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ECONOMIC FEASIBILITY AND COST MODELING FOR HORSE TRAINING CENTERS: A FINANCIAL PERSPECTIVE FROM BRAZIL

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ABSTRACT

This study aimed to develop a cost calculation model for equine training centers and assess their feasibility. It established critical parameters for such centers, including facilities, equipment, labor, and operational metrics. A Microsoft Excel-based model allocated costs into variable, fixed operating, and opportunity costs. Input prices and quantities were collected to calculate economic indicators like gross margin, net margin, profit, break-even point, total factor productivity, and rate of return. A five-year cash flow projection was developed, estimating financial indicators like net present value (NPV), rate of return, internal rate of return (IRR), and discounted payback. The project obtained an annual profit of $5,298,64, with gross and net margins of $51,630.35 and $23,852.72, respectively. In this scenario, the break-even point, which represents the minimum number of horses needed for costs to equal profits, was calculated to be nine horses. The rate of return for the project was 15%. Risk indicators demonstrated a high level of security (531.49% IRR and payback within the first year), and profitability indicators were positive, with an NPV of $87,005.78, a benefit-cost index (IBC) of 2.75, and a profitability rate of 1,261%. The project was found to be financially viable, and the cost model aligned with economic theory principles. This model offers a valuable tool for equine training center operators, investors, and stakeholders, enabling informed decision-making by providing a detailed economic and financial analysis of costs and profitability. It assists in optimizing resource management, improving pricing strategies, identifying areas of inefficiency to enhance profitability, and supporting long-term planning and sustainability in equine businesses.

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INTRODUCTION

At a population of 5.8 million, Brazil is home to the world's third-largest equine herd, following that of the United States (10.6 million) and Mexico (6.4 million; Instituto Brasileiro de Geografia e Estatística [IBGE], 2022; Pimentel et al., 2023). Within this population, over 1 million horses are used for sport and leisure activities and are housed and trained in over 500,000 properties across all 27 states (IBGE, 2022). The equine industry plays a significant role in Brazil's economy, contributing an estimated $16 billion reais (equivalent to $3,2 billion) annually and employing approximately 3 million people

directly and indirectly (Lima and Cintra, 2016). Equine businesses in Brazil offer various services including training, boarding and classes (Marins and Leschonski, 2005). In general, investment in equine businesses is often considered high risk, given startup costs to provide such a unique service is expensive and specialized equipment (i.e. training and riding equipment) can often not be re-utilized if the business fails resulting in capital immobilization for the owner (Clark, 2009; Kachelmeier, 2009).

In addition to startup expenses, investors can expect to pay an estimated monthly maintenance cost between $4-141 USD per month/per horse, depending on the type of facility and training program provided (Lima and Cintra, 2016). Additional investment risks can occur in new and well-established equine businesses during unfavorable economic times given that the product of these businesses (i.e., horse boarding and training) is often perceived as a redundant service.

Given the economic variability and potential volatility of the equine industry, effective cost calculation models are needed to assist investors in forecasting economic outcomes and controlling costs. Some tools have been made publicly available through University Extension programs in Kentucky and Montana that provide cost analysis for equine businesses (Burdine, 2006; Griffith and Gagnon, 2007). However, these tools, which were developed over 17 years ago, are insufficient for the more complex needs of modern equine businesses. While they can provide a complex general cost analysis, they lack the capability to conduct a detailed feasibility assessment for equine training centers. Additionally, these tools do not offer the granularity required to account for the diverse range of boarding and training used by current equine businesses. For example, the costs associated with different types of facilities or training programs are not broken down in sufficient detail. Furthermore, these existing tools do not have the flexibility to consider the international characteristics of equine centers.

The lack of flexibility in existing models, coupled with the absence of international applicability, represents a significant research gap. Despite the economic importance of the equine industry in countries like Brazil, there is a notable absence of a model that provides a comprehensive cost and feasibility analysis, tailored to various types of equine businesses, and adaptable to different contexts. Therefore, the objectives of this study were to develop and validate a publicly accessible cost calculation model that addresses this gap by offering a detailed, flexible tool for assessing the economic and financial feasibility of equine training centers.

MATERIAL AND METHODS

Study area

Research development consisted of four stages, and the detail of each stage is presented in Table 1.

Table 1. Description of the research development stages.

Stage	Description
1	Establish equine training center characteristics.
2	Collect price input data by centers.
3	a. Develop a cost calculation mathematical model. b. Identify key economic indicators of the business. c. Construct enterprise cash flow and calculate financial indicators.
4	Cost calculation model validation; Case study.

Characterization of the equine training center

Characterization was conducted using information from published literature and general knowledge specific to commercial equine businesses that offer boarding and training services for horses. This system was comprehensively characterized to accurately calculate production costs based on methodology developed by Alves et al. (2022). The characterization encompassed various aspects, including: i) Installations and equipment (i.e., facility dimensions and construction characteristics), ii) Labor (i.e., employee number, operation hours), iii) Management practices (i.e., feeding program, cleaning procedures) and iv) Operational indicators (i.e., horse inventory). Furthermore, the study considered two types of services provided: boarding only and boarding with training services.

Survey of input prices

After characterizing the training center system and identifying the inputs used, a survey of input prices was conducted in May 2022. The survey obtained quotes from various vendors in São Paulo state, including agricultural stores, dealers, local producers and cooperatives that serve the surrounding equine businesses. Prices were collected via telephone surveys

and reflect the average prices paid by producers at these points of sale for cash transactions. Prices were initially recorded in Reais (Brazilian currency) and then converted to USD using the average exchange rate published for May 2022 (Banco Central do Brasil [BCB], 2022; $1 USD = R$4.95).

Cost calculation model construction and feasibility indicators

The primary objective of developing the cost calculation model was to determine boarding costs and assess economic indicators of profitability and minimum horse inventory required for profit, thereby aiding in the technical management of the establishment and facilitating the determination of services prices. All cost categories suggested by the Neoclassic Economic Theory were included in the model, allocated to variable costs (VC), fixed operating costs (FOC), and the opportunity costs of capital and land (CC), in line with prior efforts to develop mathematical models for livestock production systems (Raineri et al., 2015b; Sartorello, et al., 2018; Alves et al., 2022; Stage 3a). To calculate the proposed forecasts, the model was supplied with information obtained in the system characterization and price survey phases (Stages 1 and 2). The costs were presented in units: i) monthly cost per boarded horse; i) monthly cost per boarded horse receiving general training; and iii) monthly cost per boarded horse receiving specialized training.

For the economic analysis (Stage 3b), the economic indicators calculated in the model included: i) Gross Margin (GM): the portion of the training center's revenue left after subtracting variable costs. ii) Net Margin (NM): The portion of the training center's revenue left after subtracting operational costs. iii) Economic Profit (EP): the portion of revenue remaining after subtracting total costs. iv) Break-Even Point (BEP): the number of horses at which the revenue from providing the services revenues equals the production costs. v) Total Factors Productivity (TFP): the revenue generated for each dollar spent on the business. And vi) Rate of Return (RR): the percentage gain or loss relative to the investment made.

The business cash flow for five years was calculated with the costs determined. Additionally, a financial analysis was conducted, including the following profitability indicators: i) Net Present Value (NPV): anticipated gains and feasibility of the business. ii) Benefit-Cost Index (BCI): expected earnings following investment or cash flow. iii) Profitability Rate (PR): ratio of benefits to costs. iv) Internal rate of return (IRR) the discounted rate where NPV of cash flows equals the initial investment amount. And v) Discounted payback period (DPP): the number of years required for the business to recoup capital invested. (Stage 3c).

Cost calculation model validation; Brazilian equine center case study

To validate the developed cost calculation model, a case study was conducted using information from an actively operating equine training center located in Ribeirão Preto, São Paulo (Stage 4). The property was located on five hectares of land, including ten boarding stalls ($16 m^2$ each), along with training tracks and a round pen system. The operation also provided additional services for ten horses, four solely maintained for boarding, two boarded and undergoing general training, and four boarded and receiving specialized training. The training center leased a property already equipped with facilities, eliminating construction costs, given the center only worked with a limited number of horses, whose training could be carried out by a single trainer.

RESULTS

Cost Calculation model development

A cost calculation model was developed in an electronic spreadsheet and designed to serve different types of equine training centers. This model encompasses all conceivable costs associated with such an enterprise, including maintenance costs for horses (e.g., food, healthcare, trimming, and shoeing), training expenses (e.g., taming or other types of work), acquisition of bedding (e.g., straw and shavings), labor, third-party services (e.g., accounting, insurance, and veterinary assistance), energy and fuel, depreciation and maintenance of facilities and equipment, upkeep of pastures and weed control, taxes and rates, and opportunity costs of capital and land (comprising fixed assets, working capital and land leasing). The model estimated the total cost based on allocated items, presenting the annual enterprise total cost and the monthly total cost per horse in each category of service provided (boarding only, boarding+general training, boarding + specialized training). These categorizations aid in pricing the services offered, ensuring that monthly

fees align with each activity's specific costs. Variable costs (Table 2 – Section I) were categorized and further subdivided based on the type of training program. Fixed operational costs included manpower (except for the trainer, which was allocated to variable costs), energy and fuel, depreciation, maintenance, and other fixed expenses, as shown in Table 2 (Section II). These costs are common to all service categories provided. The operating cost reflects the sum of variable costs (VC) and fixed operating costs (FOC, Section III), while the opportunity costs of capital and land considers the remuneration of capital invested in the facilities and equipment, working capital, and the land lease, as shown in Section IV (Table 2).

Table 2. Cost allocation scheme used in the cost calculation model for equine training centers.

I – VARIABLE COSTS (VC)	
1.	**Feed**
1.1.	Boarded horses
1.2.	Horses in general training
1.3.	Horses in specific training
2.	**Sanitary Management**
2.1.	Boarded horses
2.1.1.	Deworming
2.1.9.	Others
2.2.	Horses under general training
2.2.1.	Deworming
2.2.9.	Others
2.3.	Horses in specific training
2.3.1.	Deworming
2.3.9.	Others
3.	**Horses in service**
3.1.	General training
3.2.	Specific Training
4.	**Bedding**
4.1.	Bedding for the pens
4.2.	Bedding for general training activities
4.3.	Bedding for specific training activities
5.	**Hoof Care/Shoeing**
5.1.	Regular trimming
5.1.1.	Boarded horses
5.1.2.	Horses under general training
5.1.3.	Horses in specific training
5.2.	Shoeing
5.2.1.	Boarded horses
5.2.2.	Horses under general training
5.2.3.	Horses in specific training
6. Other variable expenses	
6.1.	Occasional variable costs
6.2.	Taxes (ICMS, among others)
6.3.	Rural Worker Assistance Fund (FUNRURAL)
6.4.	Animal Fees (Animal Transport Guide, and others)
Subtotal Variable Costs	
II – FIXED OPERATING COSTS (FOC)	

7.	**Manpower**
7.1.	Fixed employees
7.1.1.	Fixed employee 01
7.1.2.	Fixed employee 02
7.2.	Temporary workers
7.2.1.	Day Worker 01
7.2.2.	Day Worker 02
8.	**Equipment rent**
9.	**Services**
9.1.	Pro-Labore
9.2.	General services (Veterinarian, Insurance company, Financial Accountant)
10.	**Energy and fuel**
10.1.	Diesel
10.2.	Ethanol
10.3.	Gasoline
10.4.	Electric energy expenses
11.	**Depreciations**
11.1.	Housing
11.2.	Riding equipment
11.3.	Handling equipment
12.	**Maintenance and Conservation**
12.1.	Housing maintenance
12.2.	Riding equipment maintenance
12.3.	Handling equipment maintenance
12.4.	Pasture and grass maintenance
12.4.1.	Pasture
12.4.2.	Grass
13.	**Other Fixed Expenses**
13.1.	Taxes (ITR, and others)
13.2.	Fees (Syndicate, Association, and others)
13.3.	Pharmacy supplies
Subtotal Fixed Operating Costs	
III - OPERATIONAL COST (VC + FOC)	
IV – OPPORTUNITY COSTS OF CAPITAL AND LAND (CC)	
14.	**Remuneration on fixed capital**
14.1.	Remuneration on fixed capital – housing
14.2.	Remuneration on fixed capital – riding equipment
14.3.	Remuneration on fixed capital – handling equipment
15.	**Remuneration on working capital**
16.	**Opportunity cost of land lease**
V – TOTAL PRODUCTION COST (OP + CC)	
Annual Cost of the Equids Training Center (Operational Cost + Opportunity Costs of Capital and Land)	
Monthly total cost per horse boarded	
Monthly total cost per horse under general training	
Monthly total cost per horse under specific training	

Operational costs of the training center used to validate the model were described in Table 3. Additionally, costs and monthly fees charged in the case study center under analysis are presented in Table 4. These values involved cost allocation by horse and service type, allowing for an individualized analysis, and providing information specific to the ideal number of horses in each contract type.

Table 3. Cost composition, presented in dollars and as a percentage of the total annual cost of the equine training center under study.

Cost items	Annual total cost ($)	Total cost proportion (%)
Feed	8,831.28	11.91%
Health management	182.01	0.25%
Training services	15,259.01	20.58%
Hoof trimming/shoeing	0.00	0.00%
Bedding	1,162.59	1.57%
Other variable costs	2,378.50	3.21%
Manpower	16,723.98	22.56%
Maintenance	7,226.15	9.75%
Depreciation	496.09	0.67%
Energy and fuel	3,137.66	4.23%
Other fixed expenses	193.77	0.26%
Opportunity costs	18,554.06	25.02%
Total	**74,145.10**	**100.00%**
Variable costs	27,813.39	37.51%
Fixed operating costs	27,777.65	37.46%
Opportunity costs	18,554.06	25.03%

Table 4. Monthly costs and revenues per animal, in dollars, for services provided at the equine training center under study.

Costs	Type of service		
	Boarded	General training	Special Training
Horse maintenance			
Variables	73.18	82.20	97.72
Fixed	251.30	251.30	251.30
Opportunity	154.62	154.62	154.62
Horse training-related work	-	203.45	216.17
Monthly cost per horse	479.10	691.57	719.81
Income			
Charged monthly fee	322.94	888.09	888.09

Economic analysis

Economic indicators for the equine training center were calculated based on the operating costs and are summarized in Table 5. Analysis of these indicators show the business' viability, with positive annual results, including profit, gross and net margins. The annual profit of $5,298.64, which included *pro-labore*, indicated that variable, fixed, and opportunity costs were covered, resulting in a profit for the investor. However, it is noteworthy to point out that the breakeven point for this specific operation was nine horses. Considering the operation's total capacity of ten horses, a potential loss may occur if costs increase over time. Total productivity and the rate of return were positive; however, an increased accommodation capacity is needed to improve the project's long-term viability.

Financial analysis

The financial attractiveness of the investment project was assessed by preparing cash flows, see Table 6 below.

Table 5. Economic indicators calculated for the equine training center under study.

Economic indicators	**Value**
Profit ($/year)[1]	5,298.64
Gross Margin ($/year)[2]	51,630.35
Net Margin ($/year)[3]	23,852.70
Break-event point (number of horses)[4]	9
Total Factors Productivity ($)[5]	0.22
Rate of return (%)[6]	7.10

[1]Profit = Total annual income – Annual total cost. [2]Gross margin = Total annual income – Annual variable costs. [3]Net margin = Total annual income - Annual operation cost. [4]Break-even point = Total annual income x (average price of services) - 1. [5]Total Factors Productivity = Total annual income x (Annual total cost)-1. [6]Rate of return = Total Factors Productivity – 1.

Table 6. Cash flow projection for the equine training center over five years.

	Years					
	0	1	2	3	4	5
Cash in						
Housing	-	38,753.04	38,753.04	38,753.04	38,753.04	38,753.04
Taming	-	13,563.56	13,563.56	13,563.56	13,563.56	13,563.56
Training	-	27,127.13	27,127.13	27,127.13	27,127.13	27,127.13
Residual value of assets	-	-	-	-	-	5.05
Total inflows	-	79,443.73	79,443.73	79,443.73	79,443.73	79,448.78
Cash out						
Investments						
Useful life – 5 years	1,231.22	-	-	-	-	1,231.22
Useful life – 10 years	3,537.22	-	-	-	-	-
Useful life – 15 years	79.73	-	-	-	-	-
Useful life – 20 years	74.68	-	-	-	-	-
Costing						
Pharmacy supplies		193.77	193.77	193.77	193.77	193.77
Feeding	-	8,831.27	8,831.27	8,831.27	8,831.27	8,831.27
Land leasing	-	14,532.39	14,532.39	14,532.39	14,532.39	14,532.39
Pen bedding	-	1,162.59	1,162.59	1,162.59	1,162.59	1,162.59
Accountant	-	2,935.54	2,935.54	2,935.54	2,935.54	2,935.54
Diesel	-	1,189.23	1,189.23	1,189.23	1,189.23	1,189.23
Ethanol	-	5,994.61	5,994.61	5,994.61	5,994.61	5,994.61
Energy	-	525.59	525.59	525.59	525.59	525.59
Employee	-	3,586.70	3,586.70	3,586.70	3,586.70	3,586.70
Funrural (Brazilian tax)	-	2,160.45	2,160.45	2,160.45	2,160.45	2,160.45
Gasoline	-	8,828.43	8,828.43	8,828.43	8,828.43	8,828.43
ICMS - (State Tax on the circulation of goods)	-	218.05	218.05	218.05	218.05	218.05
Health management	-	182.01	182.01	182.01	182.01	182.01
Veterinarian	-	2,935.54	14,544.00	14,544.00	14,544.00	14,544.00
Total outflows	4,922.85	53,276.17	64,884.63	64,884.63	64,884.63	66,115.85
Net cash flow	4,922.85	26,167.56	14,559.10	14,559.10	14,559.10	13,332.93

A business operation is deemed attractive if expected benefits exceed the investment that originated this flow (Passos and Nogami, 2012; Gleißner et al., 2022). Cash flow planning aligned with the five-year lease contract duration for the specific business case study under consideration (annual interest rate 12.75%; BCB, 2022). Using the cash flow data, the financial viability indicators were calculated (Table 7).

Table 7. Financial indicators of the equine training center under study.

Financial Indicators	Value
Net Present Value ($)[1]	87,005.78
Benefit-Cost Index ($)[2]	2.75
Profitability rate (%)[3]	1,261.89
Internal Rate of Return (%)[4]	531.49
Discounted Payback Period (Years)[5]	1

[1]NPV = [cash flow / (1+ discount rate) ^ number of time periods] – initial investment. [2]BCI = Present Value of Benefits / Present Value of costs. [3]PR = (Profit / Revenue) x 100. [4]NPV(0) = [(Cash $Flow_1/(1+IRR)^1$) + (Cash $Flow_2/(1+IRR)^2$) + (Cash $Flow_n/(1+IRR)^n$)] – initial investment. [5]DPP = Year + (Absolute value of cumulative discounted cash flow at that year) / discounted cash flow in the following year).

The NPV calculation indicated the case study's viability, with an expected return of $87,005.78 over 5 years. The BCI indicated that for every dollar invested, the expected return was $2.75, and the PR was 1,261.89%. The internal rate of return was estimated at 531.49%, showing that this business scenario is a short-term high-return project with a discounted payback period of 1 year.

DISCUSSION

Equine businesses are an important economic activity worldwide, yet there is limited scientific literature on the economic and financial outcomes of horse-related services such as boarding and training. This study developed and validated a cost calculation model for equine training centers, providing key economic indicators to support informed decision-making. The model estimates variable, fixed, and opportunity costs, and calculates profitability indicators such as gross margin, net margin, and break-even point. The results demonstrate optimistic financial outcomes, with a positive return on investment and a quick payback period.

Cost calculation model

The cost calculation model developed in this study offers equine business investors a comprehensive tool for economic and financial decision-making specific to equine training centers. This model calculates general annual and individual monthly costs per horse, providing fields to input the training center's revenue, including annual profit, gross and net margins, owner's income, break-even point, total factor productivity, and rate of return. This enables a personalized calculation of economic indicators, which is essential for making informed and accurate management decisions (Alves et al., 2022).

Shared costs, such as variable expenses, fixed operating costs, and opportunity costs on capital and land, are evenly distributed among all horses, following the recommendations of the scientific literature for cost allocation among various services in the same activity (Raineri et al., 2015a). By including riding equipment's costs for all horses, even those not in training, the model avoids overloading the costs for trained horses, ensuring fair cost distribution, and preventing increased monthly fees. Also, the subdivision of variable costs according to training specifics addresses the unique management requirements of each type of training (Koskinen, 2020; Alves et al., 2022)

Studies on similar themes in equines are limited, but comparable assessments have been employed in other animal production studies, including pig farming (Bergaming et al., 2021; Alves et al., 2022), beef cattle systems (Sartorello et al., 2018; Paiva, et al., 2020), milk production systems (Kruger et al., 2019), lamb production systems (Raineri et al., 2015b) and organic fish farming (Rossignol, 2021). The study economic and financial indicators include gross margin, net margin, economic profit, break-even point, total factors productivity, rate of return, net present value, benefit-cost index, profitability rate, internal rate of return and

discounted payback period. These indicators provide a robust foundation for strategic and accurate decision-making based on concrete data (Scott et al., 2011).

Case study

The case study showcased the model's flexibility across different scenarios and projects. For instance, when leasing facilities, depreciation costs of buildings could be excluded, and leasing costs could then be included as part of the total cost. Pasture and grassland maintenance costs were not applied as these resources were not used to feed the horses. Instead, fields intended for growing hay and purchasing feed were exploited. Pastures served primarily as recreational areas, often required to promote natural behavior expression and optimize individual horse welfare, particularly for stalled horses (Macleay et al., 2017; Popescu et al., 2022).

Additional costs such as trimming, shoeing, transportation, and competition registration were excluded in the case study, as they were the responsibility of individual horse owners. Despite property rental, the case study showed that fixed costs were almost equal to variables costs, indicating significant capital immobilization in equine enterprises compared to other agricultural activities, where variable costs generally exceed fixed operational costs (Sartorello et al., 2018). Therefore, leasing structures, when viable, can be an attractive alternative.

The case study revealed that the monthly fee for horses only boarded was below the cost of maintaining them. This discrepancy was due to competitive pricing concerns in this case study, making exclusive accommodation services economically unviable for the business. An advisable strategy would be to expand facilities to accommodate more horses, thereby increasing revenue and achieving scale gains related to the apportionment of fixed costs (Raineri et al., 2015b; Alves et al., 2022). Alternatively, boarding horses in paddocks, reserved for exercise, could be considered, depending on lease length and negotiations with the property owner.

Investors have different perceptions of expected returns and associated risks, which can lead to varied assessments of the same investment opportunity (Passos and Nogami, 2012). While risk cannot be eliminated, investors can improve their understanding by seeking detailed business information and analyzing related risk indicators (Maharani and Saputra, 2021). Passos and Nogami (2012) emphasize the importance of the payback concept in the investment decision-making process, as delays in capital recovery can result in lost future investment opportunities. Leasing a property with existing structures eliminates the need for significant investments in stalls and other constructions, ensuring quick investment return.

The profitability rate, expressed as a percentage, is calculated by the ratio of benefits to costs, with higher values indicating greater attractiveness (Passos and Nogami, 2012). For example, a rate of 1,261.89% signifies a highly profitable investment. Additionally, the IRR and payback serve as risk indicators. The payback period indicates the time required to recoup the invested capital, with the investment recovery occurring within the first year of the equine training center operation. The IRR, representing the minimum attractiveness rate at which NPV equals zero, was 531.49% in this study, significantly higher than the 12.75% per year market rate at the time of analysis. This indicates a low-risk project regarding financial return on investment.

CONCLUSION

This study has successfully developed a comprehensive cost calculation model tailored for equine training centers. The model provides a structured framework for allocating variable, fixed operating and opportunity costs, ensuring business owners can accurately calculate monthly and annual costs per horse. It incorporates important financial indicators such as net present value, benefit-cost index, profitability rate, internal rate of return and discounted payback period, allowing investors to assess their businesses' financial viability and make strategic decisions with confidence.

The case study demonstrated the model's flexibility across different operational scenarios, highlighting its applicability in various contexts, including leasing arrangements and pasture management. The results indicated that expanding the business capacity could significantly improve profitability and long-term financial sustainability. Furthermore, the model's focus on shared and individual costs ensures fair cost distribution across different services, helping prevent overpricing and improving pricing strategies.

The model addresses key gaps in equine business management tools by offering a more comprehensive, adaptable, and financially sound approach to running

equine training centers. The findings underscore its potential to benefit a wide range of stakeholders, from business owners to investors and consultants, making it an essential tool for anyone looking to improve equine enterprises' financial performance and sustainability.

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