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OPTIMIZATION OF THE CAPITAL STRUCTURE OF DIVERSIFIED MILK AND DAIRY PRODUCTION ENTERPRISES IN UKRAINE

ABSTRACT

In the context of the decline in milk and dairy production in Ukraine, the justification of the most effective mechanism for financial and investment support for realizing the production and economic potential of the national dairy subcomplex is becoming increasingly relevant. Forming an optimal capital structure is an essential factor in the effectiveness of investment activities of diversified enterprises that produce milk and dairy products, considering the main technological, financial, and economic aspects of organizing production. Accordingly, systematic optimization of the capital structure by various sources will contribute to increasing the efficiency of functioning and competitiveness of enterprises in the industry, which will contribute to the restoration and further growth of milk and dairy production in Ukraine in the long term.

The study used general scientific and specialized economic research methods, namely monographic and systemic methods, calculation and constructive, analysis and synthesis, as well as economic and mathematical modelling, when determining the optimal capital structure by various most common sources of financing for newly established enterprises for the production of milk and dairy products in Ukraine.

A financial model of the functioning of an enterprise that produces and processes milk was developed to simulate the optimal capital structure. The optimization was carried out according to the criterion of maximizing net present value by determining the impact of different options for the capital structure on the values of the leading indicators of the efficiency of investment use. According to the results of the study, it was established that the most optimal option for forming the capital structure for enterprises producing and processing milk in Ukraine should be based on the maximum share of own financial resources with moderate involvement of fixed capital based on financial leasing, operational leasing with the minimization of long-term loans and private investments, which will ensure a relatively high level of investment efficiency.

Keywords: optimization, capital, production, milk and dairy products, enterprise, net present value, investments

JEL Classification: G31, Q14, Q12, C50

INTRODUCTION

Milk and dairy production in Ukraine are one of the most important areas of agrarian business, which ensures the state's food security and can form a significant export potential. At the same time, the actual volumes of milk and dairy production do not meet the demand on the domestic market, which stimulates the growth of imports and negatively affects the economic potential of the dairy industry as a whole. With the beginning of the full-scale war in Ukraine, the number of cows decreased from 1.5 to 1.2 million heads, which affected the reduction in milk production and sales (State Statistics Service of Ukraine, 2024). Crisis phenomena in dairy cattle breeding have been observed for a long time. They are a consequence of negative socio-economic processes that have been taking place in the country for decades, causing a significant reduction in the number of cows and production volumes in farms of all forms of ownership. For the restoration and development of Ukrainian dairy farming, significant investment in the creation of new enterprises, as well as the modernization and expansion of the

capacities of existing production facilities, is necessary, which will reduce the rate of decline in production in the short term and increasing them to meet the needs of the domestic market in the long term, taking into account the technological features of the organization of dairy farming. One of the crucial decisions at the initial stage of establishing enterprises, including those producing milk and dairy products, is to determine the optimal capital structure, which will undoubtedly affect the level of economic efficiency and the success of the functioning of newly created production facilities, which justifies the relevance of this scientific research.

LITERATURE REVIEW

Studies on the optimization of the capital structure of enterprises in the agricultural sector of the economy are presented in the works of many Ukrainian and foreign scientists. The study of the optimal capital structure, taking into account the specifics of the activities of agricultural enterprises and the features of the formation and use of own and borrowed financial resources, is widespread. Thus, it is worth highlighting the research of a group of Ukrainian scientists, N. S. Zgadov, G. M., Pavlenko, and O. E. Panenko, on the optimization and security of the capital structure in agricultural enterprises, which notes the feasibility of using the profitability of equity as the most acceptable criterion for optimizing the structure with the need to take into account the financial leverage ratio (Zgadova et al., 2023). O. Larchenko, in his scientific work, which concerns the use of economic and mathematical modelling in the management of the capital of an agricultural enterprise, justifies the optimal structure and size of capital, which affects the level of economic efficiency of the enterprise and also determines the optimal balance between own and borrowed financial resources (Larchenko, 2020). O. Lelyuk investigates the theoretical and methodological principles of optimizing the capital structure of agricultural enterprises with the justification of the main criteria (Leliuk, 2010). O. Oliynik focuses on the theoretical aspects of modelling capital structure in the context of developing a financial strategy for developing agricultural enterprises (Oliynik, 2019). It is also worth highlighting research aimed at the formation of analytical tools for capital reproduction in the agricultural sector of Ukraine (Lemishko, 2020), and the optimization of the capital structure for dairy enterprises (Varchenko et al., 2021).

Optimization of the capital structure of agricultural enterprises, including farms, based on the use of economic and mathematical modelling methods, is widely presented in foreign scientific literature. In particular, studies of the capital structure of the Visegrad Group countries have been conducted (Fenyves et al., 2020). The relationship between profitability and capital structure of agricultural holdings in the Czech Republic has been established and substantiated (Stekla & Gycova, 2016). The optimal capital structure for Swiss dairy farms has been studied (Schorr & Lips, 2019). The impact of working capital management on business profitability has been determined using the example of the Polish dairy industry (Gołaś, 2020). The cost and profit from producing alternative dairy products have been assessed to determine capital investments and the economic justification for creating small milk processing enterprises (Becker et al., 2007). The optimal capital structure in agricultural cooperatives has been substantiated, considering the cyclicity of working capital (Wang, 2016).

Studies have also been conducted on optimizing capital structure and firm value (Uzliawati et al., 2018). The impact of taxation on operational risks when investing, considering the optimization of capital structure (Paquin et al., 2024), has been determined. Separately, it is necessary to highlight scientific works that consider the theoretical principles of capital formation, in particular in the field of agriculture as one of the most critical priorities in the economy of Ukraine (Kunytyska-Iliash, 2023), as well as studies on the theoretical and methodological foundations of optimization and analysis of capital structure in enterprises (Rohanova & Kotliarova, 2021). and the features of capital structure management (Berenda et al., 2018). However, the theoretical and methodological features of forming the optimal capital structure in specialized enterprises for producing milk and dairy products in Ukraine, according to the main criteria for the effectiveness of investment use, remain insufficiently studied. Accordingly, our study is based on a hypothesis substantiating the impact of optimizing the capital structure in diversified enterprises producing milk and dairy products on the effectiveness of their investment activities according to key indicators, considering the conditions for attracting financial resources from various sources.

The results presented in this article are a continuation of our previous research on capital formation in livestock enterprises in Ukraine (Maksym et al., 2022), economic justification of the efficiency of feed use in milk production enterprises (Chemerys et al., 2023), analysis of the market for milk and dairy products in the EU countries and Ukraine (Chemerys et al., 2024), as well as modelling the export potential of the livestock industry of Ukraine, including milk and dairy products (Chemerys et al., 2020).

AIMS AND OBJECTIVES

The article aims to determine the optimal capital structure of diversified milk and dairy production enterprises in Ukraine to increase the efficiency of using attracted financial resources. Achieving the research goal is based on the implementation of the main tasks:

- to analyze the results of research by Ukrainian and foreign scientists on optimizing the capital structure for enterprises in the agri-food sector;
- to develop a financial model of the functioning of diversified milk and dairy production enterprises to obtain the necessary input data when optimizing the capital structure;
- to determine, based on economic and mathematical modelling, the optimal structure of capital formation for diversified milk and dairy production enterprises, taking into account the differentiated values of the cost of the primary sources of attracted financial resources;
- to conduct modelling and economic analysis of the impact of various options for the capital structure on the leading indicators of the efficiency of attracted investments for organizing milk and dairy production in enterprises in Ukraine, following the main technical and economic parameters.

METHODS

The study used the method of economic and mathematical modelling to determine the optimal capital structure for diversified milk and dairy production enterprises in Ukraine.

The monographic method was used in a comprehensive study of the main stages and factors of forming the optimal capital structure for newly established milk and dairy production enterprises in Ukraine.

The system method was used to build a holistic set of relationships between input technical and economic variables and output performance indicators of the effectiveness of attracting investments for organizing milk production and processing;

The calculation and constructive method were used to select and justify the most optimal option for the capital structure of a newly established milk and dairy production enterprise.

Methods of analysis and synthesis were used to assess the impact of the main technological and cost factors on the effectiveness indicators of the attracted investments.

Optimization of the capital structure is carried out according to the criterion of maximizing the project's net present value and is determined by formula 1.

$$NPV = \sum_{i=1}^n \frac{CF_i}{\left(1 + \frac{r_i}{100}\right)^i} - Gc \rightarrow \max, \quad (1)$$

where *NPV* – net present value of the project, EUR; *CF_i* – net cash flow in the *i*-th year, EUR; *Gc* – total capital requirement for project implementation, EUR; *r_i* – discount rate in the *i*-th year, %.

It is also possible to use other optimization criteria, particularly the level of return on investment, return on capital, return on sales, and internal rate of return. However, it is necessary to consider each selected criterion's advantages and disadvantages.

The selected optimization criterion makes it possible to cover to a greater extent the multifaceted nature of the formation of the efficiency of investment use in a newly created enterprise during the project implementation period. The determination of net present value goes through several stages. Generally, it depends on the sum of the values of net discounted cash flows for a specified period and the initial investment required to implement the project, with the optimal ratio between own and borrowed capital.

We propose determining the net cash flow, considering the refunded amount of value-added tax, which the enterprise will also use to organize production during the project implementation period. Most often, the excess of the value of the tax credit over the tax liability is observed in the first year of the enterprise's operation, when there are the most significant expenses for the purchase of fixed assets, and sharply decreases in subsequent years, in which the primary source of the tax credit formation is the amount of working capital in the form of materials and raw materials necessary to ensure the

production of products (Formula 2). However, a more significant factor in forming net cash flow when achieving high economic efficiency is the net profit value and the accrued depreciation deductions.

$$CF_i = P_i + A_i + VAT_i, \quad (2)$$

where P_i – net profit in the i -th year, EUR; A_i – depreciation in the i -th year, EUR; VAT_i – VAT refund in the i -th year (negative difference between VAT tax liability and tax credit in the i -th year), EUR.

Net profit and its dynamics during the project implementation period are an essential indicator that affects the optimization of the capital structure of the enterprise; therefore, it is advisable to present the formula for its determination in more detail, taking into account the set of main influencing factors, such as income and expenses from operating and financial activities, the features of determining depreciation for various sources of capital raised, as well as the income tax rate (formula 3).

$$P_i = (Or_i + D_{ri} + Fu_i + P_{ri} - Oc_i - Fe_i - CB) * \left(1 - \frac{K}{100}\right), \quad (3)$$

where K – income tax rate, %; Or_i – operating income in the i -th year, EUR; D_{ri} – dividends in the i -th year, EUR; P_{ri} – accrued amount of interest on the deposit in the i -th year, EUR; Fu_i – other income received from financial investments in the i -th year, EUR; Oc_i – operating expenses in the i -th year, EUR; Fe_i – other expenses from financial activities in the i -th year, EUR; CB – fee for raising capital (in the model, it acquires a static value according to the contract terms and depends on the structure of the raised capital), EUR.

The amount of value-added tax paid each year during the project implementation period is determined by formula (4). It affects the net profit amount and is the main criterion for optimizing the capital structure used in the model. The tax liability for value-added tax is formed from the proceeds from the sale of the enterprise's products, which includes VAT at a general rate of 20%. The tax credit in the model depends on the cost of fixed and working capital and the share of leased means of production (operating lease) in the capital structure, for the value of which the tax credit will not be accrued.

$$VAT_i = \frac{VA_i}{Kt} - \left(Tko_i + IF(Cr = 0; Tkg) + IF(Cr > 0; Tko_i - \frac{Gcg - Cr}{Kt})\right), \quad (4)$$

where VA_i – revenue from sales of products in the i -th year EUR; Kt – the rate of deduction of value-added tax from the cost of purchased fixed or current assets used in the business activities of the enterprise for inclusion in the tax credit; Tko_i – tax credit on working capital, EUR; Tkg – tax credit on fixed capital without rent, EUR.

Operating income (formula 5) consists of revenue from the sale of milk and dairy products and beef and animal by-products.

$$Or_i = Pt_i * Qt_i + Pt'_i * Qt'_i + \sum_{j=1}^n (Pm_{ij} * Qm_{ij} + Pu_{ij} * Qu_{ij}), \quad (5)$$

where Pm_{ij} – the price of 1 kg of j -th type of main milk product in i -th year, EUR; Qm_{ij} – production volume of the j -th type of main milk product in the i -th year, kg; Pu_{ij} – price of 1 kg of j -th type of related milk product in i -th year, EUR; Qu_{ij} – production volume of j -th type of related milk products in i -th year, kg; Pt_i – price of 1 kg of beef in the i -th year, EUR; Qt_i – beef production volume in the i -th year, kg; Pt'_i – price of 1 kg of cattle by-products in the i -th year, EUR; Qt'_i – the volume of production of cattle by-products in the i -th year, kg.

$$Qm_{ij} = \frac{Cw_i * Ec_i * Ts_i * Fkf_i * Sq_j}{Fkb * GQ_{ij}}, \quad (6)$$

where Cw_i – number of cows in the i -th year, heads; Ec_i – milk yield per cow per year in the i -th year, kg; Ts_i – milk marketability coefficient in the i -th year; Fkf_i – actual milk fat content in the i -th year, %; Fkb – basic milk fat content, %; Sq_j – the share of milk used to produce the j -th type of product in the i -th year, %; GQ_{ij} – volume of milk used for the production of j -th type of main product in i -th year, kg.

$$Qu_{ij} = GQ_{ij} * Fl_{ij} \quad (7)$$

where FL_j – the share of the output of the j -th type of by-product in milk processing into the i -th type of main product, %.

$$Qt_i = Cw_i * (Kv_i * Vcw_i + Kt_i * Vt_i) * Jct_i, \quad (8)$$

where Kv – annual cow culling rate in the i -th year; Kt – calf production rate per cow in the i -th year; Vcw – the average weight of 1 cow, kg in the i -th year; Vt – average weight of young cattle at 6 months in the i -th year, kg; Jct – average beef yield in the i -th year, %.

$$Qt'_i = Cw_i * (Kv_i * Vcw_i + Kt_i * Vt_i) * Jct'_i, \quad (9)$$

where Jct'_i – average yield of cattle by-products in the i -th year, %.

The total expenses (formula 10) include operating expenses, which consider production costs under various items (materials, raw materials, labour, depreciation, etc.), administrative expenses, and costs of product sales, rent, and insurance payments. Expenses from financial activities take into account interest on long-term loans taken from credit institutions respectively; their amount will depend on the capital structure, particularly the share that falls on long-term loans and the interest rate.

$$Oc_i = Fh_i + Fd_i + Li_i + El_i + Wt_i + Vt_i + Pt_i + Dm_i + Ot_i + Ws_i + A_i + Ad_i + Sc_i + Ll_i, \quad (10)$$

where Fh_i – the cost of fuel and lubricants in the i -th year, EUR; Fd_i – feed cost, EUR; Li_i – bedding material, EUR; El_i – electricity, EUR; Wt_i – water, EUR; Vt_i – veterinary drugs and services, EUR; Pt_i – containers for packing butter and bottling milk, EUR; Dm_i – materials and means for processing and disinfecting premises, EUR; Ot_i – other production costs, EUR; Ws_i – salary with deductions for social measures, EUR; A_i – depreciation, EUR; Ad_i – administrative costs, EUR; Sc_i – cost of sales, EUR; Ll_i – land rent (pasture), EUR.

The accrued amount of interest on the deposit, determined by formula 11, is part of the income from financial activities and an alternative option for using the enterprise's free accumulated financial resources during the project implementation period.

$$P_{ri} = C \frac{h_i * Cv_{5i}}{100} \quad (11)$$

where Ch_i – temporarily unused equity, EUR; Cv_{5i} – the opportunity cost of raising equity capital (calculated based on the current average interest rate for a bank deposit), %.

The amount of accrued depreciation in the model depends on the cost of the fixed capital employed on a lease basis. It is determined using the logical function IF, which checks whether the condition is met and returns one value of the indicator if it is met and another if the specified condition is not met (formula 12). Depreciation charges will decrease if the capital structure contains a share of assets employed on an operating lease basis and, conversely, will increase if the amount of leased assets is absent or their share is insignificant. The model considers a linear option for accruing depreciation at a zero-liquidation value of fixed assets employed to organize the production of the enterprise's products.

$$A_i = IF(Cr_i = 0; Ab_i) + IF(Cr_i > 0; Ac_i), \quad (12)$$

Cr_i – the cost of the fixed capital employed based on the lease in the i -th year, EUR; Ab_i – accrued depreciation amount in the absence of rent in the i -th year, EUR; Ac_i – accrued depreciation amount in the presence of a lease in the i -th year, EUR.

To determine the optimal need for each of the five sources of capital (formula 13), variables $x_1 \dots x_5$, are used, showing the shares of each available capital formation source. Based on the obtained values of shares for each of the specified sources, the optimal capital structure of the enterprise is determined, which, according to the objective function (optimization criterion) in the model, should provide the maximum net present value of the project for the specified period.

$$C_k = \frac{Gc * x_k}{100}, \quad (13)$$

where C_k – a capital requirement for k – that source of formation, EUR; x_k – the optimal share of k – that source of capital formation in the overall structure ($x_1 \dots x_5$), %; x_1 – attracted investments, %; x_2 – long-term loans %, x_3 – lease of fixed assets, %; x_4 – financial leasing, %; x_5 – own capital, %.

The fee for the attracted capital is determined by formula 14 and affects the value of the net profit and, accordingly, the project's net present value. An increase in the share of attracted capital will reduce investment efficiency due to the increase in other operating and financial costs. Therefore, the most optimal option is usually to focus on equity. Still, in conditions of limited sources of financing, it is necessary to find the optimal ratio between equity and attracted capital, as well as the optimality of its structure, at which the efficiency of the enterprise will be the highest.

$$CB = \sum_{k=1}^n \frac{C_k * Cv_k}{100}, \quad (14)$$

where Cv_k is the cost of raising capital from k , which is that source of formation, %.

The cost of capital raised also depends on each source's attraction cost following the determined optimal capital structure. The cost of capital raising is the percentage of the capital paid for its use. This indicator is determined by formula 15 and depends on the marginal cost of capital raised, which shows how the fundamental cost changes for each additional percentage increase in the need for capital. In addition, to determine the cost of capital raised, the model uses an indicator of the marginal value of the amount of capital, a deviation from which causes a change in the essential cost of capital raised and is set separately for each proposed capital formation source. Considering several calculation options with different possible values of the need for capital for each source, a logical function (IF) is also used to determine the cost of capital raised.

$$Cv_k = IF\left(C_k > Cdw_k; \left(\frac{C_k}{Cdw_k} - 1\right) * 100 * Cm_k + Cd_k; Cd_k\right) * IF(C_k < Cdw_k; 1; 1) * IF(C_k = Cdw_k; 1; 1), \quad (15)$$

where Cm_k – the marginal cost of capital raised by k source of formation, %; Cd_k – basic cost of capital raised by k sources of formation, %; Cdw_k – the threshold value of the amount of capital, deviation from which causes a change in the basic cost of attracted capital for k sources of formation, EUR (in the model, it takes on a conditional value of EUR 30,000 for all sources of attracting capital).

Input information for modelling the optimal capital structure in diversified milk production and processing enterprises in Ukraine was obtained taking into account our experience, cooperation with specialized enterprises that produce and process milk, technological information on the organization of milk production and processing, as well as on the basis of research into the market value of fixed and current assets necessary for the organization of production.

In particular, the planning of the cost of fixed and working capital, which are given in Tables 1 and 2, are based on research into current market prices for specialized equipment, materials and raw materials, breeding cows, and the cost of building livestock complexes, taking into account information from companies that implement the relevant logistical and raw material support for organizing milk production and processing in Ukraine and provide information and advisory support (IKR Group, 2025; Agro Frost, 2025; THL Palladium, 2025; Eridon Bud, 2025; Genetyka and Seleksia, 2025; Ukrainian Electronic Grain Exchange, 2025).

Production volume planning (Table 3) is based on the general technology of milk production and processing with the corresponding standards for the use of the main types of resources (Mashkin & Parysh, 2006; Kondratiuk et al., 2024), taking into account the volumes of milk production and processing, which are given in Table 3. The input values for the basic indicators of technological efficiency, such as feed costs per 1 liter of milk and cow productivity, are given taking into account statistical data for enterprises of Ukraine (State Statistics Service of Ukraine, 2024).

Planning of operating expenses by main items for 5 years (Table 4) is determined using data from Tables 1, 2, and 3.

The base cost of capital for modelling is assumed to be 10% when attracting private investments, 6.5% for long-term lending, 11% for operating lease, 7% for financial leasing, and 2% for equity. The marginal cost of capital coefficients are set for attracting private investment at 0.1, long-term lending and financial leasing at 0.01, operating lease at 0.02, and equity at 0.001. The specified input data are indicative and may be changed, taking into account the enterprise's access to financial resources and conditions for attracting capital.

The modelling results shown in Tables 5, 6, 7, 8, 9, and Figure 1 are determined based on the input data from the previous tables, as well as additional information on the values of the basic and marginal cost of capital, and are our own research using the developed economic and mathematical model.

RESULTS

The optimal capital structure is modeled based on feasibility data for a vertically diversified agricultural enterprise with 200 cows that will produce raw milk and process it into dairy products, such as pasteurized milk with a fat content of 2.5% and butter with a fat content of 80%, as well as related products of raw material processing. Organizing milk processing for such enterprises is one of the ways to increase economic efficiency due to the significant difference between wholesale purchase prices for raw milk and final dairy products for consumption. As of the beginning of the 3rd quarter of 2024, Ukraine's average premium milk price does not exceed EUR 310 per 1000 liters. Prices for pasteurized milk from processing enterprises with VAT range from EUR 710 to 800 per 1000 liters. The wholesale prices ratio for pasteurized and raw milk is between 2.3 and 2.6, respectively; diversification in the direction of organizing milk processing will contribute to increasing added value and the efficiency level of using the resources involved. Therefore, the described diversification option is the most profitable for attracting investments.

According to our research, to organize a diversified enterprise for 200 cows to produce raw milk with subsequent processing into dairy products, more than EUR 800 thousand of advanced capital is required (Table 1). The largest share of the required start-up investments will fall on fixed capital - 66.7%. In the structure of the cost of means of production, significant items are utility rooms for keeping cattle, the cost of the cow population, a milk processing complex, a modular slaughterhouse, warehouses, feed production equipment, machinery, and equipment. The depreciation amount is projected to be EUR 53.2 thousand annually for the period of project implementation; however, following the determined optimal capital structure, it is proposed to attract fixed assets for EUR 107.7 thousand through an operating lease, which will reduce the amount of annual depreciation to EUR 42.7 thousand, and the tax credit from purchased fixed assets will also decrease by almost EUR 18 thousand. However, attracting fixed assets based on an operating lease when determining the net present value of the project based on the company's financial reporting indicators will reduce the input value of the starting capital, which will contribute to increasing investment efficiency since fixed assets that are leased cannot be included in the assets on the company's balance sheet, the only exception being financial leasing, which is a type of lease.

Table 1. Capital expenditure, depreciation, and tax credit planning, EUR * The cost of fixed capital, from which depreciation is calculated (depends on the share of operating lease in the capital structure after optimization). Note: ** Adjusted amount of accrued depreciation; *** Adjusted amount of accrued tax credit. (Source: calculations were based on data (IKR Group, 2025; Agro Frost, 2025; THL Palladium, 2025; Eridon Bud, 2025; Genetyka and Selektisia, 2025) as well as our own research taking into account planned volumes of milk production and processing)

Adjusted capital amount subject to depreciation and tax credit	606240*		63250**	101040***
Expense item	Cost	Structure, %	Amortization	Tax credit
Livestock farm building	208000	23.1	8320	34667
Feed mixer spreader	9500	1.1	1188	1583
Feed storage sleeves	1850	0.2	1850	308
Creation of cultivated pastures	30000	3.3	6000	5000
Black-eyed heifers	300000	33.3	50000	50000
Automatic drinking troughs and feeders	10000	1.1	2000	1667
Milk pipeline	19000	2.1	1583	3167
Communications	8000	0.9	400	1333
Milking parlor	30000	3.3	2500	5000
Manure conveyor	15000	1.7	1250	2500
Waste storage	13700	1.5	685	2283
Milk cooling tank	28500	3.2	2850	4750
Tractor and auxiliary equipment	40000	4.4	5000	6667
Fodder workshop	35000	3.9	1750	5833
Milk processing shop	50000	5.5	2500	8333
Warehouses	32000	3.5	1280	5333
Milk pasteurization and bottling equipment	17200	1.9	1433	2867
Butter production equipment	5900	0.7	492	983
Modular slaughterhouse for cattle	28500	3.2	2375	4750
Creation of cultivated pastures	18000	2.0	X	X
Other equipment and inventory	2000	0.22	667	333
Total	902150	100.0	94123	147358

Working capital accounts for about a third of the start-up capital (Table 2), and the most significant items are the cost of feed, electricity, containers for bottling and packaging dairy products, and funds to ensure wages with social contributions, and other mandatory payments. During the project implementation period, a gradual increase in the need for working capital is forecasted to be EUR 320 thousand for 5 years due to the cost of material components of production and wages. The ratio of fixed capital to working capital will be within 2 to 1 at the beginning of the project, with a further decrease to 1.15 due to annual depreciation deductions and an increase in the cost of raw materials and wages.

Table 2. Working capital planning for 5 years, EUR. (Source: calculations were based on data (IKR Group, 2025; Agro Frost, 2025; THL Palladium, 2025; Eridon Bud, 2025; Genetyka and Seleksia, 2025; Ukrainian Electronic Grain Exchange, 2025) as well as our own research taking into account planned volumes of milk production and processing)

Expense item	Year				
	1	2	3	4	5
Fuel, oils, and lubricants	15125	15881	16675	17509	18385
Feed	188200	197610	207490	217865	228758
Bedding material	18250	19163	20121	21127	22183
Electricity	50813	53354	56021	58822	61763
Water	4015	4216	4427	4648	4880
Veterinary drugs	2990	3140	3296	3461	3634
Cash on account	106941	112288	117903	123798	129988
Containers for packaging butter and bottling milk	59876	60406	60935	59876	58288
Materials and means for processing and disinfecting premises	500	525	551	579	608
Other working capital	2400	2520	2646	2778	2917
Total	449110	469101	490066	510463	531404

Table 3 shows data on the leading technological indicators of the organization of raw milk production and its processing into ready-to-consume dairy products. The projected average annual livestock of Ukrainian black-and-white dairy cows at the enterprise will be at the level of 200 heads, which, with an average daily milk yield of about 20 liters, will allow obtaining more than 1,200 thousand liters of raw material annually. It is also projected to receive about 200 calves for their further fattening and slaughter at its production facilities of the modular slaughterhouse, which will become additional income for the enterprise and supplement the primary income from the sale of dairy products.

Table 3. Production volume planning. (Source: calculations were based on data (Mashkin & Parysh, 2006; Kondratiuk et al., 2024; State Statistics Service of Ukraine, 2024) as well as our own research, taking into account planned volumes of milk production and processing)

Indicator	Year				
	1	2	3	4	5
Number of cows, heads	200	200	200	200	200
Milk yield per cow per year, l	6050	6100	6150	6050	5900
Average daily yield per lactation 305 days, l	19.8	20.0	20.2	19.8	19.3
Feed consumption per 1 kg of milk, feed units (f.u.)	0.9	0.9	0.9	0.9	0.9
The volume of milk produced per year	1210000	1220000	1230000	1 210000	1180 000
Business yield of calves, %	98	98	98	98	98
Calves obtained from cows, heads	196	196	196	196	196
Milk spent on drinking calves (450 kg/head), kg	78400	78400	78400	78400	78400
Milk yield, %	93	94	94	93	93
Volume of milk for processing, kg	1131000	1141000	1151000	1131000	1101000
Average milk fat content, %	3.6	3.6	3.6	3.6	3.6
Volume of milk in basic fat content (3.4%), l	1197529	1208118	1218706	1197529	1165765
The volume of pasteurized milk with a fat content of 2.5%, kg	1172217	1182581	1192 945	1172217	1141123
Volume of butter production (80% fat content), kg	13472	13591	13710	13472	13115
By-products of milk processing into butter, l	11841	11945	12050	11841	11526
Weight of young cattle at 6 months, kg	182	182	182	182	182
Average daily gain, kg	0.8	0.8	0.8	0.8	0.8

(continued on next page)

Table 3. Continued.

Indicator	Year				
	1	2	3	4	5
Feed consumption per 1 kg of live weight gain, f.u.	7.5	7.5	7.5	7.5	7.5
Weight of sold young cattle, kg	35672	35672	35672	35672	35672
Slaughter yield, %	50	50	50	50	50
Weight of half-carcasses of cattle for sale, kg	17836	17836	17836	17836	17836
Weight of by-products of cattle slaughter, kg	16052	16052	1 052	16052	16052
The price of 1 liter of milk, including VAT, EUR	0.76	0.798	0.838	0.880	0.924
Price of 1 kg of veal including VAT, EUR	4.00	4.200	4.410	4.631	4.862
Price of 1 kg of by-products of cattle slaughter, EUR	0.38	0.40	0.42	0.44	0.46
The price of 1 kg of butter, EUR	5.00	5.25	5.51	5.79	6.08
The price of 1 liter of the by-products of milk processing into butter, EUR	0.65	0.68	0.72	0.75	0.79

Taking into account the technological volume of milk consumed for feeding young cattle, the yield of marketable milk will be at the level of 1.100 thousand liters per year with a fat content of 3.6%, which, when converted to the fundamental fat content (3.4%), will amount to from 1.165 to 1.218 thousand liters over the project implementation period. Skimming milk to 2.5% will allow the production of about 1.172 thousand liters of pasteurized milk and up to 13.500 kg of butter in the first year, and the associated products of milk processing into butter are expected to be at the level of 11.500-12.000 thousand liters. At the end of the period, due to a decrease in the productivity of cows and raw materials for processing, pasteurized milk and butter production will decrease by 2.5-3%. The output of beef and veal is forecast at up to 17.8 tons, and offal over 16 tons.

Operating expenses in a vertically diversified enterprise for producing milk and dairy products will be formed by 85% from working capital (Table 4). Feed costs will take up to 36%, more than 17% will be for wages with deductions for social measures, and the share of depreciation deductions will be more than 12%. In general, production costs are forecast at 490 thousand in the first year of project implementation and will gradually increase to EUR 573 thousand by year 5. The total operating expenses will be from EUR 530 to EUR 616 thousand for the specified period. The level of operating expenses depends on the optimal capital structure determined based on the model.

Table 4. Operating cost planning for 5 years, EUR. (Source: calculations were based on data from Tables 1, 2, and 3)

Expense item	Structure in the first year, %	Year				
		1	2	3	4	5
Fuel, oils, and lubricants	2.9	15125	15881	16675	17509	18385
Feed	35.7	188200	197610	207490	217865	228758
Bedding	3.5	18250	19163	20121	21127	22183
Electricity	9.6	50813	53354	56021	58822	61763
Water	0.8	4015	4216	4427	4648	4880
Veterinary drugs	0.6	2990	3140	3296	3461	3634
Containers for packaging butter and bottling milk	11.4	59876	62870	66014	69314	72780
Materials and means for processing and disinfecting premises	0.1	500	525	551	579	608
Other production costs	0.5	2400	2520	2646	2778	2917
Salary of production personnel	13.4	70800	74340	78057	81960	86058
Single social contribution (SSC)	3.0	15576	2717	4269	5951	7762
Depreciation	12.0	63250	63250	63250	63250	63250
Total production costs	93.3	491795	499584	522817	547264	572978
Administrative costs	2.8	14640	15372	16141	16948	17795
Product marketing costs	2.0	10565	11093	11648	12231	12842
Land rental (pastures)	1.90	10000	10500	11025	11576	12155
Total other operating costs	6.7	35205	36965	38814	40754	42792
Total operating costs	100	527000	536549	561631	588018	615770

The cost of raw materials and materials necessary for organizing the production of dairy products is the basis for calculating a tax credit on value-added tax to reduce tax liability and optimize tax payments. The projected amount of the accrued

tax credit during the project implementation period will be from EUR 60 to 158 thousand annually. However, it is worth noting that in the first year, the tax credit is expected to exceed the tax liability, allowing the returning part of the value-added tax to replenish the company's working capital.

Table 5 shows the results of modelling the leading indicators of investment efficiency with a minimum (10%) share of equity and a correspondingly high share of borrowed capital, namely 34% - financial leasing, 25% - long-term lending, 22% - operating lease, and 9% - private investments. The company will receive about EUR 270 thousand of net present value in 5 years with the specified capital structure. The internal rate of return will be up to 9%, which is the upper limit of the feasibility of investing in this project, considering the discount rate's value. Although the return on capital due to the high share of operating leases and minimization of depreciation is projected at 29-34%.

Table 5. Results of modelling of economic efficiency indicators for 5 years with an equity share of 10%. (Source: the calculated indicators are obtained from the results of modelling)

Indicator	Year				
	1	2	3	4	5
Revenue from milk sales, EUR	910122	964078	1021154	1053580	1076916
Revenue from milk processing by-products, EUR	7696	8153	8635	8910	9107
Revenue from butter sales, EUR	67361	71354	75579	77979	79706
Revenue from beef sales, EUR	71344	74911	78657	82590	86719
Revenue from cattle slaughter by-products, EUR	6100	6405	6725	7061	7414
Revenue from livestock product sales, EUR	1056524	1118496	1184025	1223058	1252448
VAT tax liability, EUR	176087	186416	197337	203843	208741
Tax credit, EUR	158 068	59 469	62 027	64 444	66 903
VAT payment to the budget, EUR	18 019	126 947	135 310	139399	141838
Net revenue, EUR	1038505	991549	1048714	1083659	1110609
Production costs, EUR	491795	499584	522817	547264	572978
Other operating costs, EUR	35205	36965	38814	40754	42792
Other operating income, EUR	0	0	0	0	0
Operating profit, EUR	511505	455000	487083	495641	494839
Expenses from financial activities, EUR	138046	138046	138046	138046	138046
Income from financial activities, EUR	0	3 062	5 686	8 595	11 598
Profit from financial activities, EUR	373458	320016	354724	366190	368391
Profit tax, EUR	67222	57603	63850	65914	66310
Net profit, EUR	306236	262413	290873	300276	302080
Return on sales, %	29	23	25	25	24
Return on capital, %	29,02	25,93	29,99	32,39	34,15
Net cash flow, EUR	369485	325663	354123	363526	365330
Net discounted cash flow, EUR	358401	306416	323199	321827	313721
The ratio of net cash flow to capital, %	33.96	30.28	31.29	30.55	29.20
Return on investment for 5 years, coefficient	1.32				
Discounted payback period (taking into account the time for preparing the project implementation + 0.5 years), years	4.66				
Tax load, coefficient	0.0954	0.1674	0.1718	0.1727	0.1724
Discount rate, %	3.00	3.00	3.00	3.00	3.00
Net present value of the project in 9 years (NPV), EUR	1435854				
in 8 years	1158119				
in 7 years	871794				
in 6 years	576613				
in 5 years	272303				
Internal rate of return, %	8.98				

The modelling results show that the project's net present value will increase with an increase in the share of equity in the structure. Therefore, the research examined in more detail the structure of the capital raised by different sources, which subsequently impacted the main optimization criterion and other essential indicators of the efficiency of investment use. The most significant factors influencing the modelling results are the marginal and essential cost of capital for each source of its formation (Table 6). The most affordable option for raising funds for the project is long-term lending in EUR - about 6.5% per annum of the amount as of the end of 2024; however, banks provide loans only for potentially liquid types of production assets with a coverage ratio of 2.5 and above, so the project has a limit on the maximum loan amount of up to EUR 341 thousand, which, taking into account the marginal cost of capital of 0.01%, will affect the optimal share for this source of attraction. Similar restrictions also apply to operating leases and financial leasing at the level of EUR 455

thousand, since not all types of production assets necessary for the organization of a project can be provided for use on a paid basis.

Increasing the share of operating leases will reduce costs if the average depreciation rate is higher than the cost of attracting capital on a lease basis, and vice versa; costs will increase if the depreciation rate of fixed assets is lower than the cost of attracting leased production facilities. Financial leasing in the enterprise's capital structure will always increase operating expenses by the amount of lease payments. Long-term loans in the capital structure or private investments will affect the formation of expenses from financial activities. Accordingly, the most optimal option for the capital structure when creating an enterprise to produce milk and dairy products is to focus on its sources without attracting external financial resources or leased production facilities. However, based on the developed model, it is possible to determine the optimal capital structure for various options for providing its financial resources, including their complete absence.

Table 6. Options for optimal capital structure by the main sources of formation, taking into account marginal and basic cost. (Source: the calculated indicators are obtained from the results of modelling)

№	Indicator	Raised capital				Own capital
		Private investments	Long-term lending	Operational lease	Financial leasing	
1	Structure, %	10.92	25.21	30.23	33.64	0.00
	Capital amount, EUR	147505	340640	408515	454600	0
	Fee for capital raised, EUR	21758	30339	70143	47942	0
	Estimated cost of raising capital, %	14.75	8.91	17.17	10.55	2.00
2	Structure, %	9.31	25.21	21.84	33.64	10.00
	Capital amount, EUR	125766	340640	295129	454600	135126
	Fee for capital raised, EUR	15817	30339	43982	47942	3177
	Estimated cost of raising capital, %	12.58	8.91	14.90	10.55	2,35
3	Structure, %	7.75	25.21	13.40	33.64	20.00
	Cost of capital, EUR	104736	340640	181032	454600	270252
	Fee for capital raised, EUR	10970	30339	22847	47942	10006
	Estimated cost of raising capital, %	10.47	8.91	12.62	10.55	3.70
4	Structure, %	7.40	25.21	3.75	33.64	30.00
	Capital amount, EUR	100000	340640	50642	454600	405378
	Fee for capital raised, EUR	10000	30339	5571	47942	20487
	Estimated cost of raising capital, %	10.00	8.91	11.00	10.55	5.05
5	Structure, %	7.40	25.21	0.19	27.20	40.00
	Capital amount, EUR	100000	340640	2531	367585	540504
	Fee for capital raised, EUR	10000	30339	278	35567	34620
	Estimated cost of raising capital, %	10.00	8.91	11.00	9.68	2.44
6	Structure, %	7.40	22.40	0.19	20.01	50.00
	Capital amount, EUR	100000	302719	2522	270389	675630
	Fee for capital raised, EUR	10000	25813	277	23534	17402
	Estimated cost of raising capital, %	10.00	8.53	11.00	8.70	2.58
7	Structure, %	7.40	17.20	0.18	15.22	60.00
	Capital amount, EUR	100000	232450	2388	205666	810756
	Fee for capital raised, EUR	10000	18188	263	16570	21978
	Estimated cost of raising capital, %	10.00	7.82	11.00	8.06	2.71
8	Structure, %	0.00	15.93	0.00	14.07	70.00
	Capital amount, EUR	0	215189	0	190189	945882
	Fee for capital raised, EUR	0	16466	0	15029	26919
	Estimated cost of raising capital, %	10.00	7.65	11.00	7.90	2.85
9	Structure, %	0.00	10.93	0.00	9.07	80.00
	Capital amount, EUR	0	147626	0	122626	1081008
	Fee for capital raised, EUR	0	10299	0	8861	32225
	Estimated cost of raising capital, %	10.00	6.98	11.00	7.23	2.98
10	Structure, %	0.00	7.40	0.00	2.60	90.00
	Capital amount, EUR	0	100000	0	35126	1216134
	Fee for raised capital, EUR	0	6500	0	2459	37896
	Estimated cost of raising capital, %	10.00	6.50	11.00	7.00	3.12

It is also worth noting the higher marginal and basic cost of raising capital based on operating leases compared to financial leasing or long-term lending due to higher risks for the lessor. An essential but not very common source of raising capital is private investments of interested individuals or legal entities in similar projects in the agri-food sector of Ukraine. The

value of the basic and marginal cost of capital from such a source is difficult to predict due to the ratio of potential risks and expected economic effects when implementing the proposed project, especially in war conditions. The minimum basic and marginal costs for organizing a diversified enterprise to produce and process milk will be 10 and 0.1%. In the context of low interest rates on deposits in EUR for individuals and legal entities engaged in entrepreneurial activities in Ukraine, investments in the creation and development of enterprises in the livestock sector, in particular in milk production, will be more effective, with a net return on capital of more than 10-12%, which is 5-6 times higher than the average bank interest rate on a EUR deposit. Tables 7, 8, and 9 show the impact of the equity share on the investment efficiency indicators.

Table 7. Modelling the impact of the share of equity in the overall structure on the value of investment efficiency indicators. (Source: the calculated indicators are obtained from the results of modelling)

Own capital, %	Net present value of the project over 5 years, EUR	Internal rate of return, %	Return on investment for 5 years, unit of measure, coefficient	Project payback period, years
0	125672	5.88	1.20	4.67
10	272303	8.98	1.32	4.66
20	395882	11.38	1.42	4.03
30	493503	13.18	1.49	3.85
40	571135	14.54	1.56	3.71
50	634152	15.57	1.61	3.61
60	689758	16.45	1.65	3.52
70	741747	17.25	1.69	3.45
80	788686	17.95	1.73	3.39
90	827506	18.51	1.76	3.33
100	861599	19	1.79	3.29

The optimal structure of the capital raised in the absence of equity for the implementation of the proposed project, according to the above input data and modelling results, will be formed by one-third in the form of financial leasing for more than EUR 450 thousand, about 30% will be the share of operational leasing of production facilities - up to EUR 409 thousand. The share of long-term loans will exceed 25%, and private investments will be almost 11%. Due to the relatively high cost of the funds raised, the maximum net present value of the project over 5 years will be only EUR 125.7 thousand with an internal rate of return of up to 6%. The net discounted cash flow will change from EUR 306.5 thousand in the first year of project implementation to EUR 248.3 thousand at the end of the 5th year (Table 8).

Table 8. Modelling changes in net discounted cash flow depending on different options for the equity share in the overall structure over 5 years, EUR. (Source: the calculated indicators are obtained from the results of modelling)

Own capital, %	Year				
	1	2	3	4	5
0	306483	263041	271187	262510	248303
10	358401	306416	323199	321827	313721
20	396362	328675	344878	342941	334286
30	430536	345224	360960	358570	349474
40	451843	359836	375212	372471	363034
50	465015	372717	387809	384790	375081
60	476652	384080	398921	395657	385709
70	497581	404239	418634	414934	404558
80	487770	394644	409251	405758	395585
90	505695	412174	426394	422523	411980
100	512821	419143	433209	429188	418498

Further increase in the weight of equity capital to 50-60% in the structure will lead to a decrease in the share of funds raised on long-term lending terms to 22-17%. After 70% of the equity capital level in the structure, according to the modelling results, the optimal option is to raise funds on long-term lending terms with a share of 15.9% for about EUR 215 thousand and production assets worth EUR 190 thousand through financial leasing with a share of 14%, which will allow to obtain more than EUR 741.7 thousand of net present value of the project over 5 years with an internal rate of return of 17.25% and a return on investment of 169%. Increasing the share of equity to 80-90% with the specific weight

of lending at 11-7.4% and leasing within 9-2.6% will contribute to achieving relatively high investment efficiency indicators, in particular in terms of the net present value of the project at EUR 827-862 thousand over 5 years, which corresponds to an internal rate of return of 18.5-19%.

Table 9. Modelling of return on sales (RS) and return on capital (RC) at different shares of equity in the overall structure, %. (Source: the calculated indicators are obtained from the results of modelling)

Own capital, %	RS	RC	RS	RC	RS	RC	RS	RC	RS	RC
	1 year		2 year		3 year		4 year		5 year	
0	25.95	29.08	21.94	26.93	23.12	31.08	23.14	33.31	22.73	34.76
10	28.99	29.00	23.45	25.90	24.56	29.96	24.54	32.36	24.11	34.12
20	31.55	28.49	24.50	24.58	25.56	28.53	25.52	31.03	25.07	33.00
30	33.60	27.30	24.86	22.57	25.90	26.35	25.85	28.86	25.40	30.96
40	35.21	27.58	25.80	22.64	26.79	26.39	26.73	28.97	26.26	31.16
50	36.49	28.59	27.02	23.71	27.96	27.54	27.86	30.20	27.38	32.49
60	37.63	29.47	28.10	24.65	28.99	28.55	28.87	31.28	28.37	33.65
70	38.69	30.25	29.08	25.47	29.92	29.43	29.78	32.22	29.27	34.68
80	39.64	31.00	30.00	26.27	30.79	30.28	30.63	33.14	30.10	35.66
90	40.44	31.62	30.75	26.93	31.51	30.99	31.33	33.90	30.79	36.48
100	41.13	32.16	31.41	27.51	32.14	31.61	31.94	34.57	31.40	37.20

Given the high risks of implementing a milk production and processing project based on 100% of the capital raised, it is advisable to increase the share of equity by at least 10-15% in the structure to increase the efficiency of investment use in particular, achieving an internal rate of return of about 10%, or more than EUR 300 thousand, the value of the primary optimization criterion for 5 years of project implementation. With a 30% equity share, the optimal leasing and long-term lending share will remain as in the previous options. However, there will be noticeable trends towards a significant decrease in operating leases to 3.75% and a slight decrease in the share of private investments by 2.2 percentage points. With an increase in the share of equity to 40%, the share of operating leases is almost completely leveled, and the share of financial leasing begins to decrease to 27.2%.

According to the modelling results, it is also possible to trace financial leverage based on the impact of changes in the capital structure on the value of net return on capital, according to which the most noticeable impact is predicted for the 1st, 3rd, and 5th year of the project implementation, which is associated with changes in the average annual cost of capital and the amount of net profit. When determining the return on capital, the capital raised in the form of an operating lease was not taken into account, the increase in the share of which in the modelling increased the projected level of return on capital despite a specific increase in operating expenses due to payments for the lease of fixed assets. Therefore, the change in the return on capital for each percentage change in the share of raised capital does not exceed 0.03 percentage points. It is expected that with a reduced share of operating leases in the capital structure, the overall impact of the cost of raised financial resources on the level of profitability will be higher.

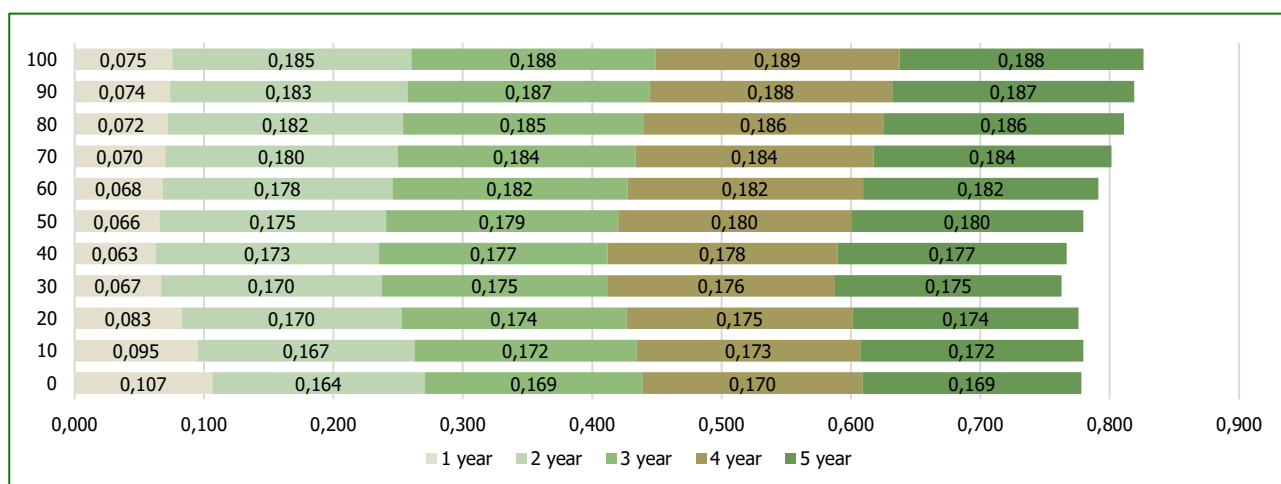


Figure 1. Results of modelling the level of the tax burden coefficient for 5 years with different options for the share of equity in the overall structure. (Source: the calculated indicators are obtained from the results of modelling)

One of the essential additional indicators that must be paid attention to when optimizing the capital structure of an enterprise is the tax burden ratio, which shows the ratio of the amount of all types of taxes paid to the cost of products sold (Figure 1). The amount of tax payments depends on the economic efficiency of the enterprise's operation. Income tax and value-added tax will increase with an increase in the share of equity in the overall structure, starting from the second year of project implementation, since, in the first year of formation, a significant amount of tax credit will reduce the VAT tax liability. An increase in the share of attracted capital, including operating leases, on the contrary, will increase the tax burden ratio in the first year of project implementation due to a lower amount of tax credit from fixed capital. However, from the second year onwards, the tax pressure will decrease due to a decrease in profit from financial activities due to increased operating and financial expenses (rent payment, financial leasing, interest on the loan, payments to investors, and other additional expenses). Generally, the tax burden coefficient when forming capital based on one's sources in the first year will be 0.075, and from the second year, it will increase to 0.185-0.188. With 50% equity, the ratio of taxes paid to revenue from sales of products will be from 0.066 to 0.18. A relatively low level of tax pressure is possible starting from the second year of project implementation (0.164-0.169) due to a reduction in the tax base for the main types of taxes, provided that capital is formed based on 100% of attracted financial resources.

DISCUSSION

The conducted studies of the optimal capital structure for diversified enterprises producing milk and dairy products in Ukraine take into account the main theoretical and methodological aspects that have been published in many scientific works (Fenyves et al., 2020; Kuniyska-Iliash, 2023; Leliuk, 2010; Oliynik, 2019; Rohanova & Kotliarova, 2021; Schorr & Lips, 2019; Uzliawati et al., 2018; Varchenko, et al., 2021; Zgadova et al., 2023). However, there are also differences; in particular, our study uses a systemic financial model of planning the results of the activities of diversified enterprises that produce milk for further processing into dairy products with the function of optimizing the capital structure according to the input data, which in its specificity differs from the results of other studies aimed at studying the capital structure for specialized farms (Becker et al., 2007; Schorr & Lips, 2019), or separately for dairy processing enterprises (Varchenko, et al., 2021), or with a general focus on research in the field of agriculture without highlighting dairy enterprises (Fenyves et al., 2020; Rohanova & Kotliarova, 2021; Wang, 2016; Zgadova et al., 2023).

It is worth noting that the results obtained also consider and confirm the influence of capital structure on the profitability of enterprises, which is presented in studies of the relationship between profitability and capital structure of agricultural holdings (Stekla & Gycova, 2016). The relationship between capital structure and tax burden is determined and substantiated, which corresponds to the results of studies on the assessment of the impact of taxation on the effective tax rate in investment activities under optimal capital structures (Paquin et al., 2024); however, our research is focused on milk production and processing enterprises, taking into account the peculiarities of the Ukrainian tax system.

The results of modelling the optimal capital structure significantly depend on such input data as the marginal cost of capital by the primary sources of formation, as well as on the amount of the basic marginal cost of capital, which in the model for this project takes on a conditional value of EUR 30 thousand, but can be changed based on the conditions for attracting capital from individual sources.

The accuracy of the calculations is also affected by the level of economic and technological efficiency of resource use, which depends on the volume of milk production per 1 cow per year, feed conversion, labor productivity, the size of lawyers' salaries, tax burden, the level of product sales prices, the features of the selected technology for milk production and processing, the cost of necessary fixed assets, raw materials, and materials, and many other input data that are taken into account in the modelling; therefore the optimal capital structure is not static, but will constantly change depending on the values of the indicated indicators.

In the model, the indicator of net present value of capital was chosen as the main optimization criterion since, for a newly created enterprise, it most fully reflects the efficiency of investment use. However, it is also possible to take into account other optimization criteria, in particular, the internal rate of return of the project, the level of return on investment, net return on capital, return on equity, the effect of financial leverage, and other criteria that are given in the articles of many scientists (Berenda et al., 2018; Leliuk, 2010; Uzliawati et al., 2018; Varchenko et al., 2021; Wang, 2016; Zgadova et al., 2023).

The limitations in the model are set considering the technological features of the organization of milk and dairy product production. Accordingly, they can be changed following the operating conditions of individual productions, which will undoubtedly affect the optimization of the capital structure.

CONCLUSIONS

The study results showed that the capital structure required to implement the proposed project for the production of milk and dairy products significantly affects the indicators of the efficiency of investment use. In general, to create a farm for 200 cows with the organization of further processing of raw materials into dairy products in Ukraine, about EUR 1.350 thousand are needed, which will approximately pay off in 3.3 to 4.7 years, depending on the capital structure, when reaching the net present value of the project in 5 years for EUR 125 thousand if financial resources are formed based on attracted capital, and about EUR 860 thousand of net present value when using own sources for capital formation. According to the modelling results, the optimal capital structure with 100% of attracted financial resources should be formed based on private investments with a share of 10.9%, long-term lending – 25.2%, operating lease - about 30.2%, and financial leasing – over 33.6%. With the increase in the share of equity capital, to achieve the maximum value of the optimization criterion, it is proposed to reduce the level of attraction from such sources as operating leases and private investments, as well as completely abandon these sources when the share of equity capital reaches more than 70%. Optimization of the capital structure for newly established enterprises for the production of milk and dairy products is an effective factor influencing the formation of long-term prerequisites for their successful functioning through increasing the efficiency of financial resource management.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

REFERENCES

1. Agro Frost (2025). <https://agrofrost.com.ua>
2. Becker, K. M., Parsons, R. L., Kolodinsky, J., & Matiru, G. N. (2007). A cost and returns evaluation of alternative dairy products to determine capital investment and operational feasibility of a small-scale dairy processing facility. *Journal of Dairy Science*, 5(90), 2506–2516. <https://doi.org/10.3168/jds.2006-433>
3. Berenda, N. I., Redzuk, T. Y., & Vorona, K. V. (2018). Management of the capital structure of the company. *Naukovyi visnyk Uzhhorodskoho natsionalnoho universytetu*, 19(1), 14–18. http://www.visnyk-econom.uzhnu.uz.ua/archive/19_1_2018ua/5.pdf
4. Chemerys, V., Dushka, V., Dorosh, M., & Maksym, V. (2020). Export potential of the livestock breeding industry of Ukraine. *Agricultural and Resource Economics: International Scientific E-Journal*, 6(3), 5–28. <https://doi.org/10.51599/are.2020.06.03.01>
5. Chemerys, V., Maksym, V., Dushka, V., Dadak, O., Ostapiv, O.-I., & Kulii, V. (2023). Economic efficiency of feed use in milk production in agricultural enterprises of Ukraine. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series Economical Sciences*, 25(102), 34–41. <https://doi.org/10.32718/nvlvet-e10205>
6. Chemerys, V., Maksym, V., Dushka, V., Kulii, V., Ostapiv, O.-I., & Brezden, M. (2024). State and main trends of milk market development in the European Union and Ukraine. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series Economical Sciences*, 26(104), 73–82. <https://doi.org/10.32718/nvlvet-e10412>
7. Eridon Bud (2025). <https://www.eridonbud.com/farms-equipment>
8. Fenyves, V., Pető, K., Szenderák, J., & Harangi-Rákos, M. (2020). The capital structure of agricultural enterprises in the Visegrad countries. *Agricultural Economics – Czech*, 66(4), 160–167. <https://doi.org/10.17221/285/2019-AGRICECON>
9. Genetyka and Seleksia (2025). <https://gsel.com.ua>
10. Gołaś, Z. (2020). Impact of working capital management on business profitability: Evidence from the Polish dairy industry. *Agricultural Economics – Czech*, 66(6), 278–285. <https://doi.org/10.17221/335/2019-AGRICECON>
11. IKR Group (2025). <https://ikrtech.com.ua>
12. Kondratiuk, V. M., Ruban, S. Yu., Borshch, O. O., Tsentylo, L. V., Vdovenko, N. M., Hruntkovskyi, M. S., Rosamakha, Yu. O., & Zhuravel, M. P. (2024). Modernization of dairy farms (engineering, feeding, genomic prediction). Kyiv.

- https://nubip.edu.ua/sites/default/files/u248/modernizaciya_ferm_z_virobnictva_moloka_02.08.2024.pdf
13. Kuniyska-Iliash, M. (2023). Assessment of the financial security of agriculture in Ukraine. *Agricultural and Resource Economics*, 9(1), 5–27. <https://doi.org/10.51599/are.2023.09.01.01>
 14. Larchenko, O. (2020). The use of economic and mathematical modelling in the capital management of an agricultural enterprise. *Taurida Scientific Herald. Series: Economics*, (2), 287–294. <http://tnv-econom.ksauniv.ks.ua/index.php/journal/article/view/78>
 15. Leliuk, O. (2010). Optymizatsiia struktury kapitalu ahrarykh pidpryemstv. *Ahrosvit*, 21, 36–41. <http://www.agrosvit.info/index.php?op=1&z=472&i=7>
 16. Lemishko, O. (2020). Formation of analytical tools of capital reproduction in the agricultural sector of Ukraine. *Agricultural and Resource Economics: International Scientific E-Journal*, 6(3), 64–79. <https://doi.org/10.51599/are.2020.06.03.04>
 17. Maksym, V., Chemerys, V., Dushka, V., & Kuz, M. (2022). Capital formation of livestock production enterprises in Ukraine. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series Economical Sciences*, 24(100), 40–46. <https://doi.org/10.32718/nvlvet-e10007>
 18. Mashkin, M. I., & Parysh, N. M. (2006). Tekhnolohiia moloka i molochnykh produktiv: Navchalne vydannia. Kyiv: Vyscha osvita. <http://www.tsatu.edu.ua/ettp/wp-content/uploads/sites/25/19-mashkin-m.-i.-tehnolohiia-vyrobnictva-moloka-i-molochnyh-produktiv.pdf>
 19. Oliynik, O. (2019). Financial strategy of the agrarian enterprise: the theoretical aspect of development and modelling. *Investytsiyi: praktyka ta dosvid*, 11, 26–31. <https://doi.org/10.32702/2306-6814.2019.11.26>
 20. Paquin, J.-P., Racicot, F.-É., Kopyay, T., & Tessier, D. (2024). Assessing the impact of taxation on the effective tax rate and operational risk of capital investment projects under optimal capital structures. *International Review of Economics & Finance*, 96(A), 103589. <https://doi.org/10.1016/j.iref.2024.103589>
 21. Rohanova, H., & Kotliarova, M. (2021). Analysis and Optimization of the Capital Structure of Enterprise. *Modern Economics*, 27, 167–176. [https://doi.org/10.31521/modecon.V27\(2021\)-23](https://doi.org/10.31521/modecon.V27(2021)-23)
 22. Schorr, A. & Lips, M. (2019). The optimal capital structure of Swiss dairy farms. *Agricultural Finance Review*, 79(3), 323–337. <https://doi.org/10.1108/AFR-05-2018-0034>
 23. State Statistics Service of Ukraine (2024). <https://www.ukrstat.gov.ua/>
 24. Stekla, J., & Gycova, M. (2016). The relationship between profitability and capital structure of the agricultural holdings in the Czech Republic. *Agricultural Economics – Czech*, 62(9), 421–428. <https://doi.org/10.17221/232/2015-AGRICECON>
 25. THL Palladium (2025). <https://www.palladium-milk.com.ua>
 26. Ukrainian Electronic Grain Exchange (2025). <https://graintrade.com.ua>
 27. Uzliawati, L., Yuliana, A., Januarsy, Y., & Santoso, M. I. (2018). Optimisation of Capital Structure and Firm Value. *EURpean Research Studies Journal*, 2(21), 705–713. https://www.ersj.eu/dmdocuments/2018_XXI_2_54.pdf
 28. Varchenko, O., Artimonova, I., & Kholodenko, N. (2021). Optimization of capital structure as a tool for managing the value of dairy enterprises, *Economics and Management APC*, 1, 111–124. <https://doi.org/10.33245/2310-9262-2021-162-1-111-124>
 29. Wang, Y.-C. (2016). The optimal capital structure in agricultural cooperatives under the revolving fund cycles. *Agricultural Economics – Czech*, 62(1), 45–50. <https://doi.org/10.17221/204/2015-AGRICECON>
 30. Zgadova, N., Pavlenko, A., & Panenko, O. (2023). Optimization of the structure of capital in agricultural businesses. *Agrosvit*, 15, 52–57. <https://doi.org/10.32702/2306-6792.2023.15.52>

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ОПТИМІЗАЦІЯ СТРУКТУРИ КАПІТАЛУ ПІДПРИЄМСТВ ІЗ ВИРОБНИЦТВА МОЛОКА ТА МОЛОКОПРОДУКТІВ В УКРАЇНІ

В умовах спаду виробництва молока та молокопродуктів в Україні все більшої актуалізації набуває обґрунтування найбільш ефективного механізму фінансово-інвестиційного забезпечення реалізації виробничого та економічного потенціалу національного молокопродуктового підкомплексу. Формування оптимальної структури капіталу є важливим чинником ефективності інвестиційної діяльності підприємств, які виробляють молоко та молокопродукти з урахуванням основних технологічних і фінансово-економічних аспектів при організації виробництва. Відповідно систематична оптимізація структури капіталу за різними джерелами сприятиме підвищенню ефективності функціонування та конкурентоспроможності підприємств галузі, що позитивно впливатиме на відновлення та подальше зростання виробництва молока та молокопродуктів в Україні в довгостроковій перспективі.

У роботі використані загальні наукові та спеціалізовані економічні методи дослідження, а саме: монографічний і системний методи, розрахунково-конструктивний, аналіз і синтез, а також економіко-математичне моделювання – при визначенні оптимальної структури капіталу за різними найбільш поширеними джерелами фінансування для новостворених підприємств із виробництва молока та молокопродуктів в Україні.

Для проведення моделювання оптимальної структури капіталу розроблено фінансову модель функціонування підприємства, яке виробляє та переробляє молоко. Оптимізація проведена за критерієм максимізації чистої приведеної вартості з визначенням впливу різних варіантів структури капіталу на значення основних показників ефективності використання інвестицій.

Згідно з результатами дослідження, встановлено, що найбільш оптимальний варіант формування структури капіталу для підприємств із виробництва та переробки молока в Україні повинен базуватися на максимальній частці власних фінансових ресурсів із помірним залученням основного капіталу на основі фінансового лізингу, оперативної оренди з мінімізацією довгострокових позик і приватних інвестицій, що дозволить забезпечити відносно високий рівень ефективності капіталовкладень.

Ключові слова: оптимізація, капітал, виробництво, молоко та молокопродукти, підприємство, чиста приведена вартість, інвестиції

JEL Класифікація: G31, Q14, Q12, C50