Indicators for Gauging the Effectiveness of Dairy Extension in Ethiopia

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Abstract
Modern extension system is being undertaken since 1950s in Ethiopia. However, majority of the farmers still use traditional dairy practices. This study was carried out to assess the effectiveness of dairy extension in disseminating dairy technologies/practices. A cross sectional survey was employed using 50 extension workers in the area of livestock sector. Almost all the selected study variables were significantly influencing the effectiveness of dairy extension. The value of dairy extension effectiveness index was also low. It necessitates integrated strategy; capacitating extension workers; and selection of model farmers those represent the majority of the farmers in the jurisdiction area.
Keywords: Dairy extension, dissemination, extension effectiveness index, extension worker

Introduction
Modern extension system which had been started in 1950s in Ethiopia is actively disseminating the improved dairy practices to the end users. Scaling up of agricultural technologies and best practices program have become part of this initiative. The Ethiopia government has designed mechanisms to improve the access of the farmers to agricultural technologies. The first effort is establishing agricultural extension wing in the research organization which is mandated to undertake extension research, technology demonstration and popularization. Agricultural Development Partners Linkage Advisory Council the then Research-Extension Advisory Councils at different stages (federal, regional and zonal levels) were also established in 2008. Though different extension systems were used previously, the country has formulated Participatory Demonstration and Training Extension System (PADETES) in 1995. The main objectives of PADETES are: 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. Currently, PADETES promote packages on cereals, livestock, high economic value crops, improved postharvest technologies, agro-forestry, soil and water conservation and beekeeping developed for different agro-ecological zones (Anandajayasekeram *et al*, 2008). Though such efforts are made, farmers' utilization of improved farm technologies is minimal and stagnant. As a result, the gap between resource rich and resource poor farmers is escalating. On the other hand, the field-level extension service has a strong foundation of Farmers Training Centers (FTCs) and trained development agents (DAs) already in place in the field. About 8,489 FTCs have been established throughout Ethiopia, and about 62,764 Development Agents (DAs) have been trained in total, with a reported 45,812 staffed on location (IFPRI, 2010).

In Ethiopia, there are about 12.9 million rural households. As a result, the current development agent/farmer ratio is about 1:300 at the household level which is probably makes the country to have the highest development agent-farmers ratio. Though extension agent to farmers' ratio has improved, the coverage of Artificial Insemination technology is one per cent in the past six decades effort of research and extension works. About 0.15 per cent of rural livestock holders use improved forages such as alfalfa and Napier grass (CSA, 2008). Similarly, the use of industrial by-products like oil cake, bran and brewery residue is negligible (0.8%). Despite decades of research and development efforts, with the aim to provide farmers new technologies to improve their farming practices, agricultural productivity for both crop and livestock production is still very low" (EARO, 2006). FAO Statistical Database (2011) also evidently points out that globally, Ethiopia has the lowest average milk productivity (380 kg/ cow/ year) and only it precedes Nigerian (245 kg/ cow/ year/) and Tanzania (239 kg/ cow/ year).

Though dairy is a common farming enterprise and income-generating activity in Ethiopia, no systematic study has been undertaken to identify the effectiveness of dairy extension workers. Hence, this study was carried out to assess the effectiveness of dairy extension workers in disseminating dairy technologies (Artificial Insemination, improved feed and feeding, improved health practices and improved housing) to the end users

which will ultimately help to formulate a comprehensive policy for systematic development of dairying in Ethiopia.

Materials and Methods
Sampling techniques
This study was carried out in Ambo and Toke Kutaye districts of West Shewa zone in 2015. The districts were purposively selected due to the significant presence of dairy extension and the availability of information in line with the specific objective of the study.   According to Storck *et al*. (1991), the size of the sample depends on the available fund, time and other reasons and not necessarily on the total population. However, for this study out of 80 extension workers 50 respondents (62.5 per cent) of the population were selected from both districts through simple random sampling techniques.

Source and types of data
The study used both primary and secondary data. The unit of analysis for the study was dairy extension workers. Thus, primary data were collected from dairy extension workers. Secondary data were also collected from extension reports, bi-annual reports, journals and proceedings. Both qualitative and quantitative data types were used to address the objective of the study.

Method of data collection
Cross sectional survey was employed to collect the data for addressing the objective of the study. Comprehensive information is obtained through mixed methods such as Focus Group Discussion (FGD), Key Informant Interview (KII), questionnaire and observation. In line with the research objective, the questionnaire was prepared and pre-tested. The questionnaire mainly included personal characteristics, extension participation, infrastructure, responsiveness of improved dairy practices, extension management, extension policy, social participation and financial capacity. Information such as socio-economic background of respondents, levels of dairy technology dissemination, status of extension management, responsiveness of dairy technology and participation level of respondents in different activities of extension and social activities were generated.

Data analysis
To develop index of extension effectiveness, first the weightage of different indicators of extension effectiveness ranks were taken from the judges (extension professionals). For this purpose, the questionnaire was sent to 50 judges (extension professionals). Rank was converted to weightage following Alfares (2006). The mean values of sub indicators were calculated and taken as a weightage of that particular sub indicator. Weightage of each sub indicator was obtained in terms of 100 points out of sub indicators. Composite or total score of extension effectiveness was calculated by multiplying the score of each sub indicators by their respective weightage. To combine the score of different sub indicators measured using different units of measurement; the score was normalized before combination. Standardized scores for each sub indicators were calculated using the formula,

$$Z \text{ ind } i = \frac{X_i - X_{min}}{X_{max} - X_{min}}$$

Where, X_i, X_{max} and X_{min} are the original values for indicator i, for the highest value, and for the lowest value respectively.
Zind i=value of standardized indicator i
Then, the extension worker effectiveness values of each respondent was calculated by using the given formula

$$EEj = \frac{\sum_{j=1}^{n} Wi \, Z \text{ ind } ij}{\sum_{j=1}^{n} Wi}$$

Where,
EEj=extension effectiveness value of j respondent
Z ind ij= value of standardized indicator i for the j respondent
wi = summated value of weightage of all i indicators
Finally using total score of extension effectiveness of each respondent, they were classified into low, medium and high categories using cumulative square root frequency method.
To further identify the influencing sub indicators of extension effectiveness, ordered logistic regression model was employed. Additionally, data of Focus Group Discussion, Key Informant Interview and observation were

analyzed using content analysis. Content analysis is useful for examining the content of the qualitatively collected data (KII, FGD) to give meaning in line with the research question.

Ordered logistic regression model specification

Following Greene (2003), the ordered logistic regression has a general form of;

$$Pr\ (Y_i=1)= G\ (\delta_1-X\beta)=1/(1+exp(X\beta-\delta_1)$$
$$Pr\ (Y_i-2)=G\ (\delta_2-X\beta)-G(\delta_1-X\beta)$$
$$Pr\ (Y_i-J)= 1- G(\delta_{j-i})- X\beta$$

Where,

$Pr(Y_i-J)$ is the probability of that a household i to be in a high range of extension effectiveness index

βs are coefficients to be estimated;

X are predictors;

δ are cutoff points, where applicable;

The estimates $\beta_k, \delta_1, \delta_2\ldots\ldots \delta_{j-i}$ are obtained by maximizing the likelihood function using the logistic distribution function $G(\cdot)$.

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The dependent variable of the study is extension effectiveness (low, medium, high) that was determined using index; and independent variables of the study were hypothesized as follows;

Personal characteristics (score value weightage) (+)

Extension participation (score value weightage)   (+)

Infrastructure (score value weightage)   (+)

Responsiveness of improved dairy practices (score value weightage)   (+)

Extension management (score value weightage)   (+)

Extension policy (score value weightage)   (+)

Social participation (score value weightage)   (+)

Financial capacity of extension workers (score value weightage)   (+)

Results and Discussion

Personal characteristics dairy extension effectiveness index

Personal characteristics dairy extension effectiveness index was developed to estimate the competence of the extension workers to undertake dissemination of improved dairy practices. Skilled and experienced extension workers positively influence the dissemination of improved dairy practices. Figure 1 revealed that personal characteristics dairy extension effectiveness index was 60 per cent. Though the extension workers of field level were criticized for possessing inadequate skills and knowledge in the prior studies, their mean score is relatively in good position compared to the score of other sub indicators.

Extension participation effectiveness index

It includes participation of extension workers in extension planning, research problem identification, research review meetings, Agricultural Development Partners Linkage Advisory Council (ADPLAC) meeting etc. These activities develop the skills and experiences of extension workers to provide responsive dairy extension services. Figure 1 depicted that extension participation effectiveness index was 26 per cent. It pointed out that the participation level of the extension workers in the main extension activities was low. It implies that the extension activities of the study area were nearly non participatory. It further leads to provide slow and stagnant extension service.

Infrastructure extension effectiveness index

Infrastructure includes facilities that are required to dairy extension activities such as transport facilities, working office, demonstration sites, communication facilities etc. These play a decisive role for disseminating improved dairy practices. As revealed in Figure 1, infrastructure effectiveness index was 53 per cent. It implies that the infrastructure situation of the study area was in the medium level. It points out that extension organization is making considerable effort for fulfilling the infrastructure that is needed for undertaking effective extension activities.

Responsiveness of improved dairy practices

Responsiveness of improved dairy practices is a decisive factor in the process of improved dairy practice dissemination and adoption decision of the users. The improved dairy practice which is in line with the farmers` criteria can easily be disseminated to the clientele. As summarized in Figure 1, the overall responsiveness of improved dairy practices effectiveness index was 52 per cent. It indicates that the dairy responsiveness of

improved dairy practices of the study area was at medium level. It further implies that the dairy technology (improved practices) that were disseminating in the study area were not fully responsive to the needs of the clientele. It necessitates more collaboration works among dairy technology suppliers and users to make it more productive.

Extension management effectiveness index

Extension management includes all extension managerial activities of the organization such as planning, directing, staffing, decision making, monitoring and evaluation. The overall extension management effectiveness was in the low range of the index (39%) (Figure1). It apparently specifies the poor extension management of the study area. It further affects the overall performance of the extension activities of the study area.

Extension policy effectiveness index

The presence of clear extension policy and strategy sets a clear direction for disseminating problem solving dairy technology (improved practices). It has also great contribution for attaining the objectives of the dairy extension program. As depicted in Figure 1, the overall extension policy effectiveness index was in the medium range of the index (45%). It implies that the extension policy was not translated into action to the level of expectation. It further affects the overall performance of the extension activities of the study area. The result is in harmony with Van den Ban and Hawkins (1996) that states policy environment strongly affects the adoption of improved technologies.

Social participation effectiveness index

Social participation improves the interaction of the extension workers with the community which further builds up the trust with the community. Figure 1 summarized that the overall social participation of the respondents was in the low border of medium range (53%). It implies that the social participation of extension workers in the study area was nearly low.

Financial capacity effectiveness index

Financial capacity indicates extension workers` income in covering all family expenditures. Obviously, an extension worker who has inadequate source of income cannot exert all his time and energy to extension works. In the other way, more time is expended out of the organization for part time works for covering his/her family expenditure. Figure 1 revealed the cumulative financial capacity of the respondents was 32 per cent. The data indicates that the financial capacity of the respondents of the study area was low. This enforces the extension workers to run their own business to cover their family living expenses. Hence, the low financial capacity of the extension workers affects the overall performance of the extension activities of the study area.
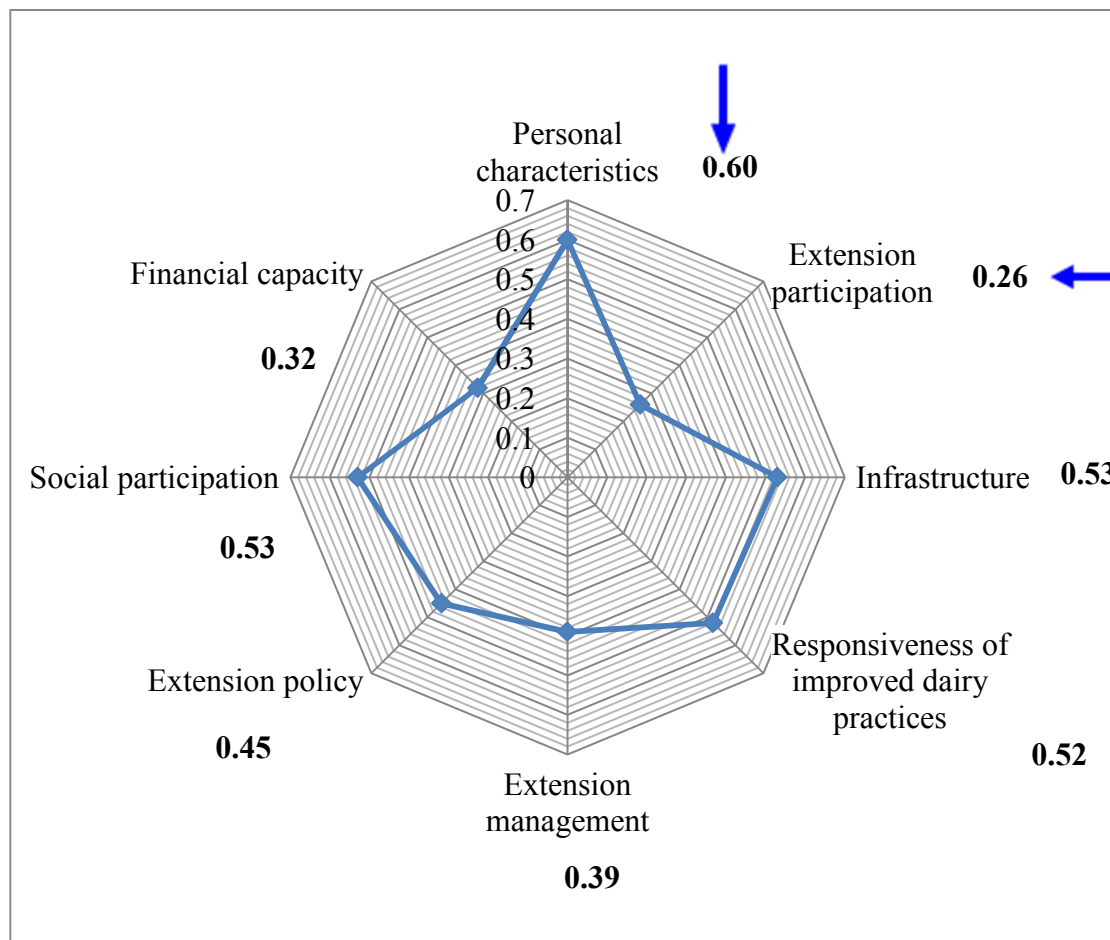
Fig.1. Mean score of extension effectiveness sub indicators
Source: Field survey, 2015

Factors influencing effectiveness of technology dissemination process of dairy production
The result of ordered logistic regression on effectiveness of dairy technology dissemination process is summarized in Table 2. The ordered logistic regression model is estimated using maximum likelihood method. The χ^2 result shows that the parameters are significantly different from zero at P<0.01 for the effectiveness of dairy technology dissemination process. The McFadden's R-square or Pseudo R^2 is 0.744, indicating that 74.4 per cent of the variations in probabilities of getting in high level of effectiveness dairy technology dissemination process was explained by the selected explanatory variables.

Among the explanatory variables taken to the model, personal characteristics, extension management, policy environment, responsiveness of improved dairy practices and social participation were found to be significantly influencing the effectiveness of extension services of the study area (Table 1).

Table 1: Factors influencing dairy extension workers for disseminating dairy technologies

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[category = 1.00]	96.086	42.231	5.177	1	0.023
	[category = 2.00]	107.944	47.127	5.246	1	0.022
Location	Personal characteristics	21.903	10.056	4.744	1	0.029**
	Extension participation	-1.158	4.661	.062	1	0.804
	Infrastructure	7.663	7.155	1.147	1	0.284
	Responsiveness of improved dairy practices	24.727	12.738	3.768	1	0.050**
	Extension management	49.969	25.679	3.787	1	0.050**
	Extension policy	65.718	33.012	3.963	1	0.047**
	Social participation	36.162	18.549	3.801	1	0.051**
	Financial capacity	-6.309	16.383	.148	1	0.700

-2 Log Likelihood	95.397		Cox and Snell	0.758
Chi-Square	70.945	Nagelkerke		0.890
df	8		McFadden	0.744
p-value	0.000			

Source field survey, 2015   **, significant at P<0.05

Conclusion

The dairy extension effectiveness index evidently revealed the low level of extension effectiveness for the respondents in the study area. The combination of index value and ordered logistic regression vividly indicated the existing status and influencing factors of dairy technology dissemination in the study area respectively. Thus, it necessitates the integrated action of multi-actors (research, extension, livestock agency etc.). Well designed system in which these actors are clearly operating is the need of the hour. Likewise, capacitating extension workers needs to be a priority task for realizing the expected achievement from the sector.

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