Risk Assessment on an Agricultural Farm

KRISTINA PAVLOVA, ELISAVETA TRICHKOVA-KASHAMOVA, STANISLAV DIMITROV
Institute of Information and Communication Technologies,
Bulgarian Academy of Sciences,
"Acad. G. Bonchev" str. bl.2, Sofia,
BULGARIA

Abstract: - Livestock production is a major economic sector concerned with the rearing, care, and production of farm animals. Animal nutrition is an important component that has the potential to significantly impact the profitability of livestock production. The production of own feed has many positive aspects. Producing its own feed ensures its quality and reduces farm costs, but it also carries risks for farmers. This paper assesses the risk on the farm, and suggests intelligent solutions to optimize the resource functioning of a livestock production system and forecasting of management decisions and to achieve better organization of farm processes, labor resources, etc. Based on the assessment, the ability to cover costs and service debt are determined and the profitability of the business is assessed. The average annual yield and its standard deviation are displayed in the paper. This statistical measure indicates the degree to which yields over a given period deviate from the average by kg/dec. The paper analyses the Business Risk indicator, which is an assessment of the level of sales and revenue, i.e. whether the farm can cover its costs and make a profit. It determines whether the company can operate as a profitable enterprise. Through the computation and examination of financial and business risk indicators, farmers may optimize their expenses and ultimately turn a profit.

Key-Words: - animal husbandry, automated feed rationing, farm management, feed costs, feeding efficiency, livestock**.**

Received: September 11, 2023. Revised: April 13, 2024. Accepted: May 16, 2024. Published: May 31, 2024.

1 Introduction

According to [1], agriculture is a dangerous business, particularly in developing nations. The biological processes that underpin the production of crops and animals cause considerable delays, which are amplified in terms of "weather" because of their significance to the production of agricultural commodities, [2].

Nutrition is a basic prerequisite for optimal performance on any farm. By [3], creating the right feed balance can increase animal performance - weight gain in beef breeds and increased milk yield in sheep and dairy cows. Therefore, optimizing management and feeding technology is a profitable investment that can improve both reproduction and the health of the whole herd.

Rising electricity, heat, and fuel prices in recent years, together with increased technological demands and the need to lower the cost of production, have forced most farmers to start creating and growing feed for their animals (Figure 1). successful farm management needs to have the right equipment for quality milling and mixing of forages for animal rations. Investing in in-house feed production equipment is an effective method of achieving efficiency in animal feeding and the ability to comply with recipes for individual groups of animals. Another major advantage is that it can be upgraded at any time with grain storage silos, textile cages for storage of finished feed, and automated systems for precise addition of components. Using automated systems, farmers-breeders can use their agricultural production as well as ration grain according to their recipes. These systems can be programmed to give the exact amount of feed needed to feed the animals.

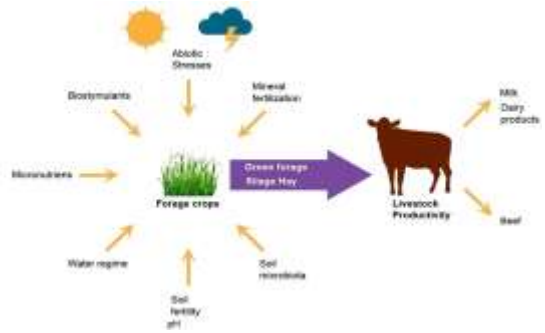

Fig. 1: Growing the feed for animals

Feed costs account for more than a third of the final consumer price. This share highlights the important role of feed utilization as a factor for competitiveness and its optimization through better genetics and feeding and rearing methods.

The market activities of the farms are aimed at obtaining maximum profit and gaining the largest market share. There is a drive to prevent or minimize the likelihood of failure. By using their feed, farmers will reduce their costs significantly. Another positive side of using your feed is that there will always be availability. If there is a surplus of the feed they have produced they will be able to sell it and from there increase income.

In recent years, several companies have provided complete design, installation, and commissioning of feed kitchens on Bulgarian farms. Livestock farmers are increasingly turning to their automated feed production equipment. There are several reasons for this - the higher cost of animal feed produced in large factories and transport costs, independence due to the possibility of self-production, or the urgent need for specialized feed prepared according to a special recipe. Using automated systems (Figure 2), they will be able to compile the exact animal ration corresponding to the required amounts of nutrients that the animals must take by Regulation (EC) No 178/2002 of the European Parliament and the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.

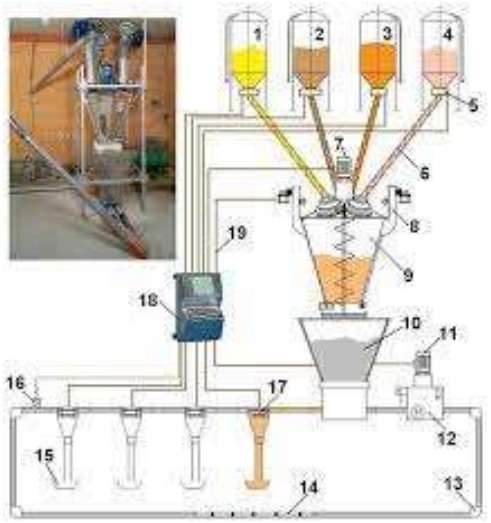

Fig. 2: Automated systems to compile the animal ration

The objectives of this document relate to the practice of providing individual or group feeds tailored to changing nutritional needs over time and individual differences in nutritional requirements. This practice aims to and optimize animal health and performance while reducing feed wastage and environmental impact. It is defined as the accurate assessment of the nutrients contained in feed and feed ingredients, the precise formulation of diets and the assessment of the nutritional needs of individual animals or groups of animals, [4]. Implementing precision animal nutrition on farms requires the integration of three important activities: automated data collection, data processing, and actions related to the control and management of the system on the farm, [5], [6] , [7]. For precision animal feeding to be applied at a personalized level, measurements, data processing, and control actions must be applied to individual animals according to [8].

Banks and farm economists are still faced with the challenge of evaluating and forecasting the financial performance of agricultural enterprises. However, even though a sizable number of studies analyzing the financial determinants of business performance have been conducted in the United States, there hasn't been much formal analysis in a European farming context, except growth and survival studies that are more focused on physical and social determinants, [9], [10], [11] work from the 1980s and 1990s, respectively. Furthermore, rather than continuous variables evaluating "success" from the owner's perspective, a large portion of the work utilizing financial determinants has been based on performance categories, defined according to creditworthiness or default risk.

In [12], examines a self-insurance strategy used by farmers for risk protection. This paper examines the impact of various farm, operator, and household characteristics on the level of on-farm diversification. Additionally, results also show a significant positive relationship between diversification and farm/crop insurance and sole proprietorships. Finally, there is also evidence that farms that received government payments are more diversified than their counterparts.

Optimization techniques are used within a simulation framework, this study demonstrates the synergy between balancing risk and alternative strategies to effectively mitigate risk under changing farm conditions. Farmers with high-risk aversion tend to prefer integrated risk management plans based on the principle of diversification. The greater attractiveness of a more diversified plan usually reduces the importance of the risk balancing strategy as the farm uses credit reserves to implement other production and marketing plans considered essential for overall risk reduction, [13].

Farmers must make choices to minimize their effects or be ready for such risky circumstances to preserve vital operations. A data-driven viewpoint is becoming more and more necessary, with machine learning (ML) emerging as a crucial instrument for the automatic extraction of valuable data to assist in risk and farm management decision-making. With recent technological advancements and digitalization, machine learning's (ML) importance in farm risk management (FRM) has grown, [14]. In many nations, risk is central to new paradigms and techniques that guide risk management programs and influence investment decisions according to [15].

The main task of farmers is to make decisions related to their daily activities. Many factors influence their decisions and they cannot be predicted with 100% accuracy. Farming is becoming increasingly risky because farmers are striving to have higher profits. This makes it necessary for farmers to analyze and identify the risk they face and have the skills to manage them, in order to better anticipate possible problems and mitigate their consequences according to [16].

Risk is the impact on production, this can be the change in weather, the emergence of pests and diseases in the fields, damage to equipment, and fluctuations in market prices. Borrowing can also be risky due to unexpected changes in interest rates. Risk can also arise as a result of changes in government policies. These risks often have a major impact on the income generated on the farm and on the health and physical condition of the farmer and also of the farm workforce according to [17].

Decision-making is the main activity related to farm management. From all decisions made, there are either results or consequences. The outcome of decisions made cannot be fully predicted even with information. It is important to determine whether producers consider the risks associated with the cost of production and animal health separately or jointly by [18]. The more complex the risk, the harder it is for farmers to make an informed decision. To make effective decisions, farmers need to gather information from a variety of sources and need information about many aspects of the farming business. Farmers need to find ways to manage risk and protect themselves from the uncertainty of the future by [19].

2 Material and Methods

The management of the farm is carried out in such a way as to maintain the animals in good health, to provide adequate and non-contagious feed and water, and to ensure optimum living conditions. Animals are reared based on risk analysis and these risks are controlled to produce food safely. Appropriate records are kept for easy traceability according to [20].

The paper analyses the financial performance of a farm. The analysis presented allows farmers to gain skills and knowledge to manage risk, identify and understand their problems, and help them make better farm management decisions. For every farmer, it matters where the animal's food will come from, whether the farmer produces it or buys it from producers. Each farmer should source it himself, as this way he will get it cheaper and know the quality of the food. The most important thing for all animals is the quality of the food they take. Because the productivity of the animals - meat, milk, eggs - depends on good food according to [20].

The quality of crops and livestock depends on biological processes that are influenced by weather, pests, and diseases. For example, low rainfall or drought leads to lower yields. Heavy rains damage or destroy crops. Pest or disease outbreaks cause large losses in terms of crop and livestock yields.

When farmers plant seeds and fertilize the soil, they do not know for sure how much rain will fall, or whether there will be storms and hailstorms. They don't know if there will be a pest or disease problem, but they have to decide whether to plant their crops or raise their livestock. Resources used such as financial capital, time and labor to plow, plant, and fertilize crops or to care for, feed, and medicate livestock may not be recovered. These are all examples of different factors that are risk factors for the activities developed on the farm. This means that farmers produce without complete certainty about what will happen to their produce according to [21].

The supply of a product is influenced by a combination of decisions made by farmers to grow that product, the weather, and other factors that affect yields.

The unit cost of production depends on inputs and yield. The influence of both factors makes them highly variable. Input costs are generally less variable than output prices. The combination of yield variability and production cost variability makes production a serious source of risk. In this article, an analysis will be carried out on two indicators - the price of the final output and the yield of the product produced.

Financial risk for the farm. Financial risk arises when a loan is taken out to finance the farming business. This risk can be caused by uncertainty about future interest rates, the willingness and

ability of the lender to provide funds to the farm, and the farmer's ability to generate the income needed to repay the loan.

Small farmers who borrow at high-interest rates may have difficulty repaying the debt. Lower than-expected farm gate prices for produce, combined with low yields, can make it difficult to repay the debt and even lead to the sale of the farm. The paper uses a methodology that examines the farm's ability to repay its loan as well.

Subsidies, food import and export control regulations, animal waste disposal rules, and farm income support payments are examples of government decisions that have a strong impact on agribusiness.

Data Input. Data from the operation of an animal farm also engaged in crop production are collected in Tab. 1. The data in the table are for wheat production. Feed grains are used to feed sheep, pigs, cows, rabbits, chickens, geese, ducks, and other animals and birds. The data are organized in four columns the first for the year recorded, in the second the yield in kg/dec, in the third the price per kg is entered for the final output during the year, and in the last column, the gross income is presented, which is the product of the data in columns two and three.

Table 1. Input data.

Year	Yield [kg/dec]	Price lv/kg	Gross [lv/dec]
1	285,813	0,485	138,743
2	423,675	0,347	147,119
3	154,675	0,405	62,662
4	104,238	0,443	46,168
5	346,338	0,337	116,582
6	427,038	0,380	162,409
7	541,363	0,384	207,806
8	252,188	0,494	124,505
9	312,713	0,369	115,236
10	423,675	0,468	198,160
11	386,688	0,405	156,654
12	467,388	0,435	203,148
13	282,450	0,406	114,759
14	215,200	0,350	75,235
15	312,713	0,446	139,613
16	279,088	0,378	105,482
17	504,375	0,488	246,032
18	171,488	0,412	70,688
19	460,663	0,420	193,696
20	406,863	0,416	169,152

Check for normal data distribution. The data from Tab. 1 are checked for normal distribution by the Jarque-Bera Test, from the applied data evaluation approach it is found that the data for all the indicators are normally distributed.

Descriptive statistics. Initially, the data were processed with the MS Excel 2016 data analysis tool Descriptive Statistics. The results are presented in Table 2.

Table 2. Descriptive statistics.

	Yield [kg]	Price lv/kg	Gross [lv/dec]
Mean	337,931	0,413	139,69
Standard Error	27,125	0,010	12,01
Median	329,525	0,409	139,18
Mode	423,675	0,405	
Standard Deviation	121,308	0,047	53,70
Sample Variance	14715,585	0,002	2883,60
Kurtosis	-0,745	-0,805	-0,58
Skewness	-0,232	0,187	0,08
Range	437,125	0,157	199,86
Minimum	104,238	0,336	46,17
Maximum	541,363	0,493	246,03
Sum	6758,625	8,267	2793,85
Count	20,000	20	20,00
Confidence Level(95,0%)	56,774	0,022	25,13
Upper Level	394,705	0,435	164,82
Lower Level	281,157	0,391	114,56
Mean + SD	459,239	0,461	193,39
Mean – SD	216,623	0,366	85,99

Table 2 shows that the average annual yield is 337.93 kg/dec and its standard deviation is 121.31 kg/dec. This statistical parameter indicates how much kg/dec the yields over the years differ from the average over the research period. The smallest yield was 104.24 kg/dec and was obtained in the fourth year of the study period and the largest yield was 541.36 kg/dec and was obtained in the seventeenth year. Furthermore, it can be stated with 95% confidence that the yield will be between 281 and 394 kg/dec, and that 68% of the data in the interval are between 216 and 459 kg/dec.

For the other two indicators, it can be seen that the average price for the study period was 41.3 cents and the average gross revenue was 139.69 lv/dec. Furthermore, the highest gross revenue was

obtained in the seventeenth year of the study period and was 246.17 lv/dec and the lowest revenue was 46.17 lv/dec obtained in the fourth year.

Analysis of the yield indicator. According to experts, yields below 250 kg are considered low, yields around 350 kg are considered medium, and yields above 450 kg are considered high. Their claim is verified by sorting the measured yield data in ascending order and dividing them into three groups, the first group recording the five years with the highest yield, the second group the next ten in order of magnitude, and the third group the five years with the lowest yield. The average yield for the first group was 480.17 kg/dec, for the second group it was 346 kg/dec, and for the third group the average yield was 179.59 kg/dec. These data confirm the experts' statement. When analyzing the data and presenting them in Table 1 and Table 2, the results of the analysis were in line with the results of the present study. In Table 3 it is seen that 25% of the years are high, 25% low, and 50% average.

Table 3. Analysis of the indicator "Yield"

Year	Yield [kg]	Point	Yield [kg]	Rank	Percent
1	285,813	7	541,363	1	100,00%
2	423,675	17	504,375	2	94,70%
3	154,675	12	467,388	3	89,40%
4	104,238	19	460,663	4	84,20%
5	346,338	6	427,038	5	78,90%
6	427,038	2	423,675	6	68,40%
7	541,363	10	423,675	6	68,40%
8	252,188	20	406,863	8	63,10%
9	312,713	11	386,688	9	57,80%
10	423,675	5	346,338	10	52,60%
11	386,688	9	312,713	11	42,10%
12	467,388	15	312,713	11	42,10%
13	282,450	1	285,813	13	36,80%
14	215,200	13	282,450	14	31,50%
15	312,713	16	279,088	15	26,30%
16	279,088	8	252,188	16	21,00%
17	504,375	14	215,200	17	15,70%
18	171,488	18	171,488	18	10,50%
19	460,663	3	154,675	19	5,20%
20	406,863	4	104,238	20	0,00%

3 Results and Discussion

The cumulative distribution function (CDF) of a random variable is a method of describing the distribution of a continuous, discrete, and mixed random variable. In farming and agriculture farm performance is measured by continuous variables, and using a cumulative distribution function allows one to estimate the probability of a random variable having a value less than or equal to a number X (random event).

Based on the analysis of the input data presented in tab. 2, intervals are defined in which the real data values of the three indicators yield, price, and gross profit may fall. Based on these data, the probability of occurrence of a random event (the number X) is calculated about indicators used to evaluate the financial efficiency of the farm. In MS Excel, the cumulative function for the data is calculated using the function =NORM.DIST(X; Mean;Standard_dev;TRUE), the obtained results are presented in the Cumulative value column of Table 4, for each indicator. The results show how likely it is that the value for the metric will be less than or equal to a set critical value.

Table 4 also presents results for values that are of interest to experts, which are the probability that the yield is below 500 kg/dec, the price is below 43 cents and the gross income per hectare is below BGN 120. For the first indicator, the probability is 91%, for the second it is 64%, and for the third 36%.

Table 4. Critical values

Critical value [Yield kg]	Cumulative value	Critical value [Price]	Cumulative value	*Critical value Gross[lv/dec]*	Cumulative value
100.00	2%	0.330	4%	45	4%
175.00	9%	0.360	13%	80	13%
250.00	23%	0.390	31%	115	32%
325.00	46%	0.420	55.57%	120	36%
400.00	70%	0.430	64%	150	58%
475.00	87%	0.450	78%	185	80%
500.00	91%	0.480	92%	220	93%
550.00	96%	0.510	98%	255	98%

Graphically obtained results from the Table 4 for all indicators are presented in Figure 3, Figure 4 and Figure 5.

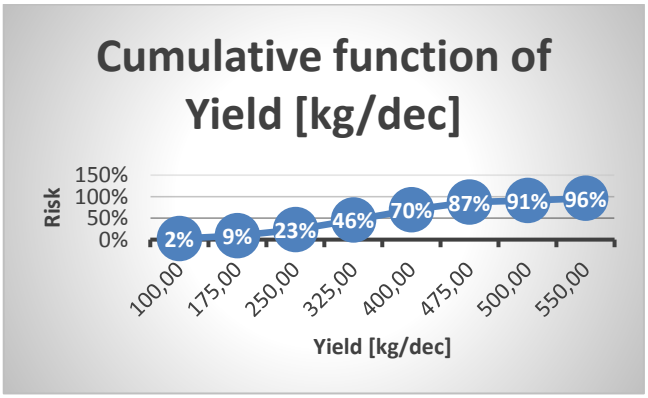

Fig. 3: Cumulative function for the Yield indicator

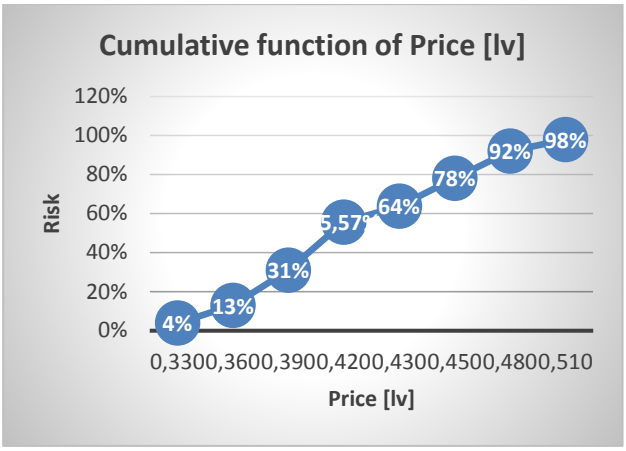

Fig. 4: Cumulative function for the indicator Price

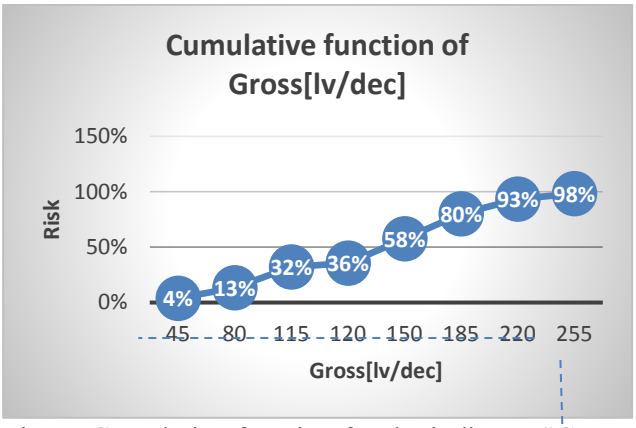

Fig. 5: Cumulative function for the indicator "Gross revenue"

Assessment of financial indicators of the farm. With the results obtained so far, it is not possible to assess the financial status of the farm. For this reason, the available data is also used to analyze the financial status of the farm.

Determination of average annual income. The average annual income is calculated by multiplying the value for cultivated areas on the farm and the average income per hectare (4625.607 [dec] * 139.69 [lv/dec] = 646162 lv.)

Calculation of annual deductions. Annual deductions are calculated using formula (1).

Annually deductions = (Annually expenses + Household costs) – Debt (1)

Annually deductions = (539340 + 96000) - 100000 = 535340 lv

The calculations were obtained from the input data for the financial indicators of the farm presented in the Table 5. In the last column, the income and expenditure data on the farm are converted per hectare of cultivated land.

Table 5. Financial data

Investment in land, buldings and equipmnet	300000	lv		
Total land	5180.032	dec		
Crop land	4625.607	dec		
			Capital for decare	
Owner equity	450000	lv	97.28	lv/dec
Debt	1000000	lv	216.19	lv/dec
Total investment	1450000	lv	313.47	lv/dec crop land
			Expenses for decare	
Annually expenses	539340	lv	116.60	lv/dec crop land
Household costs	96000	lv	20.75	lv/dec crop land
Interest	100000	lv	21.62	lv/dec
Annualy deductions	535340	lv	115.73	lv/dec crop land

Calculation of financial and business risk. A variety of risks and uncertainties are associated with agricultural activities because of the ever-changing economic and biophysical environment. Firstly, there is business risk, which encompasses risk related to production, markets, institutions, and individuals. The second is the financial risk associated with the various ways that agricultural activities are financed. The geographical location, governmental laws, and policies, the availability of formal (government) and/or traditional risk management tools, the kind of agricultural product, etc., may all have an impact on how important various risk sources are about one another. To control their risks at the farm level, farmers have access to a variety of risk management instruments, [22]. Financial and business risk are two estimates of the economic efficiency of the farm. Financial risk is an assessment of the effective use of financial leverage and debt management in the firm. It is used to determine the statistical probability that the company cannot repay its debt to creditors.

Business risk is an assessment of the level of sales and income, i.e. whether the farm can cover its costs and make a profit. It determines whether the company can operate as a profitable enterprise.

Measuring financial risk

Financial leverage ratio. The leverage ratio is a financial indicator measuring the amount of capital entering the farm in the form of debt (borrowings) and assesses the company's ability to meet its financial obligations. When the financial leverage

ratio is less than 1, the farm is considered to be well financial by industry standards, when the ratio is greater than 1, it is considered to be a risky company. While a financial leverage ratio greater than 2 is assumed that the financial condition of the farm is not good.

$$Laverage\ ratio = \frac{Debt}{Owner\ equity} = \frac{1000000}{450000} = 2{,}22 \quad (2)$$

The studied farm has a leverage ratio of 2.22, which means that the financial condition of the farm is not good and risky.

Measuring business risk on a farm

A farm's business risk can be measured by the ROA metric. The % return on assets is a reliable indicator for assessing business risk. Based on the calculations in the summary statistics section and the mean and standard deviation data for the gross income indicator, the % return on risk indicator can be calculated very easily.

The business risk of the farm can be measured by indicator of the return on assets. The asset on the farm is the cultivated land and based on the summary statistics mean and standard deviation for gross profit of the farm, the % return on the asset can be calculated.

To determine the % return on the asset (revenue), the total profit per acre is calculated and the gross profit is taxed at 15%. Annual deductions are also calculated per acre.

The return per acre per year is calculated using formula (3).

Return of asset [lv/dec] = Total [lv/dec] - Annually deductions [lv/dec] (3)

where:
- Total [lv/dec] is the total profit per hectare of cultivated land;
- Annually deductions [lv/dec] are the average annual deductions.

The indicator % return on the asset is calculated by formula (4)

$$\%\ \text{Return of asset} = \frac{\text{Return of asset}\ \left[\frac{lv}{dec}\right]}{\text{Total investment}\left[\frac{\text{lv}}{\text{dec}}\right]} * 100 \quad (4)$$

Where
- Return of asset [lv/dec] is the annual return;
- Total investment[lv/dec] is the total amount of the investment.

From the obtained results, it can be concluded that the average annual % return is 14%, and the standard deviation is 20%, and in absolute terms, the average return per hectare is BGN 44.91, with a standard deviation of BGN 61.75.

The annual interest on the farm loan is 100,000 lv or 21.62 lv./dec.

The return on equity of farmers is used formula (5).

Return of equity = Return of asset [lv/dec] - Interest [lv/dec] (5)

Where
- Return of asset [lv/dec] is the annual return
- Interest [lv/dec] is the annual cost of the loan

The indicator % return on own funds is calculated by formula (6).

$$\%\ \text{Return of equity} = \frac{\text{Return of equity}\ \left[\frac{lv}{dec}\right]}{\text{Owner equity}\ \left[\frac{lv}{dec}\right]} * 100 \quad (6)$$

From the obtained results it can be concluded that the average return on the farmer's funds is 24%, and the standard deviation is 63%, in absolute values per hectare of cultivated land the average return is 23.29 lv/dec and the standard deviation is 61.75 lv /dec.

Table 6 summarizes and presents the results of the farm's business risk.

Table 6. Return on asset

Year	Gross[lv /dec]	Total [lv/dec]	Annualy deductions [lv/dec]	Return of asset [lv/dec]	% Return of asset	Interest	Return of equity	% Return of equity
1	138.74	159.55	115.73	43.82	14%	21.62	22.20	22.82%
2	147.12	169.19	115.73	53.45	17%	21.62	31.83	32.72%
3	62.66	72.06	115.73	-43.67	-14%	21.62	-65.29	-67.11%
4	46.17	53.09	115.73	-62.64	-20%	21.62	-84.26	-86.61%
5	116.58	134.07	115.73	18.34	6%	21.62	-3.28	-3.38%
6	162.41	186.77	115.73	71.04	23%	21.62	49.42	50.80%
7	207.81	238.98	115.73	123.24	39%	21.62	101.62	104.46%
8	124.51	143.18	115.73	27.45	9%	21.62	5.83	5.99%
9	115.24	132.52	115.73	16.79	5%	21.62	-4.83	-4.97%
10	198.16	227.88	115.73	112.15	36%	21.62	90.53	93.06%
11	156.65	180.15	115.73	64.42	21%	21.62	42.80	43.99%
12	203.15	233.62	115.73	117.89	38%	21.62	96.27	98.95%
13	114.76	131.97	115.73	16.24	5%	21.62	-5.38	-5.53%
14	75.24	86.52	115.73	-29.21	-9%	21.62	-50.83	-52.25%
15	139.61	160.55	115.73	44.82	14%	21.62	23.20	23.85%
16	105.48	121.30	115.73	5.57	2%	21.62	-16.05	-16.50%
17	246.03	282.94	115.73	167.20	53%	21.62	145.58	149.65%
18	70.69	81.29	115.73	-34.44	-11%	21.62	-56.06	-57.63%
19	193.70	222.75	115.73	107.02	34%	21.62	85.40	87.78%
20	169.15	194.53	115.73	78.79	25%	21.62	57.17	58.77%
Mean	139.69	160.65	115.73	44.91	14%	21.62	23.29	24%
Standart deviation	53.70	61.75		61.75	20%		61.75	63%

Probabilistic estimate of return on an asset. The data for probabilistic assessment of return on an asset are presented in the Table 7.

Table 7. Probability table for return on asset

Critical value Gross[lv /dec]	Total Gross	Annualy deductions	Return to Assets	Return to asset per cent	Probability
45	51.75	115.73	-63.98	-20%	4%
80	92	115.73	-23.73	-8%	13%
100.6	115.7	115.73	0.00	0%	23%
115	132.25	115.73	16.52	5%	32%
150	172.5	115.73	56.77	18%	58%
185	212.75	115.73	97.02	31%	80%
220	253	115.73	137.27	44%	93%
255	293.25	115.73	177.52	57%	98%
155.17	178.446	115.73	62.72	20%	61%

Since the gross annual income for the studied period is between 46 and 246 [lv/dec] the determined critical values in the first column, are also used in the cumulative function. The data in the second column is calculated by multiplying the value from the first column by a coefficient of 1.15. In the third column, data on average annual deductions are entered.

The significant data in this table are presented in the last three columns. The data in the Return to Assets column are obtained by applying formula (3), and the data in the Return to Asset percent column by formula (4). The data in the last column Probability is determined by a function of MS Excel - NORM.DIST. A point is determined at which the total gross pass is 0 [lv/dec], i.e. the value at which the costs of the farm are covered. The probability that the gross income is below 100.6 [lv/dec], i.e. that all annual deductions cannot be covered is 23%, which means once every 4 years.

Probabilistic assessment of return on equity. Critical values for the gross annual profit are entered in the first column of Table 8. In the second column, they are calculated by multiplying the value from the first column by a coefficient of 1.15, and the total annual gross profit is determined. In the third column, data is entered on average annual deductions plus annual loan costs.

Table 8. Probability table for return on equity

Critical value Gross[lv /dec]	Total Gross	Annualy deductions + Debt	Return of equity	Return to equity per cent	Probability
45.00	51.75	137.35	-85.60	-87.99%	4%
80.00	92.00	137.35	-45.35	-46.62%	13%
100.64	115.73	137.35	-21.62	-22.22%	23%
115.00	132.25	137.35	-5.10	-5.25%	32%
119.44	137.36	137.35	0.00	0.00%	35%
131.38	151.09	137.35	13.73	14.12%	44%
150.00	172.50	137.35	35.15	36.13%	58%
185.00	212.75	137.35	75.40	77.50%	80%
220.00	253.00	137.35	115.65	118.88%	93%
255.00	293.25	137.35	155.90	160.25%	98%

The significant data in this table are presented in the last three columns. The data in the Return to equity column are obtained by applying formula (5), and the data in the Return to equity percent column by formula (6). The data in the last column Probability is determined by a function of MS Excel - NORM.DIST. A point is defined where the total gross profit is 0 [lv/dec]. The probability that the gross income is below 119.44 [lv/dec], i.e. that the annual deductions and the interest on the loan cannot be covered is 35%, which means once every 3 years.

In the last line marked in yellow, the probability that the farm will have an annual profit of 10% is calculated. This level of profit is determined because the interest on the loan is 10%. The data shows that generating a profit of less than 10% of the farm is 44%, which means that there is a 44% chance that the farm will have less profit than the bank.

4 Conclusion

The market activities of the farms are aimed at obtaining maximum profit and gaining the largest market share. There is a drive to prevent or minimize the likelihood of failure. On the other hand, to maximize farm income, intelligent solutions must be sought to reduce costs and to better organize farm processes, labor resources, etc.

Sheep farms apply various modern solutions to achieve better economic efficiency. The high cost of feed requires its optimal use. For this reason, farm management is a decisive factor for overall profit.

The paper uses mean estimates for expected gross revenue, yield, price, and standard deviation to determine their risk of occurrence. Based on the analysis, their values can be used to determine farm management strategies.

The relationship between the standard deviation and the mean describes the frequency with which adverse events occur and what the consequences are.

Based on this assessment, the ability to cover costs and service debt is determined and the profitability of a business is assessed.

Knowledge of the frequency of occurrence and financial severity of adverse events is vital to determining whether:
- take a particular risk
- find ways by which to control
- or to transfer it to insurers
- or to eliminate it.

In this way, the farmer is presented with a quantitative assessment and receives a summary of the information with which to make his decision. On the other hand, his decision depends on his attitude to risk.

Making intelligent decisions to optimize the resource performance of the livestock production system and forecasting management decisions leads to improved system performance and increased revenues. After calculating and analyzing business and financial risk indicators, farmers will be able to optimize their costs and thus make a profit.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

The authors equally contributed to the present research, at all stages from the formulation of the problem to the final findings and solution

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

The research leading to these results has received funding from the Ministry of Education and Science under the National Science program INTELLIGENT ANIMAL HUSBANDRY, grant agreement N Д01- 62/18.03.2021).

Conflict of Interest

The authors have no conflicts of interest to declare.