources and Frequency of Contact

The information sources and frequency of contact of corn farmers to the various sources is presented in Table 1.

Table 1. Information sources and frequency of information exchange of farmer-respondents on corn production.

Information Sources	Frequency of consultation	
	Mean Score	Frequency of Contact
Personal/Public Information Source	5.47	1 x / week
Family Member	5.85	1 x / week
Relatives	5.59	1x / week
Friends	5.61	1 x / week
Co-corn grower	4.83	2-3 x /month
Public Information Sources	1.72	1 x /year
Municipal Agricultural Technicians	2.76	2-3x / year
University Extension Workers	1.05	no contact
Researchers/ Experts	1.43	no contact
Chemical Company Technicians	1.73	1 x/ year
Chemic Company Sales Representatives	1.76	1 x/ year
Mass Communication	0.98	1 x /year
Radio	2.68	4-5 x /year
TV	3.10	4-5 x /year
Newspaper	0.44	No contact
Farm Journals	0.49	No contact
Farm primer	0.49	No contact
Brochure	1.54	1 x /year
Package of Tech	0.61	No contact
Leaflet	0.71	No contact
Poster	0.68	No contact
Internet	0.20	No contact
Cellphone	0.88	No contact

Legend: Scale 7.13 – 8.00 once a day

3.57 – 4.45 once a month

6.24 – 7.12 2 to 3 times a week

2.68 – 3.56 4-5 times a year

5.35 – 6.2 once a week

1.79 – 2.67 2 to 3 times a year

4.46 – 5.34 2 to 3 times a month

0.90 – 1.78 once a year

0.00 – 0.89 No Contact

Information Sources

The information sources of the corn growers are categorized into three, namely; personal information source (PIS) composed of family, relatives, friends,

and co-corn growers, public information sources (PuIS) that include the municipal agricultural technicians, university extension workers, researchers/ specialists, chemical company technicians and sales representatives; and mass media sources (MmIS), broadcast, print and the internet.

Frequency of Contact

The result of the study showed that the PIS were noted to be the most common source of information of the corn growers. A high frequency of contact score was obtained with a mean of 5.47. The value indicated that information sharing is done once a week. As to the components of the PIS family members, relatives and friends obtained scores of 5.85, 5.59 and 5.61, respectively. All of these, fall under the once a week frequency of contact. Relatives obtained a mean score of 4.83, of which frequency of contact ranges from to two to three times a month. It can be gleaned from the result that information exchanges occurred more frequently among the their family members, relatives, friends and co-corn growers. The closeness or proximity may be the reason on the more frequent contact of the farmers with them. Dugyon and delos Trinos (2015) reported that relatives, friends, neighbors and fellow tilapia pond growers are the closes sources of information of tilapia pond growers in Ifugao. The report further noted the claims of Dereje (2006), Deribe (2007) and Apata (2011) that neighbors, friends and other farmers are among the closest sources of information of rural farmers.

On the other hand, there was limited information seeking activity of the respondents from the PuIS as manifested by the low mean score (1.72). The mean score obtained reveals that corn growers sought information from the PuIS once a year only. As to the various components of the PuIS, contact with agricultural technicians obtained a higher score of 2.6 which means frequency of contact occurred 2-3 times a year. Company technicians and sales representatives obtained scores of 1.73 and 1.76 indicating a once a year contact. A score of 1.43 and 1.05 were recorded from researchers/experts and university extension workers. The scores fall within the no contact category.

Based on the above result, information exchange is more frequent among the personal network of the corn growers than with the PuIS and MmIS. The frequency of contact with the PuIS ranges from once to three times a year. The above result corroborates with the findings of Dugyon and delos Trinos (2015) that almost 75% of the tilapia grower-respondents had contact with development agents and/or extension workers once a year. Similar finding was also reported in the study of Nge'no (2013) that majority of the small holder farmers in South Rift, Kenya had contact and/or access with extension agents once a year.

Among the MmIS, only TV, radio and brochure were noted to have been used. Frequency of contact with TV and radio was recorded to be 4-5 times a year, while brochure only once a year. The rest of the mass media was never used as source of agricultural information. Personal interview with the farmers revealed that most of them owns TV and radio, but are seldom used as source of agricultural information. These are used as sources of news and entertainment. The result is supported by the findings of Dugyon and delos Trinos (2015) that media materials are often used to listen to and/or watch news, dramas, music and *teleseryes*.

Usefulness of Information

Usefulness of Information from Personal Information Sources

Information generated from the various sources of informations is categorized into two, namely; the technical information and economic information. The technical information includes the nine cultural management aspects of corn production while economic information includes 12 items that cover areas such as marketing, budget and credit information categories related to corn farming. The data generated are presented in Table 2.

The overall mean in the usefulness of technical information generated from PIS was 0.74 with a descriptive rating of *very useful*. Among these, six items such as are type of seed variety, land preparation, weather forecast, soil management, fertilizer

application and harvesting techniques recorded mean scores ranging from 0.67 to 0.95 which fall under the *very useful* category. Disease and pest control, use of machinery, and storage methods and techniques obtained mean scores of 0.42 and 0.66 which fall under *moderately useful*. In terms of economic information, the mean score obtained was 0.74 which falls within the *very useful* scale. It is interesting to note that all of the items under the economic information obtained scores ranging from 0.67 to 0.90 which all fall within the *very useful* scale. This means that all information generated from their PIS in terms of economic related issues are considered useful, hence they may have used it in corn production.

Table 2. Summary data on the perceived degree of usefulness of information generated from the two major sources, personal information and mass media sources in Bt corn farming across provinces.

Information	Personal Information Sources		Public Information Sources		Mass Media Sources	
Technical Information						
1. Seed variety	0.95	VU	0.88	VU	0.80	VU
2. Land preparation	0.90	VU	0.85	VU	0.76	VU
3. Weather forecast	0.93	VU	0.88	VU	0.80	VU
4. Soil management	0.85	VU	0.76	VU	0.66	VU
5. Fertilizer application	0.93	VU	0.85	VU	0.76	VU
6. Disease and pest control	0.42	MU	0.42	MU	0.57	MU
7. Use of machinery	0.42	MU	0.69	VU	0.57	MU
8. Harvesting techniques	0.67	VU	0.74	VU	0.57	MU
9. Storage methods and techniques	0.66	MU	0.61	MU	0.61	MU
Mean	0.74	VU	0.74	VU	0.68	VU
Economic Information						
1. Current market prices	0.85	VU	0.76	VU	0.71	VU
2. Future market Prices	0.88	VU	0.76	VU	0.73	VU
3. Market locations	0.67	VU	0.73	VU	0.76	VU
4. Budgeting methods	0.78	VU	0.78	VU	0.74	VU
5. Credit sources	0.68	VU	0.71	VU	0.74	VU
6. Procedure for credit procurement	0.68	VU	0.68	VU	0.71	VU
7. Stock/record keeping	0.74	VU	0.67	VU	0.67	VU
8. Cooperative association	0.69	VU	0.67	VU	0.67	VU
9. Labor availability	0.90	VU	0.76	VU	0.74	VU
10. Risk management in agriculture	0.73	VU	0.68	VU	0.74	VU
11. Government policies	0.68	VU	0.66	VU	0.68	VU
12 .Government grants	0.69	VU	0.75	VU	0.69	VU
Mean	0.74	VU	0.72	VU	0.72	VU

Legend: 0.67 – 1.00 Very Useful (VU)

0.34 – 0.66 Moderately Useful (MU)

0.01 - 0.33 Slightly Useful (SU)

0 Not Useful (NU)

Useful of Information from Public Information Sources

The average mean score obtained on the perceived usefulness of technical information from the PuIS was 0.74 which fall under the *very useful* category. Six items were rated *very useful* with scores ranging from 0.69-0.88 such as seed variety, weather forecast, land preparation, fertilizer application, soil management, and harvesting techniques. The other three, disease and pest management, use of machinery, and storage methods and techniques were *moderately useful* with scores ranging from 0.42-0.61. The result implies that the corn growers consider he technical information beneficial and advantageous. On economic information, mean useful of information obtained from the PuIS was 0.72 rated as *very useful*. Individual scores on the various components showed that all obtained scores ranging from 0.67 – 0.78, all are *very useful*.

Usefulness of Information from Mass media Information Sources

A mean score of 0.68 was obtained from the MmIS indicating that the technical information sought from

them is *very useful*. Individual scores revealed that five items scored mean values of 0.66 – 0.80, all fell under the rating of *very useful,* while four scored 2.61-3.22 which were under the *moderately useful* category. Notably, all components categorized under the economic information, obtained scores that fall under the *very useful* category. The scores ranged from 0.67 – 0.74 with a mean of 0.72.

It is interesting to note that despite the low scores on the frequency of contact with public and mass media information sources, the technical and economic information sought are all considered very useful. In a case study, Ramirez (1997) pointed out that, in all communities they visited, the agricultural information which had reached the users was found to be at best, limited, and in most cases, inadequate. In the case of the corn growers in this study, the information generated from the PuIS during their once in a while visit might have been the best and found to be useful to them. It can be construed that corn growers have high regard and confidence to knowledge and information sought from PuIS. Therefore, the role of the PuIS in this scenario is wanting.

Total Information Score

This variable refers to the degree of information contact between the corn growers and their information sources. The degree on information contact was categorized into three main groups according to the information scores (IS) of each source (Table 3). These are weak (IS>74), moderate (75<IS<149) and strong (>150).

Based on the result, personal information sources obtained a mean of 224.25 IS which is within the range of IS >150. The family members obtained the highest mean score (240 IS), followed by relatives (230 IS), friends (229 IS) and co-corn growers (198 IS). The scores obtained indicates strong information contact between the corn farmers and their personal information network. The result further implies that there is a very good level of information exchange between and among their personal information sources. This finding could also mean that knowledge and experiences on corn farming revolve around the personal network of the corn growers. The public information sources obtained a mean of 70.4 IS. This value falls within the IS>74 indicating a weak information exchange between the farmers and public information sources. This finding implies that there is low contact of farmers with the public information sources. Hence, the farmers do not get frequent information from agricultural technicians, university extension workers, researchers and experts. Among the mass media sources, mean IS obtained was 40.33. The score falls within the <74 IS indicating a low information score. However, TV and radio obtained mean of 127 IS and 110 IS, respectively. Both scores fall within the medium information score. The result implies that farmers also generate information from TV and radio but however, it is limited. This maybe because, there are only few programs or channels with tackle agricultural information or messages do not address information needs of farmers.

Table 3. Total Information Score for each component of the farmer's in corn information system in Amulong, Cagayan.

Sources of Information	Information Score	Description
Personal Information Sources		
Family member	240	Strong
Relatives	229	Strong
Friends	230	Strong
Co-corn growers	198	Strong
Mean	224.25	Strong
Public Information Sources		
Agric. Technician	113	Moderate
Univ. Extensionist	43	Weak
Researcher/ Experts	57	Weak
Chem. Company Technicians	71	Weak
Chem. Company Representative	68	Weak
Mean	70.40	Weak
Mass Media Information Sources		
Radio	110	Moderate
TV	127	Moderate
Newspaper	18	Weak
Farm Journal	20	Weak
Farm Primer	20	Weak
Brochure	63	Weak
Package of Technology	25	Weak
Leaflet	29	Weak
Poster	28	Weak
Internet	8	Weak
Cellphone	36	Weak
Mean	40.33	Weak

Legend: IS<74 – weak degree of information contact

75<IS<149 – moderate degree of contact

IS>150 - strong degree of contact

The result of this study showed a high total information score confirming a strong degree of contact with the PIS. It is noted that the traditional information seeking and sharing behavior between and among the farmers themselves is manifested. As opined by Churi *et al*. (2012) communication sharing of knowledge from farmer to farmer has remained to be the main methods despite of the inadequate reliability of information and experience shared among them. Information communication with fellow farmers is made easy through meetings in the village such as local beers places, market places, churches, or on their farms during *siesta* hours.

Other studies on agricultural information showed similar results that other farmers are the sources of information of farmers. However, there were different reasons why information sources outside the farmers' communities were not utilized. It was pointed earlier that in a case study on agricultural information, farmers' primary source of information was other farmers (Ramirez, 1997). It was mentioned that the agricultural technicians (ATs- formerly, extension workers) were not meeting the farmers' needs. Demiryurek, *et al.* (2008), pointed out that on the agricultural information system in dairy farming, raisers of dairy animals resorted to personal information sources due to the lack of information support from institutional sources. Similarly, in the case of the corn growers, information sought or shared from their personal network are the ones they practice in corn production. Public information sources such agricultural technicians, extension workers or experts/specialists seldom visit them, or they seldom sought information from them.

On the other hand, information seeking or linkages of the corn growers with sources outside their communities is extremely weak. When corn growers were asked if they tried to seek information from public information sources, the answer was "no". Some pointed out of the lack of time, while some others pointed out their geographical location hampered them from visiting agricultural offices or other public information sources to seek for information. In like manner, when some of the agricultural technicians who served as key informant in this study were asked if they regularly visited or conducted extension activities in the corn production communities, their answer was no. They reasoned out that office works, intervening tasks like preparation of reports and geographical location hamper them from regularly visiting the corn growers.

Personal interview with the corn growers revealed that there were some print materials distributed by chemical sales representatives and technicians like brochures, however, they are not being read. Moreover, it was also mentioned by most of the respondents, that they have cellphones but are seldom used for generating information on corn production. Likewise, they have low or no access at all to the internet. Those corn growers who have access, do not have the technical capability of browsing the internet. As pointed out by Churi *et al.* (2012), the application of information and communication technologies (ICT) has inadequately given farmers ability to access information for improved crop productivity despite the increased benefit. It was further emphasized that studies have shown that the use of ICT including internet, mobile phones, emails, community radio, TV, telecenters, computers are not fully utilized by farmers, especially in rural areas. This limitation has been a result of high cost of ICT services, low literacy level, low income and limited number of service providers in rural areas.

Conclusions

Based on the result of the study, the following information are generated

1. The information sources of the corn growers in Amulong, Cagayan include the personal, public and mass media sources. However, information exchange occurs more between and among the personal sources. Thus, the personal information sources namely family members, relatives, friends and co-corn growers comprise the communication network in corn growing.

2. Corn farmers are receptive to information provided to them. Information generated from the personal, public and mass media information sources are

considered very useful. Hence, the two-way exchange of information process, the source which are the experts,/specialists and extension workers and users of the information are crucial for an effective generation and utilization of relevant technologies.

3. A strong total information exists among and between the personal information sources. They share whatever available information, knowledge and experience the family members, relatives and co-farmers that they possess. Generation and diffusion or information exchange which composes the information system revolves within the personal network of the corn growers. Hence, they play active communication roles in the information seeking and sharing behaviors.

Recommendations

As a result of the study, the following recommendations are forwarded:

1. The high total information score recorded in the personal information sources reveals a strong interpersonal relationship among them. Therefore, channeling agricultural information directly to the farmers is an effective mechanism of information dissemination. As this mode can create a chain effect to other farmers, especially to those who had no chance of receiving the information from reputable sources.
2. Agricultural information generated from public and mass media sources are considered useful. Hence, it is recommended that agricultural technicians, extension workers and other public and media sources must intensify their agricultural information delivery systems, so that more innovative information or technology can be disseminated to the farmers. It can be done through more and frequent visits or contact with the farmers. It can be in the form of individual visits, conduct of tecno-fora, farmers' field day and even *lakbay aral*, Likewise, organizing them into agricultural information subsystems may be of great help.
3. Information dissemination therefore, especially from experts/specialists and extension workers is really required so that farmers could acquire and make useful decisions in their corn production activities. However, there is also a need to strengthen the link between the researchers, experts and the extension workers. This scheme facilitates the transformation of extension workers to be credible conveyors of information, information facilitators or information brokers. Likewise, local government units, the R&DE programs of higher education institutions (HEI) and other agricultural institutions, must recognize the importance of intensifying information delivery systems in a manner that agricultural technicians or extension workers must actively perform their roles of bringing the more relevant and timely information resource needs of the farmers.

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