Factors Affecting the Adoption of Technologies on Goat Production Taught through the FLS-GEM* in the Philippines

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***Abstract*—The Farmer Livestock School Goat Enterprise Management (FLS-GEM) is an extension modality that teaches farmers the rudiments of goat raising for 12 weeks. It involves "bit-sizes" of technologies to enable the adult learners to understand fully the rudiments of goat raising thru hands-on experiences and farm experimentation. The major management system adopted was tethering before enrolling in the FLS-GEM to partial confinement after six months and partial confinement two years after graduation then onwards. The other technology mixes adopted were provision of housing, establishment of pasture areas, strategic deworming, stall feeding and upgrading. In Region 1, the significant factors affecting the adoption of technologies were availability of forage garden, rice and corn as the major commodity with a coefficient of determination of 0.7954. The regression equation is y=286.68x-48.811. In Region 2, the major factors affecting the adoption of technologies were rice as the major commodity planted in their farms and the number of goats raised with a coefficient of determination of 0.7058. The regression equation is 139.46x+2.805. Region 8 has coconut as its major commodity raised and the factors affecting the adoption of technologies were availability of forage garden, age and educational attainment with a coefficient of determination of 0.9427. The factors affecting the adoption of technologies in Region 10 were rice as the major commodity raised in their farms, availability of labor and number of goats raised with a coefficient of determination of 0.94266 and the regression equation is y=306.42x-55.682. In Region 12, the factors affecting the adoption of technologies were educational attainment, ease of operation and better income and the regression equation is y= 279.40x-54.292 .On a national scenario, the availability of labor was the significant factor affecting the adoption of technologies with a coefficient of determination of 0.9593 implying that 95.93% cause of the adoption of technologies was due to labor availability while the other factors could be attributed to experimental errors. The regression equation is y=6.6356 x + 0.1565. This proves that the adoption of technologies differed from one region to another depending on the characteristics of the farmers trained and the available resources in the locality.**

***Index Terms*—Farmer Livestock School-Goat Enterprise (FLS-GEM), adoption, technologies, goat raising**

I. Introduction

A national goat research project entitled "National Goat Farm Performance in the Philippines was conducted in 2008-2010 to monitor the farm performances among the backyard and commercial goat farms in the five regions in the Philippines without introducing technologies to the goat raisers. It was observed that among the five regions where the study was conducted, the performances of the does and kids were poor. Kidding interval at backyard and commercial farms stood at 8.37 and 8.67 months, respectively, which were longer than the target of 8 months under the goat Industry Strategic Plan (ISP). This relatively longer kidding interval resulted in lower kidding index or less productive cycles for the does. Because of poor dam performance, the resultant offspring also suffered. Kid mortality within the pre-weaning months were 18.2% and 14.7% for Backyard Farms (BF) & Commercial Farms (CF), respectively, which increased to as high as 41.2% in calamity-stricken areas. Overall, herd mortality for the 3-year observation period was high at 28.8% and 28.4% for BF and CF, respectively [1]. Kids that survived weighed on average 16kg and 20kg at 8 months for BF and CF, respectively. These data, which are below the ISP target of 30kg, represent the actual performance of majority of goat farms that have not been reached by technological interventions. Those reached by project interventions of another PCAARRD-funded project, *Upscaling Rural Enterprise Development thru Innovative Goat Production Systems (URED)*, performed better in just two years [2]. URED preweaning mortality was on average 10.7% while slaughter weight was 24.6kg. URED kidding

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interval was 237days and conception rate, 91%. This showed that with proper technological interventions and training, goat raisers can really improve farm performance. Hence, the FLS-GEM extension modality was used to train goat raisers in the six participating regions in the Philippines.

The FLS-GEM is a technology transfer that was developed Anna Marie P. Alo of DOST-PCAARRD for teaching adults with goat as subject for training [3]. It focuses not only on the technologies of raising goats but also on building enterprises. The curriculum consists of the following management practices: 1) Production and Housing, 2) Feeding, 3) Breeding, 4) Health 5) Ecological and Nature and (6) Enterprise Development. It is a long-season process of teaching adults and involves "bit-sizes" of technologies to enable the learners to understand fully the rudiments of goat raising. It allows the adult learners to have take-home assignments and experimentation in their own farms. This allows the farmers to have hands-on experiences in testing alternative technologies and assessing their relevance to their needs. This extension modality acknowledges the farmers' ability to mix-match options suited to the farmers' endowments. [4]

The FLS-GEM modality was used initially to train community facilitators and eventually farmers. For this, the *Community Facilitators' Manual on Goat Enterprise Management* (GEM) was initially packaged. In addition, the requirements on farm recording were incorporated.

This paper discusses the factors affecting the adoption of technologies on management practices of the farmers in Regions 1, 2, 3, 8, 10 and 12 regions in the Philippines.

II. Materials and Methods

Development of Modules: The key members of the National Science and Technology on Slaughter Goat Research and Development Program that was funded by the DOST-PCAARRD assessed the matured technologies that have been generated from previous Science and Technology endeavors. These matured technologies were included in development of the Session Guide and Technical Modules of the FLS-GEM extension modality in addition to the modules used in the Integrated Goat Management options that were initially developed. [3] Additional technologies and goat enterprises that were newly developed were also incorporated.

Training of the Facilitators: After the development of the session guides, technical modules and powerpoint presentations, a national trainors' training consisting of 23 participants was conducted in which at least three members consisting of a technical person (Animal Science of Veterinary Science major), a social scientist and an economist composed the team of the six participating regions. After the 12-weeks national trainors' training, the regional team also trained at least 40 regional trainers who in turn trained the farmers. The regional trainings were done simultaneously in the six participating regions. Aside from the technical aspects of goat production, the trainors were also trained the rudiments of teaching adult learners. The total number of farmers trained within two years was 2,539 in the six participating regions.

Farmers Trainings: Simultaneous trainings at the farmers' level in the Local Government Units (LGUs) were conducted in the six participating regions in the Philippines. This methodology ensures a more widespread and wider scope of training farmers at a wider scope using the same modality. Each regional trainer would have produced 400 farmer trainees in the three years duration of the project. To assess the impacts of the FLS-GEM trainings in the six participating regions, 10% of the farmers trained per region were tagged as cooperators in which monthly farm performances were monitored on a monthly basis. These farm performances included the inventory, dam performance, kid performance, health, inflow and outflow. Furthermore, the adoption of technologies and impacts of the trainings were analyzed on a regional basis.

Determination of the Adoption of Technologies: The degree of adoption was determined using the technology testing timeline method. The timelines were clustered into three such as before attending the FLS-GEM, during the FLS-GEM training and after 2 years onwards from FLS-GEM graduation.

Statistical Analysis: From the monitored farms, 10% of the farmers trained per region were sampled as discussants using the Focal Group Discussion method. The adoption of technologies were analyzed using the stepwise regression analysis following the statistical procedure of Microsoft Excel 2013. The adoption pattern of technologies as the dependent variable was assumed to be affected by different independent variables such as availability of forage garden, age, educational attainment, major commodity, labor, number of heads of goats, ease of operation, safety of animals from thieves, predators and increment weather, resource endowment, preserves relationship among neighbors, improved productivity of goats and better income/financial security from goat proceeds.

Sites of the Participating Regions: Fig. 1 shows the sites where the project was conducted. There were 6 regions, 20 provinces and 86 municipalities or local government units where the FLS-GEM trainings were conducted.

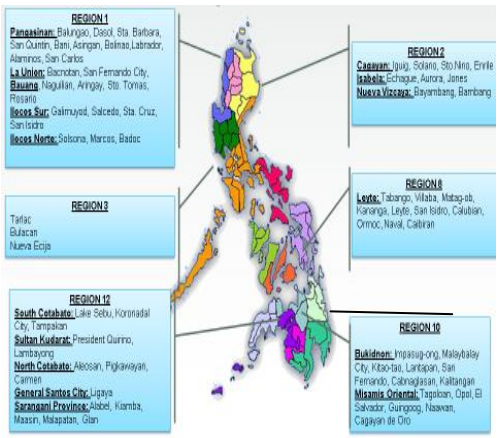

Figure 1. The six participating regions where the FLS-GEM trainings were conducted.

III. Results and Discussion

A. Technology Timeline of the FLS-GEM Graduates after Two Years

An assessment of the impacts of the FLS-GEM trainings was conducted using the focal group discussion using 10% of the total graduates per region. From the 10% randomly selected attendees to the focal group discussion, only those who had already graduated for two years or more were assessed. Based on these, there were 78 attendees who have qualified for the technology timelines. The technology timelines were classified into three as: (1) before the FLS-GEM training, (2) during the FLS-GEM training and, (3) two years after graduation.

As shown in Table I, there were 89.74% of the FLS-GEM graduate-discussants who tethered their goats before the FLS-GEM training then shifted to partial confinement during the FLS-GEM training and maintained partial confinement two years onwards after graduation. In addition, the other technologies that were adopted by this group were: (1) housing with 44.57% adoptors, (2) 51.43% practiced stallfeeding with 51.43% adoptors, (3) 51.43% adopted forage area establishment with 51.43% adoptors, (4) upgrading with 29% adotors using the natural breeding, (5) upgrading using AI and (6) 7.14% adopted waste management.

TABLE I. Frequency of FLS-GEM Graduates Who Have Graduated for More than Two Years with Their Technology Mixes Adopted (n=78)

ADOPTION	REGION						NATIONAL	
PATTERN	1	2	3	8	.0	12	N	%
A. T*-PC**-PC**	29	0	0	1	8	32	70	89.74
Others								
1.Housing	29	0	0	1	0	4	(34)	48.57
2.Stall feeding	25	0	0	0	0	11	(36)	51.43
3.Forage garden	29	0	0	1	0	9	(39)	55.71
4. Upgrading								
i.Natural mating	19	0	0	1	0	9	(29)	41.43
ii. AI	10	0	0	0	0	0	(10)	14.28
5.Waste Management	15	0	0	0	0	5	(5)	7.14
B.PC**-CC***-CC***	0	0	0	0	0	5	5	6.41
Others								
1.Housing							(5)	100.00
2.Stall feeding							(2)	40.00
3.Forage garden							(5)	1100.00
4. Upgrading								
i. Natural mating							(5)	100.00
5.Waste management							(5)	100.00
ADOPTION	REGION						NATIONAL	
PATTERN	1	2	3	8	.0	1 2	N	%
C.FG****-PC**-PC**	0	0	0	0	2	0	2	2.56
Others								
1.Housing					2		(2)	100.00
2.Stall feeding					2		(2)	100.00
3.Forage garden					2		(2)	100.00
D. T* - CC***-CC***	-	-	-		1		1	1.28
Others								
1.Housing					1		(1)	100.00
2. Stall feeding					1		(1)	100.00
3.Forage garden					1		(1)	100.00

Legend: T*-tethering; PC**- Partial confinement; CC***-Complete confinement; FG****-Free grazing

There were 6.41% of the total discussants on technology timeline who adopted the partial confinement then shifted to complete confinement to complete confinement as their technology pattern. The other technologies adopted by this group were housing (100%), pasture management (100%), upgrading using the natural mating (100%) and waste management (100%). There were 40% who adopted stall feeding.

There were 2.56% who adopted free grazing before their attendance to the FLS-GEM training then to complete confinement during the training then to complete confinement. The adoptors of this major technology also adopted housing, stall feeding and forage garden establishment.

There was one (1.28%) of the FLS-GEM graduate discussants who adopted tethering then shifted to partial confinement then to partial confinement. The other technologies adopted by this lone discussant were housing, stall feeding and forage garden.

As shown in Table II, the main reasons of adopting the technology patterns according to rank were (1) ease of operation, (2) better income, (3) improved productivity of goats as increase in weight and reduced sickness/ occurrence of parasites. Goats are browsers, hence they tend to destroy the plants of the farmers' neighbors. One of the reasons why they adopted the major adoption pattern was to preserve the relationship among neighbors that ranked no. 5 and goats also served as resource endowments that ranked number 6.

TABLE II. Reasons of Adopting the S and T Technology Options

REASON	RANK
Ease of operation (can do other errands simultaneously anytime)	1
Safety of animals from thieves, predators, inclement weather	4
Resource endowment (availability of land, labor and capital)	6
Preserves relationships among neighbors (prevents annoyances)	5
Improved productivity of goats (improved weight, increased resistance to illness)	3
Better income	2

B. Factors Affecting Adoption Pattern

Different factors affecting the adoption pattern were identified and analyzed using the stepwise regression analysis following the statistical procedure of Microsoft Excel 2013. The adoption pattern as the dependent variable was assumed to be affected by these variables: availability of forage/pasture areas, age, educational attainment, major crop planted in the farm, number of labor, number of goats raised, ease of operation, safety of animals from thieves and predators, resource endowment, preserves relationship among neighbors, improved productivity of goats and better income/financial security from goat proceeds. [5] Each region had its own characteristics, hence the factors affecting adoption pattern also differed.

As shown in Table III, the significant factors affecting the adoption patterns in Region 1 were (1) availability of forage gardens, (2) major crop planted in the fields, (3) number of goats raised and (4) ease of operation. The major crop planted in their field and the number of goats were directly related to the adoption of technologies while the ease of operation was inversely proportional to the adoption pattern. This means that if rice and corn were the major crops planted in their fields, more FLS-GEM graduates would have adopted the tethering to partial confinement to partial confinement adoption pattern. Goats have the tendency to destroy crops, hence there is a need to adopt partial confinement. In addition, the more the number of goats raised by the FLS-GEM graduate, the higher is the tendency to adopt the tethering to partial confinement to partial confinement adoption pattern. The coefficient of determination was 0.7954 indicating that 79.54% of the variations in the adoption pattern of the FLS-GEM graduates were due to these factors while the remaining factors could be attributed to other reasons including experimental errors and the characteristics of the graduates. The regression equation is Y=286.68 x -48.811.

TABLE III. SIGNIFICANT REASONS AFFECTING THE ADOPTION PATTERNS OF THE FLS-GEM GRADUATES

FACTORS	1	2	8	10	12	National
Availability of forage garden	0.000	0.000		0.000		
Age			0.000			
Educational attainment			0.000		-0.012	
Major commodity		0.0095	0.000	0.000		
Labor				0.0018		0.000
Number of goats	0.0018	0.000		0.0004		
Better income					0.000	
Safety of animals					0.000	
R^2	0.795	0.705	0.942	0.771	0.631	0.989

On the other hand, the factors affecting the adoption of technologies in Region 2 as shown in Table III, were (1) major commodity planted in the fields and (2) number of goats. There was an inverse relationship between the major commodity which is rice to the adoption pattern which implies that if the major crop planted in the fields is rice, the lesser is the chance of adopting the partial confinement. Compared to Region 1, Region 2 has a bigger landholding of 2has compared to Region 1 which is around 450 square meters. As such, goats were just let loose in the rice fields. As stated by a majority of the focal group discussion, the animals are let loose or the farmers practiced the free grazing pasture management if they rice as the second crop. The coefficient of determination was 70.58% indicating that the variation in the adoption pattern could be attributed to these factors while the remaining percentage were due to the other factors including the experimental errors. The regression equation is 139.46x + 2.805.

The results of the Stepwise regression analysis in Region 8 as shown in Table III, reveals that the significant factors affecting the adoption of technologies were age, educational attainment and major commodity. Coconut was the major commodity in Region 8. These factors have direct relationships with the adoption pattern. Majority of the FLS-GEM graduate discussants in Region 8 were aged 40-60 years old, hence they can still manage to feed their goats through partial confinement. Most of the FLS-GEM graduates let loose their animals for at most 4 hours during good weather and stall feed them the rest of the day. In addition, majority of the FLS-GEM graduates were high school graduates, thus they do not have jobs that require them to stay at least 8 hours in their job sites. In addition, coconut is the major commodity of Region 8, thus their goats can still graze beneath the coconut trees for some hours in a day and go home their houses at night time.

Table III further shows that the factors affecting the adoption of technologies in Region 10 were (1) major commodity raised in the farm, (2) availability of labor and (3) number of goats. There was an inverse relationship between the availability of labor and the adoption pattern of technologies indicating that as the number of available of labor increased, there was a decrease in the number of technology adoptors. Rice and corn are the major crops planted in the fields of the FLS-GEM graduates in Region 10. Like in Region 2, the average landholding averages 4 has. The big landholdings in Regions 2 and 10 provides enough pasture areas for the goats at the backyard level to graze after harvesting rice. Most often, the goats are let loose in the pasture area for about 4 hours and then confined the rest of the day. The coefficient of determination (R^2) is 77.08% which could be interpreted that 77.08% of the variation in the adoption pattern is being attributed to four (4) significant factors as mentioned, while 22.92% was due to errors and other factors. The regression equation is y=306.42x-55.6823.

The adoption pattern of technologies in Region 12 were (1) educational attainment (2) ease of operation and (3) better income. There were direct relationships between the ease of operation and better income to the adoption pattern, however, an inverse relationship was observed between the educational attainment versus the number of adoptors of the technologies. This implies that the less educated farmers had a higher percentage of adopting the technologies taught by the FLS-GEM training and furthermore, they are more receptive in adopting science-based technologies compared to the educated goat raisers. The coefficient of determination (R2= 0.6314) indicating that the adoption pattern of technologies was 63.14% due to these factors while the rest were due to other factors including experimental errors. The regression equation is y=279.4x-54.2923.

On a national level, the stepwise regression analysis following the statistical procedure of Microsoft Excel 2013 as shown in Table III, reveals that the availability of labor significantly affected the adoption pattern of the

FLS-GEM graduates in the country. This factor has a direct relationship with the degree adoption of the technology. The coefficient of determination was 0.9593 which means that 95.93% of the factors affecting the degree of adoption of the FLS-GEM graduates were due to the availability of labor. The other factors were due to experimental errors. The regression equation is y=6.6356 X + 0.1565. Findings of this study confirm with the findings of Alo and Venturina in 2005 [6].

IV. Conclusions

Based from the results of the study, it can be concluded that the adoption pattern of a majority of the FLS-GEM graduates was tethering to partial confinement to partial confinement in combination to the other technology mixes as housing, stallfedding, forage garden establishment, upgrading and waste management. The top three reasons cited for the adoption of this technology mixes were ease of operation, better income and better performance of their goats due to improved gain inweight and better resistance to diseases. On a national scenario, the significant factor affecting the adoption the technology mixeswas the availability of labor. The significant factors affecting the adoption patterns amon the six participating regions differed from one region to another.

V. Recommendation

The partial confinement is the best recommended management for goat raising in combination to the other technologies to be adopted depending on the availability of the resources and the endowment of the goat raiser.

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