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Determinants of Milk Production in Rupandehi District Nepal

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Abstract—*The investigation was conducted to analyze the determinants of milk production of dairy firms in Rupandehi district of Nepal with the objectives to examine the factors that affect marketed surplus of milk production in the study area. The survey was carried out for the milk farmers by collecting information from 100 sampled dairy farmers in five selected villages of the district. Descriptive statistics and least square regression technique were applied for the purpose of analysis The major determinants; total number of cattle (β=1.034), labour hours (β=0.381 ml), green fodder (β=67 ml/kg), amount concentrate fed (β=1.232 liter/kg), cost of veterinary service (β=5.12 ml), pasture land (β=0.988 liter), Area of animal Shed (β=0.004 ml/square feet), access to credit (β=0.034 ml), member of milk cooperative (β=609 ml) and multiple source of income (β=1.065 litre) are positively related with the level of milk yield. The determinants; age of farmer (β=46 ml/year), sex of farmer (β=1.473 for male), family size (β=223 ml), amount of dry fodder (β=30 ml/kg), level of education (β=104 ml/grade), Year of dairy experience (β=37 ml/year), cattle insurance (β=336 ml), Visit of veterinary staff (β=957 ml), dairy training (β=86 ml) and facility of insemination (β=301 ml) are negatively related with the level of milk yield identified under the study.*

Keywords*: determinants, milk production, dairy farms, profitability*

1. INTRODUCTION

Livestock farming is a major component of Nepalese farming system. A large number of people are involved in the production, processing, and trading of livestock and livestock products to maintain their livelihood. Recently, livestock production became not only an important component of farming, but also a key source of income earning activity for the rural people. The government of Nepal began dairy development activities in Nepal in 1952 with an experimental production of cheese. The Dairy development Board was formed in September 1989 to advise HMG on dairy development policy such as; import of dairy products and animal feed, milk prices producer and retail; legal issues affecting producer and consumer protection, support services for dairy producer and processors, and livestock insurance. In 1992, HMG established National Dairy Development Board (NDDB) for assisting dairy development in the country. It is to formulate and recommend policies and plans for dairy development in Nepal, and strengthens the dairy sector by bringing co-ordination between the private and public sectors. The National Cooperative Development Board (NCDB) was initially formed in 1991, as an advisory and coordinating body.

Livestock farming alone accounts for approximately 31% of agriculture GDP, and about 11.5% of total GDP (ASDP, 2004). Among the 31%, 53% is derived from the Hills, 38% from the Terai, and 9% from the Mountains (APP, 1995). Milk is by far, the most important livestock commodity, which contributes nearly half of livestock GDP. National average of per farm family dairy livestock holding is 3.6 cows, 2.4 buffaloes (Table 4.1). More than three fourth farmers hold cow and about half hold buffaloes.

2. STATEMENT OF PROBLEM

Nepalese society mostly being the patriarchal, role of women is given less importance in decision making and pecuniary matters. In the livestock sector, another study (Lok Nath Paudel)has found that men's participation is higher in larger animals, which are perceived as the prestigious animals in the society; women are involved in most of the difficult but non-cashable farm activities like forage collection and transportation, cleaning the gutter and sheds and feeding animals whereas men are involved in relatively easier and attractive tasks of the livestock activities such as milking animals and selling of milk; women have less chances for trainings, seminars and observation tours; and participation of women in livestock programs launched by public organisations is still very low in Nepal. Thus, the socio-cultural power relationship is still elite and higher-caste dominated in terms of ethnic consideration and male dominated in terms of gender consideration with ultimate repercussion of limited influence of these sections of society in the value creation in the chain. From the political perspective, although the power relationship has no direct effect in the creation of the value chain, it has immense effect in influencing the dairy cooperatives. Since the farmers are also the voters, each and every political party wants as much farmers as possible to follow their political ideology and support the party line. Many of the officials of dairy

cooperatives are active workers or even post holders of one or another political party.

Among the above policies, the Dairy Development Policy is the most relevant policy relating to the development of dairy sector in the country. The policy is very comprehensive and encompasses all the major aspects of dairy development. It has emphatic provisions for increasing milk production and productivity in rural areas, making production of milk and dairy products commercial and competitive, dairy product diversification based on the potentiality of internal and external markets for import substitution and export promotion, easy availability of good quality milk and dairy products to the consumers, free market price of milk and dairy products, expansion of dairy processing plants, capacity enhancement of dairy cooperatives and other dairies, various facilities for dairy development, creation of dairy fund, and involvement of all related institution in its implementation. Some common problems of milk farmers are: depletion of animal feeding base and inadequate government support services, inadequate and inappropriate breeding support services, weak farm advisory services and training, critical shortage of dairy animals, high opportunity costs of land and labour, shrinking farm labour due to migration of youth for off-farm jobs, inadequate credit facility, poverty and illiteracy among livestock raisers, limited market opportunities, higher cost of milk production.

3. LITERATURE REVIEW

A rational dairy farmer allocates a given set of inputs to maximize profits from his/her enterprise. In order for the farmer to maximize profits he/she has to produce given the level of Production. At this level, the dairy farmer's objective is to produce a maximum output given the available inputs. When this is achieved a farmer is said to be technically efficient (Kakhobwe, 2007). Furthermore, given a set of input prices, a farmer would want to optimally produce his output using the minimum cost of input mix. Achievement of the minimum cost of production means the farmer is allocatively efficient.

The lack of market access that many farmers face is considered to be a major constraint to combating poverty (Best et al., 2005). With this operation, it is believed that modern market competition scares dairy farmers away from the market, public support is shrinking or inefficiently governed, economists fail to provide incentives to farmers; consequently farmers rediscover the importance of collectively (Gibbon, 2008). Current knowledge on dairy value chains, performance and prices is poor for designing policies (Ayele et al., 2003). If scarce resources are used to produce output that cannot be sold, it might have a reverse effect on development (Cloudis and Muller, 1961). An efficient, integrated and use of productive inputs that is marked with good performance is of crucial importance for optimal allocation of resources in agriculture and for stimulating producer to increase output (Jones, 1972; FAO, 1999). Due to the scarcity of fuel-wood, rural people are forced to bur large quantities of animal dung and agriculture residues for cooking fuel, therefore, depriving soil of valuable nutrients and organic matter, thus adversely affecting farming. Nepal is losing forest at the rate of 1.7% annually (CE, 2000). The major input possessed by the poor is their own labour. Human capital, therefore, refers to the labour available to household combined by education, skills, knowledge and health (DFID, 1999).

The Research problems require addressing the following questions:

1. Why dairy farming has not been recognized at commercial scale production?
2. What are the factors that affact production of milk in the study area?
3. What are economic features of dairy farming?

4. OBJECTIVES OF THE STUDY

The present paper aims to fulfil following objectives:

1. To examine the major factors affecting milk productivity;
2. To assess gross margin and profitability in milk production.
3. To recommend the measures to improve dairy farming

5. HYPOTHESES

Following hypothesis is set for the present research study:

Farmer characteristics such as sex, age, education, experience, extension services, availability of pasture land etc influence Milk yield, marketed surplus, decision to add value to milk, level of value addition to milk and decision to choose the milk market access

6. 6. METHODOLOGY

6.1. Study Area

Rupandehi district lies in Terai region. It is situated in the Lumbini zone of western development region of Nepal. It's headquarter is Bhairahawa. Geographically, Rupandehi district lies at longitude 83°12'16''east to 83° 38'16" east and latitude 27°20'00" north to 27°47'25" north with the borders Nawalparasi in the East, Kapilbastu in the West, Palpa District in the North and India in the South.

6.2 Sampling Techniques

The first stage involved purposive selection of five villages. In addition, villages were purposefully selected due to the large number of improved and local dairy farmers who produce milk. In the second stage, from dairy farmers simple random sampling method was used to select 100 farmers.

Formal survey was conducted with dairy value chain actors such as dairy farmers, local dairies (Retailer) and milk cooperatives. To conduct formal survey with dairy farmers, five villages, namely, Semlar, Rudrapur, Godaha, Tali and Ranibari have been purposively selected on the basis of dairy production and milk sales potential. Sample size was determined using a simplified formula provided by Yamane (1967) provided below. Out of the total 5000 (nearly) dairy farmers in the five selected villages, 100 representative dairy farmers were selected, 20 dairy households from each village using Simple Random Sampling.

$$n = \frac{N}{1 + N(e^2)}$$

Where, n = sample size, N = population size,

e = level of precision. The level of precision is the range in which the true value of the population is estimated to be; it is expressed in percentage points (±10)

6.3 Data Collection, Data entry and Data Processing

Primary data was collected from dairy farmers in the selected village by administering semi-structured questionnaire. The collected data was entered in raw and column in Excel. Each raw includes all the characteristics of one household while each column represents different characteristics of the households.

6.4 Methods of Data Analysis

Least square econometric method was employed to identify the determinants of milk production in the study area. Data analysis also employed descriptive statistics such as percentage, and comparison and standard deviations.

7. RESULTS AND DISCUSSION

A. Gross Margin Analysis (Profitability)

Gross margin is defined as the difference between the value of an enterprise's gross output and variable costs (Ergano and Nurfeta, 2006). The following formula was used to calculate the gross margins:

GM = GR –VC ... (1)

where, GM is gross margin per liter as well as per milk animal in Rupandehi, Nepal. GR is gross revenue calculated as the product of price per unit output and per milk animal yield in the study area.

Gross income included the value of milk sales, the value of milk consumed by the household and milk given to the calf. Enterprise variable costs including feed (concentrates), veterinary, breeding and labour (hired) costs were calculated based on financial prices.

The study reveals that farmer receives Rs. 55 for one liter milk. The variable cost includes cost incurred on green fodder, dry fodder, concentrate fed, causal laour and veterinary service. Total variable cost of producing one liter milk is equal to Rs.17.26. Therefore, gross margin, in one liter milk, after deducting variable cost comes to be equal to Rs.37.73.

On the average, a dairy farmer receives the value Rs.371.61 from the milk produced by one milk animal. Total variable cost per day incurred per animal is equal to Rs.116.67. Therefore, after deducting variable cost in gross income, gross margin per milk animal is found to be Rs.255 (approx).

B. Profitability

The following formula was used to calculate the gross margins:

Profit = GR –VC-depreciation ... (2)

Depreciation on milk animal per year, Rs.8000, is calculated by taking 10% of average price of milk animal, i.e, Rs.80000. Depreciation per day is calculated by dividing Rs.8000 by 365 days which is equal to Rs.23.43. Average milk yield per animal day per household is 6.75 liter. Therefore, depreciation per liter milk is computed by dividing Rs.23.43 by 6.75 liter which becomes equal to Rs.3.24. Therefore, profit, in one liter milk, after deducting variable cost and depreciation from price comes to be equal to Rs.31.56. Therefore, after deducting variable cost and depreciation in gross income, profit per milk per day animal is found to be Rs.233 (approx).

C. Determinants of Milk Production

To study the determinants of milk production OLS model was applied. The model is

$$Y_j = \beta_0 + \sum_{i=1}^{N=21} x_i \beta_i$$

Where

Y_j=quantity of milk production of j^{th} dairy household

β_i=coefficients of estimates

x_i=determinants of milk production

Using the pooled data, the result of the model is obtained in table-7.1:

Major determinants (Table-7.1) of milk yield identified under the study can be outlined under following heads:

Age of Farmer

Age of farmer is negatively related and but not statistically significant with the level of milk production. This indicates that ceteris paribus, an increase in age of farmer by a year results in 46 ml decrease in the milk yield but not statistically significant with the level of participation.

Table 7.1: Determinants of Milk Production

Model		Coefficients βi's	Std. Error	t	Sig.
1	**(Constant)**	**.614**	**1.892**	**.325**	**.746**
	Age of farmer	-0.046	.029	-1.569	.121
	Sex of farmer	1.473	.853	1.727	.088
	Size of Family	-.223	.102	-2.180	.032
	total number of cattle	1.034	.950	1.088	.280
	Labour hour per day	.381	.161	2.365	.021
	Amount of green folder	0.067	.029	2.320	.023
	Amount of dry folder	-0.030	.040	-.751	.455
	amount of concentrate	1.232	.223	5.532	.000
	Level of education	-0.104	.072	-1.447	.152
	Year of dairy experience	-0.037	.037	-1.014	.314
	cost of vetrinary service	1.428E-5	.001	.024	.981
	Pasture land	.988	.806	1.225	.224
	Area of shed	0.004	.001	4.491	.000
	Cattle insurance	-.336	1.025	-.328	.744
	visit of veterinary staff	-.957	.893	-1.072	.287
	Market distance	.000	.000	-1.972	.052
	Dairy Training	-.086	.826	-.104	.917
	Loan taken	.034	.758	.044	.965
	Member of cooperative	.609	.728	.836	.406
	Multiple source of income	1.065	.897	1.187	.239
	Facility of insemination	-.301	.643	-.468	.641

Source: Writer's calculation (SPSS)

Sex of farmer

Sex of farmer is influences and statistically significant at the level 10%. This indicates that ceteris paribus, male farmer results in 1.473 ml increase in the level of milk production in comparison to female farmer. The reason behind is that female farmer consider the dairy farming as an additional load to other daily activities.

Family size

On contrary to prior expectation, family size is negatively associated in milk yield and statistically significant at 5%. While keeping other explanatory variables constant, contrary to prior expectation, increases in family size by one decreases yield of milk and results in 223 ml decreases in the milk production. This implies that young members of family are abroad for earning the livelihood. Larger size of family means greater number of family members as dependent.

Total Number of Cattle

In the present study, cattle refer to milk animals such as, cows and buffaloes. As expected, total number of cattle is positively associated and statistically significant at less than 10% with yield of milk. As the total number of cattle increases by one, yield of milk increases by 1.034 litre.

Labour Hour per Day

As expected, labour hours devoted to care milk animals is positively associated in milk yield and statistically significant at 5%. While keeping other explanatory variables constant, increase in one labour hour to care milk animal results into increases yield of milk per day by 381ml. This implies that greater the availability of labour higher the yield of milk

Amount of Green Folder

Green folder is regarded as very important input for livestock. Amount of green fodder given per animal per day is positively related and statistically significant at 5% with the level of milk production. This indicates that ceteris paribus, an amount of green fodder given per animal per day by one kg results in 67 ml increase in the milk yield per.

Amount of Dry Folder

Dry folder is important source of food for the livestock. On contrary to prior expectation, amount of dry fodder given per animal per day is negatively related but not statistically significant at 10% with the level of milk production. This indicates that ceteris paribus, an amount of dry fodder given per animal per day by one kg results in 30 ml increase in the milk yield per. The rationale behind may be the likelihood of low quality of dry fodder used by the dairy farmers in the sample study.

Amount of Concentrate Fed

Concentrate fed also is important source of food for the livestock. In the sample study of the dairy households, concentrate fed is found to be the most important determinant as source of food to increase the milk production. As expected, amount of concentrate fed given per animal per day is positively related and statistically significant at 1% with the level of milk production. This indicates that ceteris paribus, an amount of dry fodder given per animal per day by one kg results in 1.232 litre increase in the milk yield per day. The rationale behind may be the likelihood of good quality of concentrate fed used by the dairy farmers in the sample study.

Level of Education

Education plays very important role in human life. On contrary to prior expectation, level of education is negatively related but not statistically significant at 10% with the level of milk production. This indicates that ceteris paribus, increase in level of education of dairy farmer by one grade results in decrease in the milk yield per day by 104 ml. The rationale behind may be the likelihood of that educated dairy farmers are involved also in other economic activities.

Year of Dairy Experience

Year of dairy experience, on contrary to prior expectation, year of dairy experience is negatively related but not statistically significant at 10% with the level of milk production. This indicates that ceteris paribus, increase in dairy experience of farmer by one year results in decrease the milk yield per day by 37 ml. The reason behind may be that less productivity of dairy farmers discourages them to give continuity of this profession.

Veterinary Service

Veterinary service given to care milk animals, as expected, is positively related but not statistically significant at 10% with the level of milk production. This indicates that ceteris paribus, increase in the cost of veterinary service by one Rs. 1000 per year results in increase the milk yield per day only by 5.12 ml. The reasons behind in most of cases of animal diseases farmers are found not to consult immediately the veterinary experts. They consult the experts only after the case becomes serious. So farmers are found not to take benefited from the veterinary services.

Pasture Land

The availability of pasture land is used as dummy variable in the study. Milk yield is found to be positively related to the availability of pasture land to the dairy farmers. A dairy farmer with availability of the pasture land can produce 0.988 litre more milk per day in comparison to the dairy farmers who does not have access to pasture land.

Area of animal Shed

Animals should be provided sufficient space to live and eat. If animals are kept in crowed it creates problem in maintain good health and growth. In the present study, area of animal shed is found positively related to milk yield and statistically significant. Increase in area of animal shed by 100 square feet leads to increase in milk yield per day by 400 ml.

Cattle Insurance

On contrary to prior expectation, cattle insurance is negatively associated with milk yield but not statistically significant. Cattle insurance is used as dummy variable in the study. A dairy farmer with cattle insurance can produce 0.336 litre less milk per day in comparison to the dairy farmers who does not have cattle insurance.

Visit of Veterinary Staff

Visit of veterinary staff, on contrary to prior expectation, is negatively related but not statistically significant at 10% with the level of milk production. Visit of veterinary staff is used as dummy variable in the study. This indicates that a dairy farm visited by veterinary staff can produce 0.957 litre less milk per day in comparison to the dairy farmers whom veterinary staff does not visit.

Market Distance

Market distance is expected to put negative impact on milk yield. On contrary to expectation, market distance is not related with milk yield per day and statistically significant at closely to 5%. The reason behind is that farmer have means of transporting milk to market. Therefore, market does not matter for milk production.

Dairy Training

Dairy Training is considered to have positive impact on dairy farming. On contrary to prior expectation, Dairy Training is negatively related but not statistically significant at 10% with the level of milk production. Dairy Training is used as dummy variable in the study. This indicates that a dairy farmer participated in Dairy Training can produce 0.086 litre less milk per day in comparison to the dairy farmers not participated in Dairy Training. This indicates that dairy training have not been effective in increasing milk productivity of dairy animals.

Access to credit

Access to credit is believed to have positive impact on dairy farming. As expected, access to credit is positively related but not statistically significant at 10% with the level of milk production. Access to credit used as dummy variable in the study indicates that a dairy farmer with an access to credit can produce 0.034 litre more milk per day in comparison to the dairy farmers who do not have access to credit. .

Member of Milk Cooperative

Member of cooperative is also believed to have positive impact on dairy farming. As expected, Member of milk cooperative is positively related but not statistically significant at 10% with the level of milk production. Member of cooperative used as dummy variable in the study indicates that a dairy farmer with an access to credit can produce 0.609 litre more milk per day in comparison to the dairy farmers not member of cooperative.

Multiple Source of Income

Milk productivity is considered to be negatively affected by multiple source of income of dairy farmers. On contrary to prior expectation, multiple source of income is positively

related but not statistically significant at 10% with the level of milk production. multiple source of income is used as dummy variable in the study. This indicates that a dairy farmer with multiple source of income can produce 1.065 litre more milk per day in comparison to the dairy farmers who do not have multiple source of income. The rationale behind is that a dairy farmer having multiple source of income can invest more amount of money in managing dairy activities. .

Facility of Insemination

Facility of insemination is considered to put positive impact on Milk productivity of dairy farmers. On contrary to prior expectation, Facility of insemination is negatively related but not statistically significant at 10% with the level of milk production. Facility of insemination is used as dummy variable in the study. This indicates that a dairy farmer with Facility of insemination can produce 0.301 litre less milk per day in comparison to the dairy farmers who do not have facility of insemination. The rationale behind is that a dairy farmer having Facility of insemination are unable to make improvement in livestock farming.

8. POLICY IMPLICATIONS

1. In an increasingly globalised world, research on economic development of dairy farmers can no longer afford to limit itself only to optimization of livelihood support strategies and agricultural technology. It should also seek strategies to improve competitiveness and efficiency as driving forces in research for economic development. This study contributes through identification and prioritization of constraints and coming up with strategies for leveraged intervention for improving competitiveness and efficiency of dairy market chain in *Rupandehi*, Nepal.
2. Productivity and quality are becoming more important for dairy farmers to compete in an increasingly competitive market. To promote dairy productivity, public support should formulate appropriate policy in the form of managerial capacity building and institutional support. Policy makers should also encourage through facilitating the negotiation process and raising awareness. Furthermore, the core constraints of dairy productivity could be tackled through appropriate institutional support and extension services. Therefore, there is a need to pool efforts together and make the the dairy production economically viable which requires provision of fully fledged technical backups. Increased availability at affordable prices and promotional activities can increase consumption levels.
3. The determinants milk production reflects that in the dairy farming middle and old aged farmers are involved with low level of efficiency. It seems necessary to provide encouragement and dairy training to young members of dairy household. The cooperative practice, extension services (veterinary service, hygiene of dairy animal, cattle insurance, and access to adequate credit) are required to make effective.
4. In the dairy farming dung is major by-product. Dung is used as a source of energy and/or organic fertilizer. As a source of energy, dung can be directly used as cake for cooking or as bio-gas (Gobar gas). To promote environment capital by increasing use of gobar gas and dung-fertilizer, public support should formulate appropriate policy in the form of managerial capacity building and institutional support. Policy makers should also encourage installing gobar gas plant by dairy farmers.
5. The findings are quite consistent with the expected behavior of Nepalese dairy farmers and provide a clear picture about participation decision and level of participation in-farm level milk value addition. They have important policy implications because these value addition behaviors of farmers would seem to continue to play a vital role in enhancing efficiency of dairy farmers thereby increasing the productivity and of dairy animals. It is important to understand the determinants of value addition processes of dairy farmers for the benefit of the poor farmers. Information generated help all dairy market chain actors aiming to upgrade dairy production and support policy analysis and policy making. Therefore, dairy production policies that would consider determinants of dairy farmers' participation decision and level of participation in-farm level value addition are likely to serve the interests of dairy market chain actors.
6. The trade-off between market oriented and subsistence dairy production is, in the sense that production can respond to external demands from the market or intra-household consumption needs. Therefore, research should revisit its breeding and development strategy in line with exploiting the potential of local cows/buffaloes and improved cows/buffaloes for milk production.
7. Even if the study attempted to analysis dairy production to consumption in a market chain approach, there are a number of issues that still remain to be addressed. A number of interesting directions can be suggested here to broaden the scope of the current study. First, market chain analytical approach cannot be the only methodology to be used to enhance dairy farmers' competitiveness and efficiency. Network analysis, innovation system perspective, vertical integration, modern marketing research approach and backward and forward linkage approaches could provide an alternative or complementary strategy to improve farmers' competitiveness and efficiency. Second, to support dairy farmers' competitiveness and efficiency, the role of institutions that can complement, such as mechanisms to secure property rights, credit and saving institutions, weather-indexed insurance and institutional innovation for input markets, can and should be simultaneously

explored. Third, this study only focused on one objective of market chain analysis, identification, prioritization and coming up with upgrading strategies to improve competitiveness and efficiency of dairy farmers, the other objectives such as governance structure, cost-effectiveness, income distribution are not targeted. Fourth, production economics of market chain analysis such as technical efficiency, input-output transformation are not considered. Therefore, these are some areas of market chain analysis that need further research.

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