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ECONOMIC FEASIBILITY OF TECHNIFIED TILAPIA PRODUCTION IN BRAZIL

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Tilapia production in Mato Grosso do Sul has steadily increased, making the state the third largest in exports. The growth of aquaculture necessitates technological advancements to enhance fish uniformity and increase stocking capacity. Evaluating the economic feasibility of such ventures in the region is crucial for strengthening the rapidly growing production chain. Analysis of various sales price scenarios in the study area fosters dialogue for sector development and understanding operational bottlenecks. This research assesses the implementation of technified tilapia farms across different water surface areas (5 ha, 10 ha, and 20 ha) in southern Mato Grosso do Sul, in Brazil's Midwest.

The evaluation adopts a semi-intensive system in excavated ponds with earthen bottoms and monk drainage. Stocking begins with 40 g juveniles at an initial density of 6 fish per m². After a 210-day cultivation period with 95% survival rate, fish are harvested averaging 840 g in weight. The feed conversion ratio for this technified production is 1.47 kg of feed per kg of fish produced. Productivity per hectare per cycle was 48 t ha⁻¹ cycle⁻¹ (73 t ha⁻¹ year⁻¹). Initial investment analysis includes fixed asset expenditures (CAPEX) such as fountain and paddle aerators, automatic feeders, silos for feed storage, electrical grid posts, solar panels, generator, employee housing, composting facility, and documentation (licenses and project approvals). A 3% annual provision for maintenance of improvements and equipment (Operational Expenditure [OPEX]) was considered based on the total acquisition value. Depreciation was calculated using the straight-line method.

Operational costs and expenses (nominal values) were surveyed, including fixed labor, electricity, feed, maintenance, technical assistance, harvesting, and juvenile procurement. Cash flow projections spanned a 10-year horizon. The following indicators were calculated: Internal Rate of Return (IRR), Modified Internal Rate of Return (excluding reinvestment) [MIRR], Net Present Value (NPV), and Simple Payback Period. The discount rate used (15.62% - nominal interest rate) represents the cost of equity (ke). The Capital Asset Pricing Model (CAPM) benchmark for the US market as of May 2024 was utilized to calculate ke. Sales were considered primarily to the processing industries.

Results (Table 1) indicate that sales price significantly impacts indicators for this market, with farms larger than 10 ha recommended due to greater resilience against price fluctuations paid by the industry.

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Aquatic systems are increasingly recognized as indispensable for enhancing the food and nutrition security of a growing and increasingly urbanized population. There is a growing preference for production methods that use less land and water while emitting low or zero CO₂. Spirulina (a cyanobacterium) is a staple in many diets across the world, highlighting its potential as a sustainable food source. Despite Spirulina production occurring across all regions of Brazil, this data is notably absent from official statistical records, leaving the precise number of producers and their production volumes undisclosed. Consequently, domestic production falls short of meeting Brazil's demand, necessitating reliance on imports from other Spirulina-producing nations to supply health food stores. Currently, the production chain for microalgae farming is nonexistent in Brazil, emphasizing the importance of conducting a comprehensive analysis to facilitate the growth of this sector. Therefore, our research aimed to evaluate the establishment of an artisanal Spirulina production hypothetical farm in the southern region of Mato Grosso do Sul, located in the central-western region of Brazil.

The system used in the hypothetical study is a semi-continuous setup featuring raceway tanks within an open configuration. Water movement within the tanks is facilitated by rotating paddle wheels driven by a motor. Each module consists of two tanks measuring 3.5 meters in width, 25 meters in length, and 0.32 meters in height, with a total volume of 28 cubic meters. These tanks are inoculated with an algal solution during the exponential growth phase, initially comprising 10% of the total tank volume. The harvesting of algal biomass occurs daily, starting from the 12th day of cultivation, with the crop being filtered. Cultivation takes place indoors within an agricultural greenhouse, which is covered with transparent plastic to allow for natural lighting and maintain a consistent photoperiod. The culture medium employed for the analysis is Zarrouk. The average yield considered was 0.5 grams of dry Spirulina per liter of productive medium, achieved from 12 days after the algal inoculation began (0.5 g/L or 48 t/ha/year). An assessment of the initial investment in fixed assets was conducted, encompassing both the expunging capital (CAPEX) and implementation costs. A maintenance reserve of 3% per year of the total acquisition value was factored in for the upkeep of enhancements and equipment (Operational Expenditure [OPEX]). Depreciation was computed utilizing the straight-line method. A comprehensive review of operating costs and expenses was conducted to facilitate cash flow analysis over a 10-year timeframe. Following the determination of operating cash flow, key indicators were derived, including net present value (NPV), internal rate of return (IRR), modified internal rate of return (assuming reinvestment of 10% per annum of the FC value), as well as simple and discounted payback periods. The discount rate applied was the cost of equity (k_e). The calculation of k_e utilized the Capital Asset Pricing Model (CAPM) benchmarked against the USA. The adjusted CAPM formula is as follows:

The selling price (\$19.34) was determined based on the local market for domestic products, primarily targeting natural produce markets. The product's sale in the region is positioned as a high-quality food item with an emphasis on traceability.

The production of Spirulina demonstrates economic viability with flexibility to accommodate various economic scenarios. These scenarios may include adjustments to discount rates, adaptation to consumer market trends, potential decreases in sales prices, increases in costs and expenses, as well as enhancements in fixed investments.

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