

Awareness of Green Technologies among Dairy MSMEs in Cagayan Valley an Administrative Region in the Philippines

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Abstract Dairy is one of the growing and promising industries in the Cagayan Valley region. There were concerted efforts made by the government, non-government, and people's organizations to design a road map on Dairy for Cagayan Valley. This industry little by little has gotten bigger considering the greater demand for dairy products in the market. Better management and proper health care of dairy animals are important for maintaining higher productivity. Looking at economic development, the environment has been sacrificed in any case. The world is facing climate change because of economic development, the industrialization productions of goods, over-harvesting of natural resources, and left behind the restorations of a degraded environment. Though at present, the government of various countries made an initiative to mitigate climate change. In the Philippines, various laws and programs are a concern for the environment which is implemented and observed by all government agencies. In the case of Cagayan Valley, before the massive production of dairy in the region, the dairy Micro Small Medium Enterprises (MSMEs) are evaluated for their awareness of green technologies and assessed the determinants that influence the level of awareness and mitigate climate change. This study was conducted in Cagayan Valley covering Isabela, Quirino, Nueva Vizcaya, and Cagayan provinces from 2018 to 2020

with the Dairy Micro Small Medium Enterprises operating in the region as respondents and was selected from the list provided by the Department of Trade and Industry and the Department of Agriculture through the National Dairy Authority. A semi-structured questionnaire was used and conducted Focus group discussion, Problem Analysis, Key Informant Interviews, Environmental Scanning, and Strength, Weaknesses, Opportunities, and Threats analysis. The data were processed using descriptive-inferential statistics. The assessment on the level of awareness of the technologies was rated high with a weighted mean of 3.85 percent. The assessment for environmental practices of the dairy farmers/MSMEs is rated very good with 3.9 weighted means. As to the problems and constraints encountered by the dairy farmer, the dairy farmers have highlighted the insufficient technical and financial support from the authorities for green technologies. They have noted the lack of technical know-how and been told that there will be an added cost to their operation, while the least that they have mentioned are very costly and have no sources of capital for acquisition and implementation, and difficulty to integrate with their existing dairy operations.

Keywords Awareness, Green Technology/s, Greening, Dairy, Dairy Industry

1. Introduction

For a long time, agricultural production has been using modern technologies that usually utilize synthetic chemicals in the production and processing of the products. These resulted in the degradation of the natural resources and biodiversity on the farm. The quality of the products was affected, finding the high content of chemical residues that affect the health of the consumers. There are efforts made by the government through the Department of Agriculture by providing measures on the problems in the production and processing of products. They introduced the organic-based production of crops and animals. Organic production protocols have been set for farmers to follow as an option for the use of toxic chemicals. Various conferences, seminars, and training were conducted on this issue specifically to its adverse effect not only on food consumption but also on the environment. Due to the excessive use of chemicals in farming that emitted toxic gasses into the atmosphere, the environment is intensively affected by it which contributed to climate change. There are programs implemented to get rid of the problems in the environment as emphasized by the Department of Environment and Natural Resources (DENR) as one of their mandates.

Green technologies were evolved to alter and minimize the effects of the environment in the production and processing of the products. This is new and it needs skills and knowledge to implement properly. There are four (4) best green practices that have been implemented in the Philippines 1. Implementing the laws and ordinances for the environment; 2.) Having an efficient waste management system; 3.) Creating a sustainable public transportation system, and 4.) Devoting more areas to green public space.

In recent years, the national government has passed legislation to address environmental degradation. The Clean Air Act of 1999 and the Philippine Water Act of 2004 protects the environment and water. The Philippine Ecological Solid Garbage Management Act of 2000 was enacted to enhance people's waste disposal practices. Meanwhile, RA 9729, also known as the Climate Act of 2009, was passed to help develop ways to help minimize the adverse effects of climate change. Local government units (LGUs) are implementing long-term solutions to limit the use of plastic bags and other plastic-based materials in food establishments, grocery shops, supermarkets, and retail outlets are switching to paper bags, which reduces the use of plastic significantly.

Solid waste management is one of the escalating issues plaguing Metro Manila. According to studies undertaken by the National Solid Rubbish Management Commission Secretariat, a single person produces 0.5 kilograms of waste every day in Metro Manila. Considering that the metropolis has a population of roughly 10.5 million people, the total garbage generated daily amounts to 4,762,720 kilos each

day. Many cities have devised effective waste management systems to address this issue. They set up a materials recovery facility (MRF) in local barangays where rubbish is correctly sorted into organic waste, non-biodegradable, biodegradable, and residual trash. Residents are also encouraged to follow the 3Rs (Reduce, Reuse, and Recycle), separate their trash properly, and engage in cleaning drives and other clean-up activities.

Based on the article of ABS-CBN news, vehicles are the most polluting source in Metro Manila. According to the Department of Environment and Natural Resources (DENR), mobility sources (i.e. transportation/motor vehicles) are responsible for the 80percent of air pollution. The remaining 20percentage originates from stationary sources such as industries, industrial facilities, and road dust, to name a few. The building of environmentally friendly public transportation to replace obsolete and clunky Jeepneys and buses is one of the most popular. E-Jeepneys, e-shuttles, and e-tricycles are some of the green public transportation options available in several places.

In the dairy industry sector, there are also greening technologies implemented to impart measures to control the adverse effect of the environment in the dairy industry. In the case of the Cagayan Valley region, it has been introduced to the selected dairy farms the green corn silage as feed to the animals, solar-powered irrigation for forage production, biogas digester for methane gas collection from manure, and e-tricycle for the transportation of dairy products from farm to market. These are not conventional practices of the dairy farmers in the said locality. Since these are new to them, they might not aware of the purposes of these greening technologies.

Productivity of micro, small and medium enterprises (MSMEs) for dairy will be affected based on their level of awareness of the said technologies introduced to the dairy farmers. Full adoption and utilization of the technologies will be needed for better awareness of them among the stakeholders, especially the farmers. Thus, the conduct of this study. Profiling of the dairy farm is a key aspect in generating the assessment of the viability of the green technology to be adopted by the farmers as a method of increasing their productivity and efficiency in farming, such as greening technology in dairy production as opined in the study conducted [1].

Generally, the study assessed the awareness of green technologies among dairy Micro, Small, and Medium Enterprises (MSMEs) in Cagayan Valley; Specifically, the study would like to determine the profile of the MSMEs in the region; assess the awareness of the Dairy MSMEs on green technologies in Cagayan Valley; Assess the determinants that influence to the level of awareness of green technologies from among the Dairy MSMEs; Relate the awareness of Dairy MSMEs to the level of utilization and adoption on green technologies in Cagayan Valley, and recommend options to solve and improve the daily operations of Dairy MSMEs.

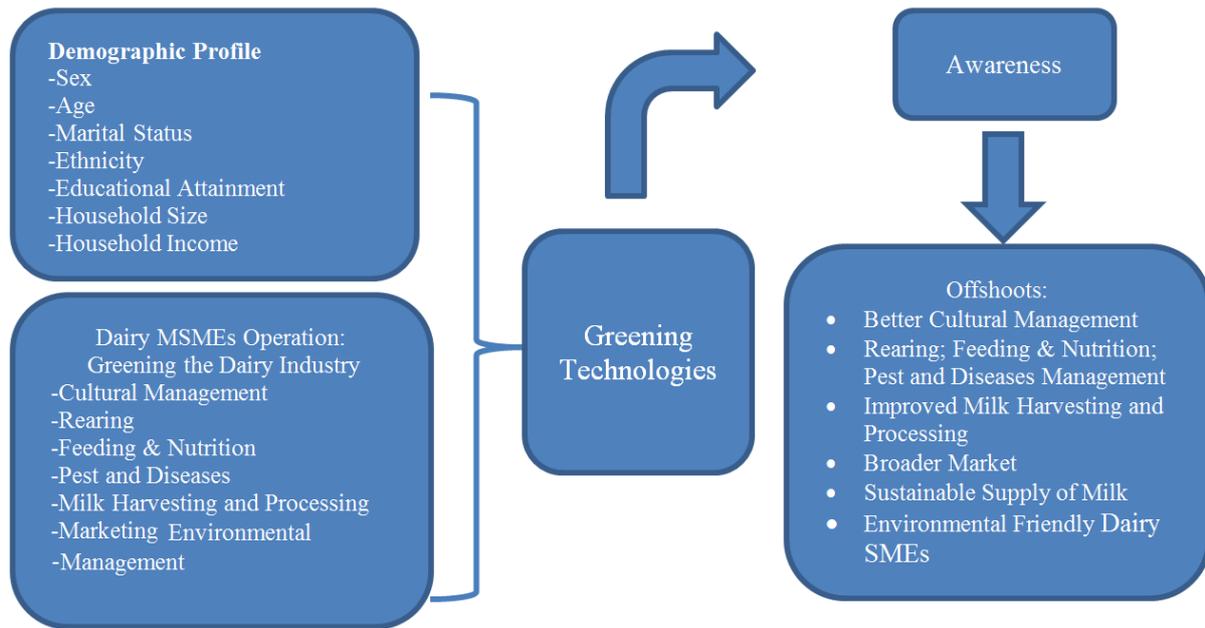


Figure 1. Conceptual Framework of the Study

2. Research Methodology

The study was conducted in Cagayan Valley covering Isabela, Quirino, Nueva Vizcaya and Cagayan provinces from 2018 to 2020. The respondents were the Dairy Micro Small Medium Enterprises operating in the region. They were selected from the list provided by the Department of Trade and Industry (DTI) and the Department of Agriculture through the National Dairy Authority (NDA).

Descriptive and inferential analyses were employed to treat the gathered data. Frequency, percentages, arithmetical mean, and standard deviation were used to analyze the data. Likert Scale was utilized to depict the responses of the respondents regarding the level of awareness of green dairy technologies. Inferential statistics such as the Chi-square test, multiple regression, and Person's Correlation analysis. The levels of significance were set at 10%, 5%, and 1% level of significance.

The primary data were gathered through the use of a semi-structured questionnaire that focused primarily on the demographic profile, level of awareness of Dairy MSMEs in Cagayan Valley. Other types of data gathering employed were: Focus group discussion, Problem Analysis, Key Informant Interviews, Environmental Scanning, and Strength, Weaknesses, Opportunities, and Threats analysis.

Other information relevant to organic rice farming published by concerned government agencies, NGOs, research agencies, gazette papers, etc. were considered as sources of secondary data.

3. Results and Discussion

Demographic Profile of the Respondents

There were ten (10) dairy farmers assessed in this study for their awareness of green technologies in dairy production. As shown in the result of the study, the majority of the dairy farmers interviewed were female, with an age ranging from 48 to 65 years. Most of them had an age range from 54 to 59 years with an average age of 57.70 years. The majority of the dairy farmers were married, of Ilocano ethnicity, and most of them had college educational levels. Mostly, the respondent's occupation was farming with years ranging from 1 to 27 years, but the majority of them have shorter years of farming experience with an average of 7.7 years. They were engaged in dairy farming from 2 to 8 years but most comprise of short dairying experiences with an average of 3.2 years. Farmers have dairy carabao as their farm animals, while other cattle or both animals.

The dairy farmers have a family member of 1 to 6 with 1 to 3 family workers in their dairying activities, but most of them have 3 to 4 with an average of 3 members in the family. The family workers had an average of 2 heads. All dairy farmers have sources of income from farming and a combination business and some as Overseas Filipino workers, however, 50 percent of them have sourced out their income solidly from farming. The farmer's household income is ranging from Php1, 000.00 to Php102, 000.00 monthly. It can be noted that most of them have a lower monthly income bracket from Php1, 000.00 to Php34, 000.00 with an average of Php31, 100.00. The dairy farmers mostly relay information from the seminars attended provided by the State University and Colleges (SUCs), Philippine Carabao Centers (PCC), and

Department of Agriculture (DA) for new technology that they can use in their daily operations. Around 50 percent of them have availed seminars on Total Mixed Ration provided by the ISU team while the rest from other providers. Dairy farmers have invested less in dairyfarming from Php10, 000.00 to Php60, 004.00 and most of them have spent Php26, 668.00 to Php43, 336.00 with an average of Php31, 501.80.

Only 22.2 percent of farmers had advanced secondary or higher education, according to the previous survey, which is better than the findings of [2]. About 46.1 percent of farmers had a small landholding and 35.6 percent had a medium landholding (less than 1 hectare), and there was no significant relationship between land size and dairy adoption. The findings contradict those of [3], who discovered a positive correlation between these two qualitative factors in their study.

Assess the Awareness of the Dairy MSMEs on Green Technologies in the Cagayan Valley

There are various green technologies for a dairy farm that are not much harmful or could affect the environment like silage making, solar-powered irrigation systems, biogas digester, electronic vehicles, vermin culture, composting, and wastes segregation. Table 1 shows the awareness of dairy farmers on green technologies in the Cagayan Valley.

For the practice of silage making as feed to dairy animals, the respondents have rated the high awareness which they believed for its usefulness and contribution to protect the environment by way of minimizing the emission of gasses during decomposition materials. In silage making, the silage substrates are stored in sacks with plastic lining to conserve and use the emitted gases for rapid decomposition and production of good bacteria during the ensiling process. The farmer respondents were knowledgeable about this technology since they were the participants of the series of training conducted by the Isabela State University (ISU) project team and PCC. They have a high awareness of silage making and the usefulness of this to their operation particularly on maintaining good health and increasing the quality of milk to the dairy animals. The green corn silage production would be a promising farm enterprise that can help increase farm income. The awaiting opportunity to them, they can produce corn for silage three times a year considering the crop can be harvested within 75 to 80 days and there is a high demand of silage product not only here in the region but also in other regions particularly southern Tagalog in the provinces of Batangas, Bulacan, and Tarlac.

Other than grazing, users of upgraded technologies, management methods, and production systems produce more milk than non-adopters [4].

Only 7.8 percent of farmers who fed their cows suggested improving the feed quality, while 33.3 percent fed better feed (concentrate mixed). About 54 percent of farmers fed concentrate to their cattle, however, the

required ratio was not specified [5]. Around 59 percent of the farmers fed their cattle the traditional way. The majority of the farmers did not use a balanced combination of concentrates and green feed, resulting in nutritional imbalance. Only 10.6 percent of farmers kept suggesting cowsheds, whereas 41.1 percent improved their cowsheds. Due to their incapacity to maintain it, a considerable percentage of farmers (48.3%) built traditional, or nonscientific, cowsheds.

The farmer respondents had moderately high awareness about the use of solar panels to run the irrigation for corn and forage production. This can be attributed to few who have adopted these technologies commercially on the farm. This exposure can be noted in the model dairy farm at Malaya Multipurpose Cooperative at Mallig, Isabela was established by the project team for a farm demonstration. They observed that this technology is environmentally friendly since this will not use fossil fuel but the abundance of sunlight that the region has, and fewer maintenance costs of operation. To maximize farming operation, water must always be available since it is very important to grow plants and animals. The farmers can fully maximize their land for green corn silage or forage production even when drought comes. They can plant corn for silage production or maintain a good vegetative forage plantation three times a year as a quality feed for their dairy animals. But the initial investment for this technology is very high which the small individual farmers cannot afford. Thus, government or non-government organizations must think of a way how to help the dairy farmers with this.

The awareness of biogas digester for methane gas collection from animal manure has been assessed as moderately low by dairy farmers. Although they have observed this technology as considerably aligned to one of the bests greening technology practices, the dairy industry has seldom constructed this facility due to high costs of construction which might be added to their cost of investment. Furthermore, carabao and cattle manures can be easily collected and stored for safekeeping as compared to swine manure which in a slurry form, is odorous, and high content of methane gas whereas swine industry owners must favorably construct biogas digester and observe most of them have this to mitigate air and water pollution. Additionally, due to competing uses of farm manures as soil nutrients amelioration in the field crops and fishponds and high demand for commercial organic fertilizer production, establishment or construction of this facility would be the less priority interest of dairy farm owners.

One of the most concerns by the farmers, in general, is about farm transportation, particularly the hauling of farm products going to the market. Some farm municipalities in Cagayan Valley have no considerable means of transportation that can bring safe their products to the market. This is also attributed to the nature and condition of farm-to-market roads which in the far-flung areas, roads are nearly constructed with no gravel and sand, and most of

the time, they are impassable by light vehicles. Through this premise, the dairy farmers are much aware of the contribution of this facility aligned to greening technologies. The electronic tricycle which was introduced to them by the project has a rating of high awareness that this facility is necessary to them, and it can help maintain the environment by not emitting carbon dioxide. This contributes also to cost reduction in the transportation of their farm products due to low maintenance costs of operation.

The vermin culture and composting of farm manures have been rated very high awareness by dairy farmers. It is obvious to them that this technology has contributed much to managing their farm waste manures. Many of them have engaged in commercial vermin-culture production due to the abundance of substrates that they can use, needed less capital, the production process is not complicated, and vermin-casting has high demand in the market. Vermin culture and composting are considered the champion in offering technologies since they confine the various farm wastes into the composting chamber as food for earthworms and convert them to capsulized worm castings fortified with trace elements during the process of indigestion which are essentials to plant growth. The GreenHouse Gases (GHG) immersion in the atmosphere was limited due to this practice by way of collections of decomposing materials from the open field, indigestion of these decomposing materials by the earthworms turns out into castings, and farmers applied these vermin casts as fertilizer in the crops instead of using inorganically/commercialized fertilizers.

Regarding the awareness of the dairy farmers on wastes segregation, although this was observed uncommonly in the household, still they have a high awareness of it. They have recognized the importance of segregation of biodegradable to non-biodegradable household wastes wherein the prior is used for composting or feed to vermiculture for casting, while the latter was used to recyclable materials like reusing the bottles or plastics containers, traded to the junk shops, and those could not be used anymore are disposed of properly that could not affect the environment. On dairy animal wastes particularly manure, they were often used as fertilizers for their crops, especially for their vegetables, and fertilizer for the fishpond to produce the natural food of fish.

About the perception that the green technologies are environmentally friendly, the dairy farmers were much more amenable and have a high awareness of it. In this time of modern days when most farmers are using synthetically

farm inputs to raise crops and animals that contradict green technologies, these farmers have in mind the hope of reversing the effects of current practices in the farming of most farmers. They were already experiencing the effects of what they practice like increasing soil acidity due to excessive use of inorganic fertilizers and heavy users of chemicals like glyphosate to control weeds which resulted in heavy loss of topsoil complemented with soil erosion during heavy rains. There is poor growth of field crops and forages that limit the supply of feeds to the dairy animals which is also aggravated by the emerging new pests and diseases that affect their yield. The climate change phenomenon we are experiencing now a day is proof of continuously disregarding the effect of malpractices of industrialization, and farming modernization without considering the welfare of the environment. Various forms of GHG are emitted to the atmosphere that forms greenhouse gasses which severely affect the climate, extreme weather conditions not favorable to crops and animal productions, the occurrence of strong typhoons, and the emergence of pest and diseases in both plants and animals including human.

As to the awareness of dairy farmers of environmental laws of the Philippine republic, they have high awareness of it. In these modern times and the advent of information technology where social media, the internet, cell phones, and those conventional sources of information like radio, newspapers, and televisions are contributory to getting information of farmers whether they are in far-flung areas in the municipalities. Government agencies like the Department of Agriculture, SUCs, LGUs, and other mandated departments through their agents are also very active in information dissemination. Through the attainment of societal goals that the government is pushing forward to achieve food sufficiency and security, employment, poverty reduction, and the like are implemented comprehensively through programs that all agencies and sectors in the society take their parts. Environmental concerns have crisscrossed all programs and endeavors which are difficult to neglect due to their importance in attaining success. Thus, discussion of environmental laws and ordinances are included as one of the concerns during seminars and training of farmers.

The dairy farmers, although they are few in Cagayan Valley, they have full of aspirations to become better practitioners in the time being and appreciate the benefits of green technologies in mitigating climate change and sustaining a better environment.

Table 1. Level of Awareness of dairy farmers on Green Technologies

Awareness Level of dairy farmers on Green Technologies	Mean	Descriptive Rating
a. The level of awareness on the use of green corn silage as feed to the dairy animals.	3.90	High
b. The level of awareness on the use of solar-powered irrigation systems for green corn and forage production.	3.00	Moderately High
c. The level of awareness on the use of biogas digester for methane gas collection from animal manure and use as fuel in cooking.	1.90	Moderately Low
d. The level of awareness on the use of electronic tricycles for transportation of dairy products	4.10	High
e. The level of awareness on the use of vermin to compost the farm manure/dairy manure for compost production	5.50	Very High
f. Waste segregation for bio-degradable and non-bio-degradable in your MSMEs Dairy operation	4.40	High
g. Green dairy technologies are an environmentally friendly	4.10	High
h. Aware of the environmental laws of the country	3.90	High
Mean	3.85	High

1 – Low; 2 – Moderately Low; 3 – Moderately High; 4 – High; 5 – Very High

Determinants that Influence the Level of Awareness of Green Technologies from among the Dairy MSMEs

Production Factors and Determinants

As shown in Table 2, dairy production factors and its determinants of operation, which are shown in the result, the dairy farmers have a year’s range from 2 to 10 years in this industry. However, most were 2 to 3 years with an average of 3.9 years in dairying. This short experience of farmers in dairy production is not a hindrance since they are closely monitored by concerned agencies particularly the National Dairy Authority, Philippine Carabao Council, SUCS, and the Department of Agriculture. The farmers have raised dairy animals from 1 to 14 heads but most of them have raised 2 to 3 heads with the average animal raised per farmer of about 4 heads. They adopted a feeding system for their animals like cut and carry, free-range, and a combination of it. Free-range culture is the most practiced among the respondents. The farmer’s sources of information and technology, they are using were adopted from the knowledge gained in seminars. The majority of them have access to information and technologies from the PCC, NDA, DA, and SUCs. The technical and feed supplement subsidy provisions from PCC. Through the assistance provided to them, most of the farmers have gained technical skills/ knowledge in dairy production and management that they are now using to maintain and take care of the herd.

Assessment of Dairy Production and Operation

Various production and operation of dairy farmers were subjected to self-evaluation which the results are reflected in the result. For cost assessment in green dairy technologies implementation, most dairy farmers rated moderately high which means this may incur too much cost in acquiring, establishing, and maintaining this facility in their farm. Regarding the technology of implementing the green dairy technologies, most of them have signified moderately difficult to follow which need technical assistance from the expert of the technologies. However, almost all the dairy farmers are amenable that the green dairy technologies are convenient or practical, to help solve their problems in feed shortage, water supply, and other farming operations.

On the system of milk collection within the locality and marketing outside, the dairy problems signified easily based on the present setup that they have. As members of the dairy association who will assemble the collected milk, then pass it through to their processing and marketing cooperative. Although this is the current setup in their business model, the dairy farmers have assessed themselves that they have moderately high skills/knowledge in processing the products. This is always their option if there would be a surplus of milk, or they have the legacy of time to process the product. The dairy farmers assessed themselves that they have a good condition, facility, and equipment in the processing of milk if they were to produce good quality products.

Table 2. Dairy production factors and determinants in operation

Particular	Frequency (n=10)	Percent (%)
1. Number of Years in Dairy Production		
2	4	40.00
3	3	30.00
4	1	10.00
8	1	10.00
10	1	10.00
Mean	3.9	
2. Number of Heads Raised		
1	2	20.00
2	1	10.00
3	2	20.00
4	3	30.00
5	1	10.00
14	1	10.00
Mean	4	
3. System of Feeding		
Cut & Carry	3	30.00
Combine	5	50.00
Free range	2	20.00
4. Number of Seminars Attended		
none	2	20.00
4	3	30.00
5	3	30.00
6	1	10.00
10	1	10.00
Mean	4	
5. Access of Information/technologies in dairy production		
Yes	8	80.00
No	2	20.00
6. Provision of Technical and Subsidies		
Yes	8	80.00
No	2	20.00
7. Technical skills/knowledge in dairy production and management		
Yes	8	80.00
No	2	20.00

Product Marketing Assessment

Most of the dairy farmers have raised more carabao than cattle, particularly to those respondents from San Agustin, Isabela, and Cagayan where they are under the supervision of PCC. The cattle dairy farmers were surveyed from Mallig of Isabela, Quirino, and Nueva Vizcaya which are monitored by NDA. In both sources, the farmers have sold for around 3.9 liters on an average daily per farmer. This is raw milk sold to marketing cooperatives or individual market agents that they have contacted in their respective locality. The dairy farmers have an insignificant volume of processed milk products since they preferred to sell them in raw form due to a lack of time for them to process. In the case of San Agustin dairy farmers, the cooperatives are responsible for processing their raw milk. The cooperative has processed various kinds of milk drinks like flavored yogurt, ice candy, pastillas, etc. They sold their products in the surrounding localities, walk-in buyers, and wholesale buyers that are engaged in retailing them.

Table 3. Marketed raw milk by the dairy farmers

Milk in Liters	Frequency (n=10)	Percentage (%)
3 - 9	5	50.00
10 - 16	3	30.00
17 - 23	2	20.00
Mean	3.9	

On marketing assessment as provided by the dairy farmers, they rated good for the quality of the product packaging. This is from most of the respondents which they got from their experiences and observation of the products they produced. With regards to the situation of the supply of dairy products, they look forward to a low supply of milk in the region. At a present, the number of dairy animals is attributed to low milking productivity produced. This can be a challenge for the authority to expand the level of production since according to the assessment of the dairy farmers must have a moderately high demand for dairy products in the future. Favorable strategies must be implemented, and that will encourage the farmers to engage

in dairying. Some of this would be the access to the program of the government and non-government agencies which supports the dairy production and offers low interest of capital, with minimal requirements that can be accessed from the lending institutions for additional capital and dairy infrastructure projects.

Are the existing dairy producers/processors can compete with their competitors of the product in the market? They cannot be due to their rough situation in dairying. Therefore, they assessed themselves as low condition- they can compete. It may take a long way for the farmers to improve their status in dairy operations and compete with those established ones. Though the government has exerted its effort to help the farmers must do exercise more of its share because the government is looking only for the general welfare of the public. Various kinds of support will come to those who are interested, willing, and committed farmers to improve themselves. As to the product distribution from farm to market or target buyers, they perceived good based on their current situation. The farmers produce milk that is then collected by the cooperative agent daily and are responsible for marketing the products either in raw or processed forms. Medium shelf life of the product is expected. The dairy farmers considered this critical to them since if there is a time delay in the collection of milk this will be spoiled since the farmers have no good cold storage facility. In the case of SADACO in San Agustin, Isabela, the milk collector has their cold storage van that can maintain the quality of milk during transportation.

Product storage has been assessed to be good. They have a storage facility and utensils that they used from milk collection to the udder of the animal and before the milk collector agent comes. For product promotion, it is no longer the concern of the dairy farmers, however, they perceived good about it. The method for promoting the products is through “word of the mouth”, for it will be their satisfied customers who will be the ones to promote their products to their friends, relatives, acquaintances, and new buyers. Regarding product price assessment, the dairy farmers have rated moderately high which explained its shortage and high demand in the market.

Table 4. Market and marketing assessment of dairy products

Level of Assessment	Frequency (n=10)	Percent (%)
Quality of the product packaging assessment by dairy farmers		
1- Very Poor	1	10.00
2 - Poor	1	10.00
3 - Good	7	70.00
4 - Very Good	1	10.00
5 - Excellent	-	-
Mean	2.8	Good
Assessment of supply of dairy products in the market		
1 - Very Low	2	20.00
2 - Low	5	50.00
3 - Moderately High	2	20.00
4 - High	-	-
5 - Very High	1	10.00
Mean	2.3	Low
Assessment of demand of dairy products in your target market		
1 - Very Low	1	10.00
2 - Low	-	-
3 - Moderately High	8	80.00
4 - High	-	-
5 - Very High	1	10.00
Mean	3	Moderately High
Assessment of the situation of dairy product competition in the market		
1 - Very Low	2	20.00
2 - Low	5	50.00
3 - Moderately High	2	20.00
4 - High	-	-
5 - Very High	1	10.00
Mean	2.3	Low
Assessment of product distribution from the farm to the market or target clients of the firm		
1- Very Poor	1	10.00
2 - Poor	-	-
3 - Good	8	80.00
4 - Very Good	-	-
5 - Excellent	1	10.00
Mean	3	Good

Table 4 Continued

Assessment of dairy products shelf life by the dairy farmers		
1 - Short	1	10.00
2 - Moderately Short	1	10.00
3 - Medium	5	50.00
4 - Long	3	30.00
5 - Very Long	-	-
Mean	3	Medium
Assessment on how the product store		
1 - Very Poor	-	-
2 - Poor	1	10.00
3 - Good	7	70.00
4 - Very Good	1	10.00
5 - Excellent	1	10.00
Mean	3.2	Good
Assessment of product promotion and advertisement		
1 - Very Poor	1	10.00
2 - Poor	-	-
3 - Good	7	70.00
4 - Very Good	2	20.00
5 - Excellent	-	-
Mean	3	Good
Assessment of product pricing done and relate to the paying capacity of the consumers		
1 - Very Low	-	-
2 - Low	1	10.00
3 - Moderately High	8	80.00
4 - High	1	10.00
5 - Very High	-	-
Mean	3	Moderately High

Environmental Protection Assessment

Environmental protection activities are all concerned by dairy producers since this will not only be for the plight of the business but also the good of the animals, facilities, and other living organisms in the farms. Evaluation of the dairy farmers was carried out to know the present condition of the environment of the dairy farms. In terms of the condition of the resources used in dairy farms and the wastes disposals, the dairy farmers have perceived them good. The important resources are the stocks, feeds, and biologics needed in dairy products which must be always in good condition so that productivity will be always assured.

The farmers must aim better to have excellent and efficient resources for a higher yield of milk. This will complement good wastes disposal practices. There must be good practice for proper wastes segregation for biodegradable and non-biodegradable so that prior wastes items will be disposed of and used for composing feed to the earthworms for vermiculture. The latter wastes items, if possible, will be recycled, also be sold to the junk shops, or disposed of in a safer place like digging in the soil for those hazardous materials like bottles of farm chemicals and the like. Disposal of hazardous items must not affect the air and water table that is also detrimental to those who depend on their potable water in the deep well.

Table 5. Assessment for environmental practices of the dairy farmers

Level of Assessment	Frequency (n=10)	Percent (%)
1. Assessment of the condition of the resource management in your dairy farm		
1- Very Poor	1	10.00
2 - Poor	-	-
3 - Good	9	90.00
4 - Very Good	-	-
5 - Excellent	-	-
Mean	2.8	Good
2. Assessment of the condition of waste management disposal implemented in your dairy farm		
1- Very Poor	-	-
2 - Poor	2	20.00
3 - Good	6	60.00
4 - Very Good	2	20.00
5 - Excellent	-	-
Mean	3	Good
3. Response of practice of dairy wastes segregation by the dairy farmers		
Yes	8	80.00
No	2	20.00
4. Assessment of how the segregation of MSMEs dairy wastes done		
1- Very Poor	-	-
2 - Poor	-	-
3 - Good	1	10.00
4 - Very Good	9	90.00
5 - Excellent	-	-
Mean	3.9	Very Good

Almost all of the farmers practiced waste segregation in the farm and in their respective households and perceived them as very good. This only shows that the dairy farmers are aware of the benefits of good environmental practice particularly since their product is a food item.

Determinant Analysis for Awareness of Green Dairy Farmers

Various variables affect the awareness of green dairy technologies among dairy farmers. This includes the demographic profile, socio-economic conditions, and perception among the farmers regarding the said technologies. In this case, there are 39 variables coded as Xs considered, while Ys is the level of awareness of the dairy farmers. In the regression model, Ys are the dependent variables, while Xs are the independent variables which the equation has resembled as $Ys = f(Xs)$. The stepwise

regression method was used to treat the level of association of the independent variables to each other. These also check the collinearity and eliminate the variables that will not contribute to the improvement of the model to find the best fit.

Level of Awareness

The level of awareness of the dairy farmers to green dairy technologies, the regression model has expressed high reliability that explained or captured around 91.10% ($R^2 = 0.911$) of the variations, while the Durbin Watson value of 2.23 indicated the presence of lower collinearity. There is a significant result for the computed F test of about 35.93 ($p < 0.01$) in the Analysis of Variance (ANOVA) which revealed that the variables included in the model have a significant difference in their means. The regression model is expressed as shown below:

$$Y_1 = \text{Constant} + X_{36} + X_{26}$$

$$Y_1 = -2.51^{**} + 1.25^{**}(X_{36}) + 0.47^{**}(X_{26})$$

Among the 39 variables, only two variables were provided with the best fit to the model such as wastes aggregation and product quality. But the model suggested that the level of awareness of the dairy farmers is not aware of the green technology as indicated with a negative constant value of -2.51 for instance the two variables included in the equation are set to zero or not positively at all. The coefficients of the two variables are positive and significant ($p < 0.01$) that can contribute to increasing their level of awareness about green dairy technologies. Doing wastes segregation and harvesting with quality milk will relate to the minds of the dairy practitioners to consider greentechnologies.

The findings of both previous studies [6] and [7] support the first constraint's discovery (2009). Other breeding constraints include the Artificial Insemination (AI) center being too far away from the farmer's home (51.1%), an incompetent technician failing to deposit semen in the correct spot (44.4 percent), the right breed not being in the right place (38.3 percent), and an insufficient number of pedigree bulls for natural service (35.5 percent), and inadequate knowledge of AI services (30.5 percent). Apart from the biological adaptation issue of exotic inheritance, a lack of technical understanding is a barrier to raising crossbred cattle [8].

Correlation Analysis of the Level of Awareness with the Level of Adoption and Utilization of Green Dairy Technologies

The awareness of dairy farmers about green technologies is very important for the proper adoption and productive utilization. The farmers accustomed to the methodology of implementation, facility components, and other tools and equipment that comprise any green technology will be increased, through seminars/training and demonstrations about the use of these technologies. Information using media is to educate the dairy farmers to become more aware. Based on the perceived rating of awareness correlated to adoption and utilization, their level of awareness has a significant correlation to the level of adoption with a rho value of 0.48 ($p < 0.10$) and to the level of utilization with a rho value of 0.67 ($p < 0.01$) of the dairy farmers. Likewise, also the level of adoption is significantly correlated to the level of utilization with a rho value of 0.67 ($p < 0.05$). The results revealed that the authorities must pour in or conduct activities that will increase awareness of green dairy technologies for better and wider adoption and utilization of green dairy technologies by the farmers. This can complement other influencers like technical and financial support needed to acquire those costly green technologies that ordinary farmers cannot afford even if they have an interest to adopt and utilize the technology.

Farm household characteristics with correlation coefficients ($r = -0.044$ to 0.347 , $p < 0.05$, $p < 0.01$). Lower

correlation coefficients between all independent variables indicate that there was no multi-collinearity. The degree of the decrease or increase in adoption level in terms of an increase in the level of independent variables from the lower to the upper level was indicated by the values of -coefficients. Dairy technology adoption is inversely correlated with farmer age group and farm size but positively associated with farmer education and experience, household income, and earning members. However, according to the findings of [9], the producer's age and education level have a beneficial impact on the adoption of technology innovation in dairy cattle breeding.

Problems and Constraints Encountered by the Dairy Farmers

The dairy farmers like the other farmers have faced various problems and constraints in their operation of green dairy technologies. The dairy farmers have highlighted the insufficient technical and financial support from the authorities for green technologies. They have noted next to the lack of technical know-how could be an added cost to their operation, while the least that they have mentioned are very costly and have no sources of capital for acquisition and implementation, and difficulty integrating with their existing dairy operations. But these problems are manageable to address or provide measures for the benefit of the farmers. Only look for other interventions from non-government for those that are not available to the government.

According to the findings of the study [10], 76.7 percent of farmers have a lack of understanding of scientific dairy management, and 72.0 percent have a lack of information about clean milk production. The first main limitation to dairy development was the lack of provisions for animal testing, and the second was farmers' lack of knowledge about animal health care. In addition to these limits, 60.5 percent of farmers believe that the veterinary hospital's distance from the farmer's home is a scientific treatment issue. The next stage of major constraints in dairy development health care was the lack of adequate veterinary services (47.2 percent) and the unavailability and high cost of medicines and disinfectants (36.7 percent). Members of the "Punjab Dairy Farmers Association" experienced these two limits in 48.3 percent and 43.3 percent of cases, respectively, [11]. Another key restraint of dairy technology, according to one-third of the respondents, was a lack of awareness and information about the need for immunization, as well as a high price charged by veterinary staff for medical help as perceived by one-third of the respondents.

According to the majority of the respondents (84.4 percent), one main issue in terms of milk marketing is the lack of a dairy cooperative in the research area. This finding seeks support from this author [10]. Because they were not making enough money from milk, the majority of the respondents (62.2 percent) did not know how to convert milk into value-added products. Other socioeconomic

obstacles included a lack of education to adopt scientific husbandry procedures (53.3 percent), a lack of cash for management investment (47.2 percent), and lack of credit facilities, as well as a high rate of interest (42.2 percent). Technology scarcity, a lack of expertise, and financial constraints were all highlighted as major roadblocks to technology adoption as observed by [12]. The most significant barriers to dairy growth and development were a lack of information according to [13] and animal feed [14]. This could also be considered based on the findings of the study by [15] where they find out that there were various packages of technologies introduced for adoption like green corn production and green corn silage to increase production.

4. Summary

This study is focused on the level of awareness of green technologies among dairy Micro, Small, and Medium Enterprises (MSMEs) in the Cagayan Valley. The objective is to determine the willingness to analyze, adapt, utilize and practice the green dairy technologies in the operations by Dairy MSMEs.

Based on the results of the study the following are reflected; there are four (4) best green practices that have been implemented in the Philippines 1.) Implementing the laws and ordinances for the environment; 2.) Having an efficient waste management system; 3.) Creating a sustainable public transportation system, and 4.) Devoting more areas for green public space.

As to the level of awareness for the green technology specifically minimizing the emission of gasses during decomposition materials thus observed in the practice of silage making as feed to dairy animals, the respondents have rated high awareness which they believed for its usefulness and contribution to protect the environment by way of minimizing the emission of gasses during decomposition materials.

For the assessment of marketing-related activities provided by the dairy, they rated good for the quality of the product packaging. With regards to the current situation of the demand for dairy products, there is a low supply of milk in the region, and this is a challenge to increase the level of production as forecasted by the authority. Favorable strategies must be implemented that will encourage the farmers to engage in dairying. Some of these would be the access from the program as supported by the government and non-government agencies for dairy production, offering of low interest for capitalization, and imposed minimal requirements that can be accessed from the lending institutions which can be used for their added capital and dairy infrastructure establishment.

As for the Environmental Protection Assessment, activities are all focused on the concern of dairy producers since this will not only be for the plight of the business but also the good of the animals, facilities, and other living

organisms in the farms. Evaluation of the dairy farmers was carried out to know the present condition of the environment of the dairy farms. The important resources are the stocks, feeds, and biologics needed in dairy products which must be always in good condition so that productivity will be assured. This will complement good wastes disposal practices, proper wastes segregation for biodegradable and non-biodegradable so that prior wastes items will be disposed of and used for composing feed through vermiculture. The other wastes items, if possible, should be recycled, sold to the junk shops, or disposed of in safer places like digging in those hazardous materials like bottles of farm chemicals and the like. Disposal of hazardous items must not affect the air and water table that is also detrimental to those who depend on their potable water in the deep well.

For the problems and constraints encountered by the Dairy Farmers, the dairy farmers like any other farmers have faced various problems and constraints in their farming operation. The dairy farmers have highlighted the insufficient technical and financial support from the authorities for the adoption and utilization of green technologies. They have also noted the lack of technical know-how and the added costs to their operation, while the least that they have mentioned is no sources of capital for acquisition and implementation, and difficulty to integrate with their existing dairy operations. Although, these problems are manageable to address since the government provides measures on how to address these problems for the benefit of the dairy farmers.

5. Conclusions

The following conclusions were reached because of the study: To raise the level of awareness of dairy MSMEs in Cagayan Valley about green technology, a more detailed marketing campaign should be conducted to educate farmers and traders about the efficiency and cost of green technologies, as well as the benefits. The study also reveals that Local Government Units (LGUs) must open the floodgates of opportunity for dairy producers in terms of financial assistance in greening the dairy business. Also, those LGUs and other Government Agencies for the Dairy Industry, such as the Philippine Carabao Center (PCC) and the National Dairy Authority (NDA), as well as other supporting agencies, whose mandates are to promote the growth of the livestock industry as well as the living conditions of dairy farmers, must provide technical know-how in various forms of greening the technology in the dairy industry, such as mitigating gas emissions, using solar power, biodigesters, and dairy composting. Government agencies must also build a commercial model that dairy producers may use to justify their use of greening technology in the dairy sector. In this study, the Isabela State University and the partner Local Government Units (LGUs) must forge a Memorandum

Agreement on the capacity building of dairy farmers on greening the dairy industry's technology, thus another proposal for raising awareness among dairy farmers in Region 02 As to the problems faced by the farmer/traders, government intervention for technical and financial support may be tapped. Coaching and facilitation for preparing grant applications to be submitted to funding agencies. As well as SUCs for enhancing the technical knowledge and know-how regarding the utilization of green technologies.

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