Dairy Enterprises' Market Participation Decisions and the Level of Value Addition: Evidence from Addis Ababa and Its Vicinity, Ethiopia

Fiseha Nigussie[1], and Mohamed Adem[2]*

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Abstract

Ethiopia has ample potential and suitable agro-ecological conditions to establish dairy enterprises, and the enterprises contribute significantly to the economic, environmental, and quality-of-life, and well-being of individuals. Rapid urbanisation, rising income, and relatively high dairy product consumption per capita in the study area contribute to the sector's latent potential. However, little is being done to enhance the value addition of the milk production chain which in turn enhances value-added output. The attributes that influence dairy enterprises' decisions to penetrate the market and the degree of milk product value addition were examined in this study. A sample of 212 dairy enterprises was drawn from the study area's target population. The stated objectives have been achieved using both descriptive statistics and the Double-Hurdle econometrics model. The number of dairy cattle was a more significant factor in deciding whether to participate in the value addition of dairy products. Findings show that variables of interest in machinery and equipment, the volume of milk in the litter, access to credit services, and skills training had a positive and significant influence on the decision and the degree of value addition in the dairy production. The study also indicated that increasing milk volume, minimising the bureaucracy of credit service provision, and fostering low-cost technology and equipment innovation are vital to the success of a dairy enterprise. The study found that dairy enterprises stimulate substantial and diverse milk value additions.

Keywords: Decisions, VAM, double-hurdle model, micro and small enterprise, and dairy enterprise

JEL Classification: D22

[1] Mr. Fiseha Nigussie is an MSc. student, College of Business and Economics, Department of Economics, Bahir Dar University (BDU), Ethiopia

[2] Mohammed Adem (Ph.D.) is an Assistant Professor at the College of Business and Economics, Department of Economics, BDU, Ethiopia

*Corresponding author: ademoha@gmail.com

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1. Introduction

Livestock is critical to Ethiopian economic development, accounting for one-quarter of national GDP and 40% of agricultural GDP (Kenea, 2019). Ethiopia's cattle population is more than 50 million, making it the largest in Africa and the seventh largest in the world (Bogale and Erena, 2022). Cattle have always been prized as a source of food, income, and social status. With an estimated 12 million cows and a conducive environment for dairy production, Ethiopia's livestock sub-sector is projected to provide 60-70% of the Ethiopian population's livelihoods (Shapiro et al., 2015). Dairy farming is an important aspect of Ethiopian livestock production, with unrealized potential due to a vast and diverse livestock population and dairy-friendly agroecology (Minten et al., 2020, Ayalew and Abatenhe, 2018). However, due to low per capita dairy consumption, the majority of the country is suffering from a persistent shortage of dairy products. According to the AGP-Livestock Market Development Project (2013), annual milk consumption is 19 litres per capita, well below worldwide standards.

The dairy sector seems to be on the verge of taking off, albeit most of its activities are concentrated in Addis Ababa, the surrounding territories, and other regional cities with big milk and dairy products markets. The average annual milk intake in the country is approximately 20 litters, but urbanization leads to an increase in that number (Dinkale, 2019). Although the nation has significant untapped potential in the dairy industry, the dairy sector is constrained by several factors, and the nation remains a net importer of milk and dairy products. Imports of dairy products are growing (Tadesse and Yilma, 2018). For example, between 2011 and 2015, the country spent an average of more than 15 million USD per year on imported dairy products, with the value increasing from about $13 million in 2011 to $18 million in 2015 (Tadesse and Yilma, 2018). The country has yet to realize its full potential in promoting and profiting from dairy production. In Addis Ababa, the average milk consumption per person is 50 liters per year (Mikru et al., 2021, Brasesco, 2019). Most dairy enterprises in and around most of the cities were established in the last 20 years in response to the rising market demand for fresh and processed milk (Kapaj and Deci, 2017, Vroegindewey et al., 2021, Alemu, 2019).

More than 80% of the milk produced in the country is marketed as raw milk or pasteurised milk with no added value (Wanjala et al., 2017). Milk holidays are an issue for dairy enterprises during the flush season since the shelf-life of raw and pasteurised milk is relatively short. Diversifying milk into different products will extend storage duration, resulting in greater benefits for enterprises and boosting the

value of dairy at each stage of production. However, because the cost of production and the selling price of raw milk are comparable, dairy firms do not benefit from milk sales. Product diversification and value addition may be two of the most beneficial practices for dairy enterprises. Value addition in the dairy industry can have a substantial impact on job creation and enterprise welfare. Value-added participation can help boost employment prospects and income generation. Dairy enterprises will be able to play a bigger part in combating poverty and fostering economic growth if they contribute more to value addition.

Facilitating market access and improving chain competitiveness and efficiency are important prerequisites for improving livelihoods (Bammann, 2019). The comprehensive identification of impediments to dairy value addition is crucial for increasing the profitability and productivity of dairy enterprises (Läpple and Thorne, 2019). Dairy firms must be robust enough to quickly change markets in order to maintain resilience. The city of Addis Ababa and its surroundings have the potential for dairy production, processing, marketing, and consumption; however, there is little information regarding dairy value addition. Besides, the dairy production system is not market-oriented, and milk produced by smallholders is primarily used for household consumption. This is due to inefficient dairy product marketing, which is characterized by long market chains, high margins, and poor marketing facilities and services. In the study area, dairy enterprises have limited access to market information and a less organized dairy marketing structure.

Despite the fact that the dairy enterprise is now facing the aforementioned challenges, very few studies have been conducted to analyse dairy enterprise market participation decisions and the amount of value added by dairy products in other areas (Hitihamu et al., 2021, Beyene et al., 2017b, Tegegn and Tamir, 2020, Tadesse et al., 2017a). Also, no study of this kind was undertaken in Addis Ababa and the vicinity to deal with the issues mentioned earlier. Therefore, the rationale for carrying out the study is based on the aforementioned concerns. Therefore, this study aims to fill the gap in the existing literature by adding new knowledge to the existing acquaintance on the determinants of dairy enterprises market participation decisions and the level of value addition of dairy products.

2. Methods

2.1 Description of the study area

This study was undertaken in Addis Ababa and the surrounding areas. Addis Ababa is the country's and Africa's primary political, economic, and cultural hub. It is the federal government's seat and home to several continental and international bodies, including the Africa Union and several countries' embassies. The city is divided into ten sub-cities, and the total population is projected to be 3,408,631, with 52.3% of the population being female (CSA, 2017).

Dairying in Addis Ababa and nearby is characterized by micro and small dairy enterprises and a few medium dairy-processing enterprises. In recent years, the demand for quality, value-added, and diversified dairy products has increased due to an increase in purchasing power, urbanization, population growth, and consumer awareness. In Addis Ababa, the top 10% of earners consumed 38% of milk, while the lowest income group consumed only 23% (Tadesse and Yilman, 2018).

2.2. Data Source and Type

Both primary and secondary data that have a qualitative and quantitative nature were employed to achieve the objective of this study. A semi-structured questionnaire was used to collect primary data from a representative sample of dairy enterprises. Secondary data relevant for this study was taken from the Ethiopia meat and dairy industry development institute (EMDIDI), the investment office, the micro and small enterprise agency, and the office of urban agriculture; those were located in the district of the study area, as well as from the Central Statistics Agency (CSA) and other published and unpublished sources.

2.3 Sample Size and Sampling Technique

2.3.1 Sample Size Determination

This study focused on micro, small, and medium dairy enterprises that were located in Addis Ababa and nearby. Therefore, all micro, small, and medium dairy enterprises in the study area constituted the sampling frame of the study. In sum, there were 484 dairy enterprises at the chosen site. So, the sample size was determined from the total number of dairy enterprises at a 95% confidence level with a 5% level of precision using Yamane's (1967) formula:

$$n=\frac{N}{1+N(e)^2}=\frac{484}{1+484(0.05)^2}=219$$

Where: n=sample size, N=total population (total number of dairy enterprises) e=level of precision.

2.3.2 Sampling Procedures and Technique

A multi-stage sampling technique was employed to select a sample of dairy enterprises. In the first stage of the study, Addis Ababa city and the surrounding towns such as Debire Zeit, Sebeta, and Sululta were purposely selected due to the presence of the largest number of dairy farms. In the second stage, stratified random sampling was employed to identify a sample dairy enterprise for data collection. The dairy enterprises from which a sample is to be drawn do not constitute a homogeneous group; they differ by amount of capital and number of employees. Due to this fact, stratified sampling is the best technique to obtain a representative sample. Then, the dairy enterprises were stratified into micro, small, and medium enterprises. Based on the amount of capital and employees they own; this then creates non-overlapping sub-populations or strata. The stratification is done to increase precision in the estimates of the characteristics of the whole population. In the final stage (third), the dairy enterprise was selected from each stratum using a simple random sampling technique.

Table 1: Sample distribution by study area and enterprise category

Categories of enterprises	Total population	Sampled enterprises	Addis Ababa		Debire zeit		Sebeta		Sululta	
			Sub total	Sampled	Sub total	Sampled	Sub total	Sampled	Sub total	Sampled
Micro DE	268	121	63	29	58	27	76	34	71	31
Small DE	170	77	45	21	33	15	54	24	38	17
Medium DE	46	21	19	9	5	2	12	5	10	5
Total	484	219	127	63	96	44	142	65	119	54

Source: Own computation, 2020

2.4 Econometric Model Specification

This study aimed to investigate the factors that determine the decision and level of value addition to milk (VAM) using the double-hurdle model. This model was chosen because it allows for the modelling of two parts: the first is the likelihood of achieving a value of 0 or 1, and the second is the value addition index of non-zero values. The double hurdle model formulated by Cragg (1971) by changing the conventional Tobit model has been used. There is a similarity between the double-hurdle and the extended Tobit models in the decision to participate and the degree of participation equations. The first hurdle relates to whether or not the dairy enterprises partake in VAM; the second is the degree of participation in VAM. This could be specified as:

$$D_{1i}^{*} = B_1 X'_{1i} + e_i \,; D_{1i} = \begin{cases} 1, if\ D1_i^{*} > 0 \\ 0, if\ \ D1_i^{*} \leq 0 \end{cases} e_i \sim \mathrm{N}(0,1) \qquad \textbf{(1)}$$

$$D_{2i}^{*} = B_2 X'_{2i} + \epsilon_i \,; D_{2i} = \begin{cases} D_{2i}^{*}, if\ D1_i^{*} = 1\ and\ D_{2i}^{*} > 0 \\ 0, else \end{cases} \epsilon_i \sim \mathrm{N}(0,1) \qquad \textbf{(2)}$$

This indicates that the observed degree of VAM (D_{2i}^{*}) is zero when there is zero censoring ($D_{2i}^{*} \leq 0$), inaccurate reporting, or some other random situation. The study rewrites equation 2 to make the procedures for seeing zero values clear (Jones and Wykes, 1989, Gao et al., 1995, Chi, 2017).

$$D_{2i} = D_{2i}^{*} = B_2 X'_{2i} + \epsilon_i\ if\ B_1 X'_{1i} + e_i\ > 0\ and\ B_2 X'_{2i} + \epsilon_i > 0 \quad (\mathbf{3})$$

$$(\text{when No} - \text{zero values imply} \Rightarrow \text{Partaking in VAM by diversification})$$

$$if\ B_1 X'_{1i} + e_i\ > 0\ and\ B_2 X'_{2i} + \epsilon_i \leq 0$$

$$(\text{when zero values imply } \Rightarrow \text{ Partaking in VAM by Specialization})$$

$$if\ B_1 X'_{1i} + e_i\ \leq 0\ and\ B_2 X'_{2i} + \epsilon_i > 0$$

$$(\text{when zero values imply } \Rightarrow \text{ a Random event/faulty report})$$

$$if\ B_1 X'_{1i} + e_i\ \leq 0\ and\ B_2 X'_{2i} + \epsilon_i \leq 0$$

$$(\text{when zero values imply } \Rightarrow \text{ No} - \text{Partaking to VAM})$$

A positive degree of VAM may be detected if an enterprise decides to participate in VAM and diversifies it, this is the first condition. The second circumstance that results in zero values is when a non-participant chooses to participate but does not diversify. Zero values might be detected if the enterprise does not participate and hence does not record any positive participation degree in the final equation. Assuming the error terms in equation 1 are independent; the stochastic specification can be written as:

$$\begin{pmatrix} e_i \\ \varepsilon_i \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & \sigma^2 \end{pmatrix}\right]$$

The double-hurdle model with independent error terms can be estimated using the following log-likelihood function, which is based on Adusah-Poku and Takeuchi (2019) and Mudemba et al. (2021) and is most commonly used in computer simulations.

$$LL = \sum\nolimits_0 \ln\left[1 - \phi(\beta_1 X'_{1i})\phi\left(\frac{\beta_2 X'_{2i}}{\sigma}\right)\right] + \sum\nolimits_+ \ln\left[\phi(\beta_1 X'_{1i})\frac{1}{\sigma}\varphi\left(\frac{D2_i - \beta_2 X'_{2i}}{\sigma}\right)\right]) \quad \textbf{(4)}$$

The contribution of all observations with an observed zero is related to the first term. It means that VAM and the participating degree yield zero observations. According to Chen et al. (2020) approach, all zeros are created solely by non-participating choices. The simplified form of the log-likelihood for independent error terms is:

$$LL = \sum_0 \ln[1 - \phi(\beta_1 X'_{1i})] + \sum_+ \ln\left[\phi(\beta_1 X'_{1i})\frac{1}{\sigma}\varphi\left(\frac{D2_i - \beta_2 X'_{2i}}{\sigma}\right)\right] \quad \textbf{(5)}$$

The additional term in the first term of equation 3, $\phi\left(\frac{\beta_2 X'_{2i}}{\sigma}\right)$ depicts what the double-hurdle model contributes. This additional term considers the possibility of observing zero-valued observation in the second stage. The second term in equation 3 accounts for the contribution of all observations having a non-zero degree of engagement in VAM decision making. The probability in the second term is the product of the conditional probability distribution and the density function arising

from the censoring rule and observing non-zero values (Wodjao, 2020). The former describes the possibility of meeting the VAM decision threshold in the instance at hand. The latter indicates the degree of witnessing a non-zero VAM participation degree.

Furthermore, the log-likelihood function of the double-hurdle model is equivalent to that of a truncated regression model and a univariate probit model (Ogeto et al., 2019, Wodjao, 2020) under the assumption of independence between the two error terms. Consequently, the log-likelihood function of the double-hurdle model may be maximized without losing information. It might be done by maximizing the two components: the Probit model and total data, then running a Tobit regression on the non-zero observations (Jones and Wykes, 1989).

2.5 Description of Variables

Outcome Variables

This study aimed to look into dairy enterprises' market participation decisions and the degree of milk value addition. This was investigated using two outcome variables: decision to participate and level of value addition to milk. The second outcome variable (level of value addition, which is a proxy for diversification) was derived from the data set using the product diversification index. The level of VAM is determined by choosing a dairy product diversity index that has a value between 0 and 1. The first step to compute the index is estimating the profit margin per litter of milk. Margin per litter (ML) was defined as a unit price minus variable cost (Horngren et al., 2016). There are three main different sources of variable cost: the raw milk, other raw materials (rennet, ferments, salt, rice, fruit, etc.), and packaging.

$$ML = \frac{Price\ per\ unit\ of\ product(P/UP)}{Liters\ of\ milk\ per\ unit\ of\ product(L/UP)} - \frac{Variable\ cost\ per\ unit\ of\ product(VC/UP)}{Liters\ of\ milk\ per\ unit\ of\ product(L/UP)}$$

The Herfindahl and Simpson indices were used to calculate the index, which is done as follows: Firs, the proportion of the 'ith' value added milk/dairy product could be computed as:

$$ML = \frac{P}{L} - \frac{VC}{L}$$

ML could be re-defined as the difference between income per litter of milk (IL) and variable cost per litter of milk (VCL).

$$ML = IL - VCL$$

Therefore, the value-added for a single product of milk could be computes as: Value added to milk for a single product (VAM) =Margin per litter of a product (MLi) times quantity of the product (Qi)

$$VAM_i = ML_i Q_i$$

Where 'i' indicate the specific milk product

Therefore, the total/Gross Value Added to Milk $(GVAM) = \sum_{i=1}^{n} ML_i Q_i = \sum_{i=1}^{n} VAM_i$

Then, the Herfindahl and Simpson indices were used to drive the index, which is done as follows: First, the proportion of the 'ith' value-added milk/dairy product could be computed as:

$$\mathrm{Pr_i} = \frac{ML_i Q_i}{\sum_{i=1}^{n} ML_i Q_i} = \frac{VAM_i}{\sum_{i=1}^{n} VAM_i}$$

Where ML=Margin per litter (ML); Q=quantity; VAM= Value Addition to milk; and Pri, the proportion of the 'ith' value-added milk/dairy product; and then the dairy product diversification index can be estimated as:

$$\mathrm{D_p^S} = \left(\sum_{\mathrm{i=1}}^{\mathrm{n}} \mathrm{Pr}\right)^2$$

The dairy product diversification index-Herfindahl Index approach is the sum of squares of all 'n' proportions and measures value addition to milk concentration. D_p^H takes the value of one when there is complete specialization and

approaches zero when the number of value-added dairy products shows perfect diversification. For direct interpretation, the Simpson Index (D_p^H) was executed as:

$$D_p^S = 1 - \left(\sum_{i=1}^{n} Pr\right)^2$$

The D_p^S Value has a direct relationship with diversification. The zero value of D_p^S indicates specialization, and moving toward one shows an increase in the number of value-added dairy products.

Table 2: Definition of variables and their expected signs

Variables Label	Variable Type
Dependent variables	
The decision to participate in VAM (1=Participation in VAM 0=otherwise)	Dummy
The extent of participation in VAM	Continuous between 0 and 1
Independent Variables	
Age of the enterprise manager	Continuous
Sex of the enterprise manager (1=male 0=otherwise)	Dummy
Family size of enterprise manager	Continuous
Education level of enterprise manager	Continuous
Experience of enterprise manager	Continuous
Ownership status (0= if the owner is manager 1=otherwise)	Dummy
Current Capital in 1000	Continuous
Number of employees	Continuous
Machinery & equipment (1=yes 0=no)	Dummy
Number of dairy cattle	Continuous
The volume of milk in litter per day	Continuous
Access to credit services (1=yes 0=no)	Dummy
Research & development (1=yes 0=no)	Dummy
Incentive (1=yes 0=no)	Dummy
Skill training (1=yes 0=no)	Dummy
Access to Market info. (1=yes 0=no)	Dummy

The explanatory variables of the study have been selected based on the economic theory, data availability and previous empirical studies (Lee, 2005, Marenya and Barrett, 2007, Knowler and Bradshaw, 2007, Kassie et al., 2010, Wollni et al., 2010). The detailed description of the variables, measurement units and their hypothesized direction of influence are presented in Table 2.

3. Results and Discussion

This section describes dairy enterprises' socioeconomic and demographic profiles. Then, a regression analysis was done to look at factors that influence dairy enterprises' decision to enter the market and their degree of engagement in VAM. Only 212 out of the total 219 sample sizes completed the survey questionnaire; hence, the analysis of the study is only pertinent to 212 enterprises.

3.1 Descriptive Statistics of Outcome Variable

Table 3 presents the descriptive statistics of outcome variables of dairy enterprises decision to participate in VAM activities and the degree of participation in VAM. Of the total dairy enterprises examined, 66.03 percent were involved in milk value addition (VAM), while 33.97 percent did not participate in the activity. Furthermore, the mean value of the degree of involvement in the VAM index was found to be 0.305, with a standard deviation of 0.146, implying that most dairy firms have an index that is closer to the mean owing to lower variation. The mean value indicates that dairy firms' engagement in the level of value addition or product diversification is quite low.

Table 3: Descriptive statistics of outcome variable

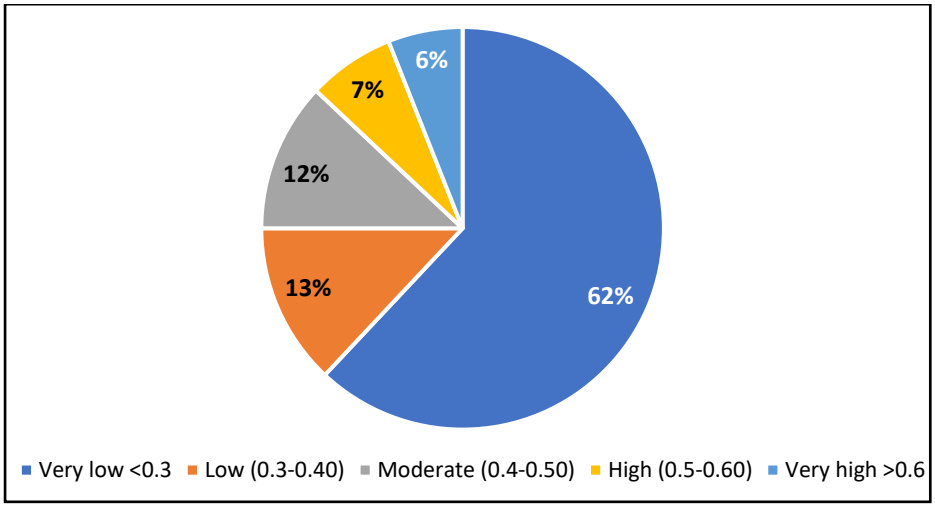
Variable	Category	Frequency	Percent
Decision to Participate to VAM	Participant (1)	140	66.03%
	Non-Participant (0)	72	33.97%
	Continuous	Mean	SD[3]
Degree of Participation to VAM		0.30546	0.14653

Source: own computation, 2020

[3] Standard Deviation

According to the given classification, 62 percent of the dairy enterprises examined had a very low degree of engagement in VAM, which is lower than the average of the sampled enterprises. The other 13 percent enterprises had also low participation index which is between 0.3 and 0.4. Only 25 percent of enterprises had a diversification degree greater than the sample's mean of 0.3.

Figure 1: Classification of degree of VAM



Source: Own computation, 2020
Source for classification: District Statistical Handbook, 2008; Hugli.

3.2 Socioeconomic and demographic profiles of dairy enterprises' manager

The result indicates that 48.7% of participant enterprises were managed by their owners, while 51.3% of the participant enterprises were managed by individuals who were not the owners of the enterprises. Similarly, out of the total non-participant enterprises, 73.6% were managed by the owners of the enterprise, while 26.4 percent of enterprises had managers who were not the owners of the enterprise. In terms of the gender of managers, 67.8% of participant dairy enterprises were run by male managers, while female managers led the remaining 32.2% of the enterprises. 52.9% of the non-participant dairy enterprises were led by male managers, while women managed 47.2% of non-participant enterprises. The chi-square test was done to check whether there was a statistically significant difference in gender and enterprise ownership status. The finding confirmed a statistically significant difference at 5% and 1% levels, respectively.

Table 4: Descriptive statistics of categorical variables

Variables	Category of partaking in VAM	%		%	Chi2 (1)
Sex	Participant	66.03	Female	32.14	4.624**
			Male	67.86	
	Non-participant	33.97	Female	47.22	
			Male	52.78	
Ownership status	Participant	66.03	Manager & Owner	48.57	12.1682***
			Manager	51.43	
	Non-participant	33.97	Manager & Owner	73.61	
			Manager	26.39	

***, **, significance level at 1% and 5% respectively

Source: Own computation, 2020

The average age of dairy enterprise managers who participated was 39.5 years, while the average age of non-participating the enterprises' managers was 32 years. It means that the enterprise managers who participated were 7.2 years older than the non-participants. On average, participant enterprises manager had higher level of education (13.1 year) and more work experience (9.6 years), whereas non-participants enterprise manager had lower level of education (10.2) and less years of work experience (5.9 years). This indicates that education and expertise are critical in adding value to milk products. The level of education and experience that dairy enterprise managers have may determine how well they are familiar with new technology and developments that can assist them run their businesses. It is also likely that it will influence decisions about the adoption of new technology and contribute to decision-making processes that can change the lives of businesses. Participant enterprises manager had an average family size of 2.7 members, whereas non-participant enterprises manager had an average family size of 2.2. The mean comparison test was carried out to determine whether there was a statistically significant difference in the mean age of enterprise managers, average level of education, average years of experience, and average family size. The result indicates that there was a statistically significant difference at the 1%, 1%, 1%, and 5% levels of significance, respectively.

Table 5: Descriptive statistics of continuous variables

Variables	Partaking in VAM status	Mean	Min.	Max.	t-test
Age	Participant	39.5214	21	62	-4.96***
	Non-participant	32.3056	21	45	
Family_size	Participant	2.7143	0	6	-2.22**
	Non-Participant	2.2222	0	6	
Education	Participant	13.4143	4	22	-7.83***
	Non-participant	10.1944	0	15	
Experience	Participant	9.6428	1	20	-7.25***
	Non-Participant	5.9861	1	10	

***, **, significance level at 1% and 5% respectively

Source: Own computation, 2020

3.3 Resources, Technology, and Institutional Service Access

It is believed that dairy cattle, milk volume, capital, employees, and machinery and equipment ownership will be the most significant resources required in the milk value addition task. The average number of dairy cows held by participating enterprises, as well as the volume of milk produced, was 17.1 cows and 341.6 litres, respectively, whereas those who did not participate had only 7.8 cows and produced an average of 139.4 litres of milk. This indicates that there is a greater and statistically significant difference between the two groups. Participants' milk production volumes ranged from 0 to 960 litres, whereas those who did not participate ranged from 0 to 32 litres.

Participants had an average current capital of 600,960 Eth. Birr and employed 14.3 people, whereas non-participants had an average financial capital of 124,900 Eth. Birr. Nonetheless, in terms of financial capital and employees, participating dairy enterprises had greater potential alternatives than non-participants (see Table 6). Furthermore, non-participants' current capital ranged from 40,000 to 282,660 Eth. Birr, whereas participants' current capital ranged from 100,000 to 3,000,750 Eth. Birr. This demonstrates that personnel and financial resources could influence the choice made by dairy enterprises in relation to the level of involvement in value addition.

Table 6: Descriptive statistics of access to resources and technology

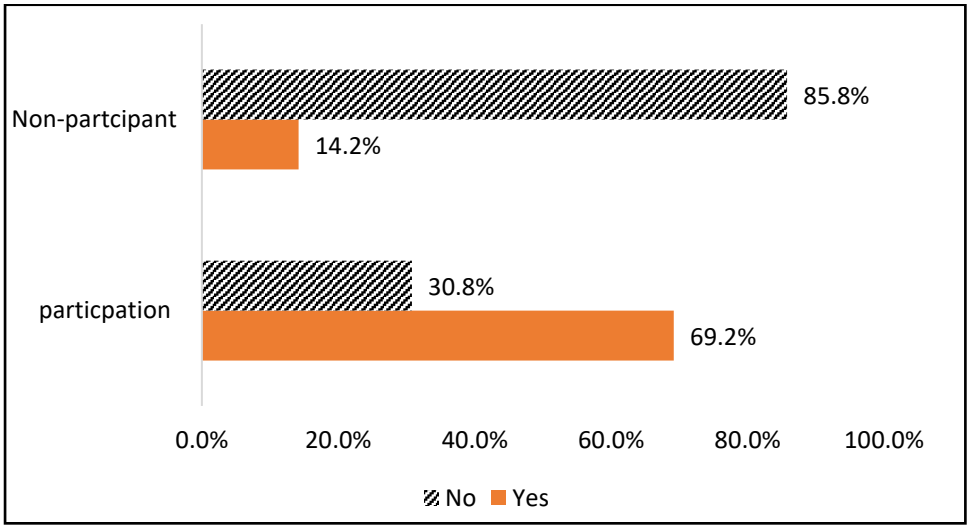
Variables	Partaking in VAM status	Mean	Min.	Max.	t-test
Dairy cattle	Participant	17.1	0	32	-7.022***
	Non-participant	7.8	2	19	
Volume of milk Per day	Participant	341.6	0	960	-6.792***
	Non-participant	139.4	30	320	
Capital (in 1000)	Participant	600.96	100	3000.75	-6.279***
	Non-participant	124.9	40	282.66	
Number of employees	Participant	14.3	2	52	-2.689***
	Non-participant	10.1	2	30	

***, significance level at 1%

Source: Own computation, 2020

Participants had better access to machines and equipment ownership and a more extensive selection of tools and equipment than enterprises that did not engage in value-adding work. 69.2% of participating dairy enterprises have access to machinery and equipment. In comparison, only 14.2% of non-participating dairy enterprises had access to machinery and equipment. This might suggest that having access to sophisticated machinery and equipment enables enterprises to add value to milk.

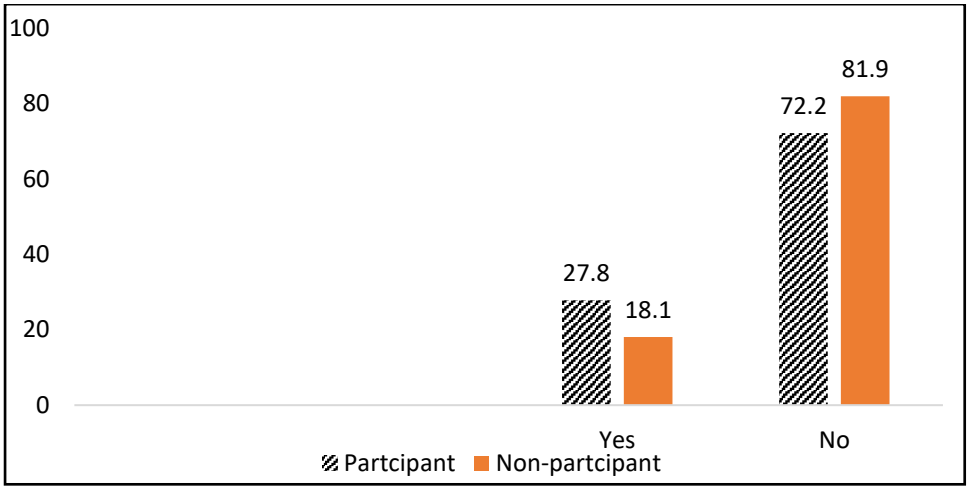
Figure 2: **Access to machinery & equipment**



Source: Own computation, 2020

Credit was an essential component of the dairy industry because it enabled enterprises to participate in activities that increased the value of milk and product diversification. The descriptive statistics indicated that 72.2% of participating dairy enterprises did not have access to credit, whereas the rest of the dairy enterprises (27.8% of them) had credit access. On the other hand, 81.9% of non-participant enterprises didn't receive loan access, while the remaining (18.9%) were offered credit. Dairy businesses must have access to various financial institutions from which they may get loans. Local moneylenders were the traditional source of financing for dairy farmers' companies when they needed more capital.

Figure 3: Access to credit service



Source: Own computation from 2020 survey

Ethiopia's dairy industry is among the fastest-growing in the world. An increase in the demand for value-added products, such as milk and dairy products, has led to a growth in the number of individuals seeking work. The government aims to minimize the quantity of milk and other imported dairy products, creating major pressure on national budgets.

Only 9.7 and 11.1 percent of individuals who did not engage in the milk value addition had access to different incentives and skills training. This contrasts with the 90.3 and 88.9 percent of non-participants who had no incentives and skills training access. On the other hand, participants who had access to incentives and skills training made up 50.7% and 65.77% of the total. In contrast, 49.3 percent and 34.3 percent of participants did not have access to the incentives or skills training. Compared to the total number of enterprises that participated in the study, only a tiny

percentage (11.2 %) of the dairy enterprises were interested in being involved in research and development activities to improve product quality and expand their product line.

Table 7: Institution and government support

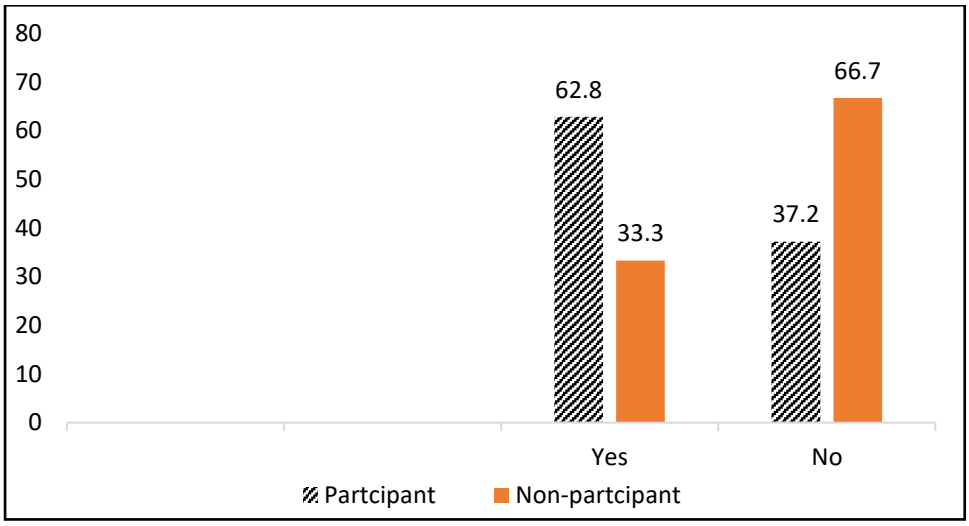
Variables	Category of partaking in VAM		%	Chi2(1)
Research & development	Participant	No	82.9	13.9185***
		Yes	17.1	
	Non-participant	No	100	
		Yes	0	
Incentive	Participant	No	49.3	34.3555***
		Yes	50.7	
	Non-participant	No	90.3	
		Yes	9.7	
Skills training	Participant	No	34.3	56.8871***
		Yes	65.7	
	Non-participant	No	88.9	
		Yes	11.1	

***, significance level at 1%

Source: Own computation, 2020

37.2 percent of the total participant diary enterprises did not have access to market information, compared to 62.8 percent of participants who had access to such information. Of the non-participant dairy enterprises, 66.7 percent were not provided with any media outlet about the market information. The remaining 33.3 percent of enterprises gained access to information. Exposure to direct market information enables the sale of milk and milk products through many transaction channels and gives a specific collection of advantages. With the backing of a well-organized market intelligence information system, all the dairy firms and traders can engage with one another and set a price for their goods.

Figure 3: **Access to market information**



Source: Own computation, 2020

3.4 Econometric Results

3.4.1 Determinants of the choice and degree of participation in VAM

The Double-Hurdle regression model was used to investigate the factors that influence dairy enterprises' decisions to take part in a market and their level of VAM. The likelihood ratio chi-square test result (LR chi2 = 225.23 and LR chi2 (14) = 291.09) indicates that at least one of the predictors' regression coefficients is not equal to zero, as shown in the table below. The null hypothesis states that all of the regression coefficients in the model are equal to zero. This indicates that the model succeeds in explaining the relationship between the dependent and at least one independent variable.

Table 8: Determinants of Decision and degree of partaking in VAM, Double-Hurdle Approach

Variables	Double-Hurdle (Probit regression) Outcome Variable-Decision to participant			Double-Hurdle (Tobit regression): Outcome Variable-Degree or extent of participation		
	Coeff.	Std. Err.	P>|Z|	Coeff.	Std. Err.	P>|t|
Age	0.1184	0.0421	0.005***	0.0023	0.0012	0.067*
Sex (male=1)	0.4655	0.4554	0.307			
Family size	-0.7332	0.2707	0.007***	-0.0165	0.0074	0.027**
Education level	0.3874	0.0976	0.000***	0.0256	0.0034	0.000***
Experience	0.2195	0.0933	0.019**	0.0086	0.0031	0.006***
Ownership Status (0=own 1=hire)	0.8345	0.4785	0.081*	0.041	0.0188	0.030**
Current Capital	0.0073	0.0021	0.001***	0.000011	0.000018	0.561
Number of Employee	0.0289	0.0256	0.259	0.0007	0.0009	0.441
Machinery & Equipment (1=yes 0=no)	1.0802	0.628	0.085*	0.1252	0.0227	0.000***
Number of dairy cattle	-0.1152	0.0668	0.085*	.	.	.
The volume of milk in the litter	0.0082	0.0032	0.011**	0.0002	0.0001	0.000***
Access to credit services (1=yes 0=no)	0.9747	0.5442	0.073*	0.0669	0.0201	0.001***
Research & development (1=yes 0=n)	1.1567	0.8363	0.167	0.0839	0.0271	0.002***
Incentive (1=yes 0=No)	-0.004	0.5131	0.994	0.0081	0.0216	0.706
Skills training (1=yes 0=No)	1.0132	0.5645	0.073*	0.0682	0.0199	0.001***
Access to Market info. (1=yes 0=No)	-0.5234	0.5493	0.341	0.0464	0.0202	0.023**
Intercept	-12.059	2.3471	0.000***	-0.4992	0.0531	0.000***
Sigma				0.1151	0.0073	
Log likelihood = -25. 722333	Log likelihood = 61.438462, Number of observations= 212, LR chi2 (14) = 291.09, Prob > chi2 = 0.0000, Pseudo R2 = 1.7305, Left–censored obs. (at D2<=0) =76, uncensored obs.=136, Right-censored obs. =0					
Number of observations= 212						
LR chi2 (16) = 225.23						
Prob > chi2 = 0.0000						
Pseudo R2 = 0.8141						

Note: ***, **, *: Implies statistical significance at 1%, 5%, and 10% levels,
Source: own computation, 2020

The managers' age has a positive and statistically significant influence on both the decision to engage in VAM and the level of VAM at 1% and 10% significance levels, respectively. All other things being equal, as the managers age increases, the likelihood of engaging in VAM and the degree of VAM increases. This means that older individuals are more eager to participate in the market than younger people. This indicates that older enterprise managers might have a broader knowledge base and range of abilities as a consequence of their experience. The findings of this study are congruent with those of Tadesse (2017), who revealed that age had a positive and significant influence on whether or not to engage in VAM. However, this finding contradicts the findings of Obanla (2018) and Lijalem (2019), who observed that age had a negative influence on the value addition to milk. The firm managers' family size had a negative and significant influence on their decision to enter the dairy market at the 1% level of significance and the degree that they participated in adding value to milk (VAM) at the 5% level of significance. Tegegn and Tamir (2020) also found that the family size of managers influences the decision to participate in a market and the extent of value addition to milk negatively.

The higher the level of education, the better equipped business owners are to grasp the numerous dairy products and their importance in the dairy sector. Education improves enterprise owners' skills to offer many types of value to their companies, and the more educated they are, the better positioned they are to manage their companies efficiently. Managers' levels of education have a positive and significant effect on their decision to participate in VAM and the extent to which they engage in value addition. This conclusion is consistent with the findings of Beyene et al. (2017a) and Tegegn and Tamir (2020). They found that levels of education had a positive and significant association with their involvement in milk value addition and the decision to participate. It was found that participants' decisions and degree of engagement in VAM were positively influenced by the number of years of experience they had worked in the dairy business and statistically significant. A one-year increase in experience leads to a higher possibility of entering the dairy market and the degree of VAM involvement.

Ownership status had a positive and statistically significant influence on the decision to engage in VAM and the level of value added to milk. This means that when competent managers are employed in the enterprise, the possibility of market participation and the degree of value addition to milk increase. In other ways, owner-managed enterprises are less likely to participate in VAM activities since dairy owners may not add as much value to milk as a professional manager does.

Financial capital influences the choice to participate in VAM at a 1% level of significance, but it has no effect on the amount of engagement. Besides, it was found that having access to various machinery and equipment had a favourable and statistically significant effect on whether or not people participated and how much they participated. Dairy businesses with access to machinery and equipment were more likely to take part in the VAM. This study revealed that the dairy firm could produce more types of dairy products if they had access to an additional spectrum of milk apparatus and equipment.

The greater the number of dairy cattle in an individual's herd, the less likely the dairy firm was to engage in VAM. This might be because larger dairy enterprises are compelled to give their cows a greater quantity of concentrated feed. Many dairy enterprises would prefer to invest in animal feed processing than in milk value addition. In contrast, the volume of milk produced was positively associated with the choice to participate in value-added milk (VAM) as well as the level of value addition, and these relationships were statistically significant at the 5% and 1% levels of significance, respectively. VAM may occur from an increase in milk production, which results in a higher volume, increasing the possibility that the milk will be processed into value-added commodities. Tadesse et al. (2017b) both confirmed the same result, however Ayyano et al. (2020) came to a different finding. Access to credit influences both the decision to engage and the ultimate amount of milk value addition. This indicates that firms with credit access were more likely to participate in VAM, allowing them to loosen financial liquidity limits. This conclusion is reinforced by Beyene et al. (2017a) and Ding et al. (2019), who both found comparable results in their separate studies.

Engaging in research and development increases the likelihood of participation and the extent of value addition to milk. Research and development had a positive and significant influence on how VAM participated at a statistical significance level of one percent. Skills training was also shown to have a positive and statistically significant influence on participation choices and the degree of VAM. Enterprises that have received skill training were more likely to participate in VAM than those that did not receive it, and enterprises with access to market information were more likely to engage in VAM than those that did not have access to it.

4. Conclusion and Policy Recommendations

4.1 Conclusion

The study attempted to identify the factors that influence involvement in dairy marketing value addition in Addis Ababa and the surrounding areas. It intended to detect dairy enterprise participation decisions and their impact on milk value addition or product diversification.

To that end, 212 dairy enterprises participated in this survey, with 66.03% participating and 33.97% not participating. The average age of participants was 37.07 years, and 57.08 percent of dairy enterprise owners managed the operations of their enterprises. It was also found that the average family size of managers was 2.55, and they had 12.32 years of education and 8.4 years of work experience. The mean values of them current capital, number of workers, amount of milk in litters per day, and number of dairy cows in the study area were 439.27 ETB, 12.87, 272.93, and 13.97, respectively.

Providing proper services to dairy enterprises can assist them in producing value-added dairy products. 27.83% of participants in the study used credit services, 36.79% used incentives, 47.17% used skills training, and 52.83% used market information. Furthermore, 11.32% of enterprises conduct research and development related to the enhancement of dairy value addition.

Access to cutting-edge machinery and equipment, the amount of milk stored per litre, financing services, and skills training all promote dairy firms' participation in milk value-addition activities. On the contrary, the number of dairy animals had a modestly adverse effect on the decision to join VAM. This might be because a dairy farm with a bigger number of cows needs a significant amount of high-concentration feed in order for their animals to have increased milking production.

4.2 Recommendations and Policy Implications

The study advises that decision-makers, stakeholders, and dairy enterprises devote special attention to the dairy industry in order to increase dairy value addition. It suggests the following areas as crucial intervention to increase VAM participation in the industry:

Dairy enterprises should be promoted and expanded for better economic benefit and to adopt new technologies for advancing value addition to milk.

Financial institutions including banks and microfinance institutions should review their entire processes to establish an atmosphere that would encourage dairy firms to solve their financial issues and take part in dairy market value addition. Financial institutions need to expand their access to credit services and shorten their provision periods to be able to take part in VAM.

Consistent efforts should be made by the government or other stakeholders in order to provide machinery and processing equipment for chilling and processing milk for dairy enterprises that are suitable for milk value addition.

To improve milk value addition and subsequently marketable supplies for better market participation, a strategy should be designed to provide technical skill training for the enterprises to improve and diversify dairy products.

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