Economic analysis of five oyster farms in Southern Brazil

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Abstract – The article describes a comparative economic analysis executed on five oyster farms in Florianópolis, on the southern coast of Brazil. The analysis was carried out based on interviews with the producers and the data were grouped into components of the production cost to calculate economic indicators, used in a comparative analysis of the farms. Labor expenses represent the largest component, varying from 42% to 44% of the production cost, which ranged from R$5.70 to R$8.34 dz.$^{-1}$, with the mean of R$6.96 dz^{-1}. The economic analysis of the five farms with different business characteristics shows that the profitability of this sector depends on good planning with definition of production scale, processing strategy and sales price. The comparative analysis highlights the importance of monitoring and control of the components of effective cost of production and depreciation expenses to support farm management decisions and ensure business profitability

Index terms: Aquaculture; Bivalve mollusks; Production cost.

Análise econômica de cinco fazendas de ostras no Sul do Brasil

Resumo – O artigo descreve uma análise econômica comparativa realizada em cinco fazendas de ostras em Florianópolis, litoral sul do Brasil. A análise foi realizada a partir de entrevistas com os produtores e os dados foram agrupados em componentes do custo de produção para cálculo dos indicadores econômicos, utilizados na análise comparativa das propriedades. As despesas com mão de obra representam o maior componente, variando de 42% a 44% do custo de produção, que variou de R$ 5,70 a R$ 8,34 dz^{-1}, com uma média de R$ 6,96 dz^{-1}. A análise econômica mostra que a rentabilidade desse setor depende de um bom planejamento com definição de escala de produção, estratégia de processamento e preço de venda. A análise comparativa destaca a importância de monitorar e controlar os componentes do custo efetivo de produção e despesas de depreciação para apoiar as decisões de gestão da fazenda e garantir a rentabilidade do negócio.

Termos para indexação: Aquicultura; Moluscos bivalves; Custo de produção.

Introduction

Santa Catarina state is known as the main oyster production region in Brazil, with a producton 2,856 tons of oysters in 2019. One hundred small-scale oyster farmers exist in this region, most of them concentrated in Florianópolis Island, producing mainly the Pacific oyster *Crassostrea gigas* (INFOAGRO, 2020).

The farming systems employs lanterns nets, either disposed in longlines or in wood racks, and some farmers are using floating bags in the nursery and juvenile phases. The use of machines is limited for washing the oyster in some farms, and all the grading and counting procedures are done manually. The farming system is artisanal and labor intensive, and most farmers use family workforce.

Analyzing the oyster production cost and the profitability of a modal oyster farm in Florianópolis, Munoz & Mataveli (2016) found R$5.85 dz^{-1} as the cost for a 1ha farm producing 18 thousand dozens per year. Their study did not consider the marketing costs, which, depending on the strategy and channels used, can greatly affect a business' profitability.

Although there are some similarities among oyster farms, the infrastructure, production scale, processing strategy, marketing and finances of each are different, meaning analysis must be individualized and consider local circumstances (PARKER et al., 2020). Two methodologies to calculate production costs in agribusiness exist: total cost, on which the components are grouped into fixed and variables expenses, and operating cost, on which the components are grouped into operating cost and opportunity expenses (FERRARI et al., 2019).

Few farmers keep record of production costs, and limited information about oyster production cost in Brazil is available. This paper aims at an individual economic analysis of oyster farming in Florianópolis Island, considering the specificity, production scheme and marketing strategy of different producers.

Material and methods

Five oyster producers located at Florianópolis Island were interviewed to collect information about their production volume, number of employees and their salaries, volume of oyster spat acquired annually and their survival rate, processing and marketing strategy and costs, expenditures with consumables, maintenance and third party or outsourced services, and assets values. Farming system varied as follows: Farm 1 and Farm 2 utilize single longlines, 120m long, 70 floats with 30

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liters in volume, and 240 lantern nets per longline; Farm 3 and Farm 4 utilize floating bags during nursery and initial growth stages, and suspended rack with lantern nets after the oysters reach 50mm until harvest size; Farm 5 utilizes double longlines, 100m long, with 60l floats and 200 lantern nets per logline. Table 1 summarizes the main characteristics of the farms analyzed. Two are registered as legal entities under the micro enterprise taxation regime. The other three farms are classified as individuals and taxed as rural producers.

The survey was conducted between September and December 2020. The collected information was organized in spreadsheets, and the main economic indicators were calculated according to the methodology employed by Epagri to conduct economic analyses of the agrobusiness in Santa Catarina (FERRARI et al., 2019), as described below:

Gross Revenue (GR): (production x price) – the result calculated by multiplying the sales of oysters by the selling price.

Effective Operating Cost (EOC): Refers to all expenses taken by the farm over a productive cycle or period analyzed and that will be consumed in the same period. It covers all items considered direct expenses, such as inputs, mechanical operation (diesel and repairs), labor, outsourced service, processing, transportation and commercialization, general expenses, financial expenses, and taxes.

Total Operating Cost (TOC): (EOC + Depreciation) – Sum of EOC with the value of the annual depreciation of the physical assets of the establishment (Vehicles, machines, implements, equipment).

Total Cost (TC): (TOC + Opportunity Cost) – Sum of TOC with the remuneration of production factors (assets) considering the opportunity cost of the capital invested in the farm.

Gross Profit (GP): (GR - EOC) – Result obtained by deducting from the Gross Revenue all Effective Operating Costs spent to produce oysters, in Brazilian Reais (R$)

Gross Margin (GM): (GP/GR) – Percentual margin obtained by the division of Gross Profit by Gross Revenue.

Net Profit (NP): (GR - TOC) – Result obtained discounting all Operating Costs from Gross Revenue. That is, the costs spent for operating the project plus the cost of Depreciation.

Net Margin (NM): (NP/GR) – Percentual margin obtained by the division of Net Profit by Gross Revenue.

Profitability Index: This indicator shows the relationship between Operating Profit (OP) and gross revenue, in percentage. Shows the available rate of revenue for the project, after payment of all operating costs.

Leveling Productivity (LP): This indicator identifies, for a given price level and production cost, what is the minimum production volume to cover this cost, given the unit selling price for the product.

Depreciation: All physical structure of an establishment – improvements, machines, vehicles, equipment, loses its acquisition value over the years. Until the end of the useful life of this

Table 1. Farming system, annual production volume of oysters, farm area, annual volume of oyster seeds, number of employees, selling price, access to sanitary inspection, and marketing channels adopted by the five oyster farms analyzed

Tabela 1. Sistema de cultivo, volume de produção anual de ostras, área da fazenda, volume anual de sementes de ostra, número de funcionários, preço de venda, acesso à inspeção sanitária e canais de comercialização adotados pelas cinco fazendas de ostras analisadas

	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5
Farming system	Longline with lantern nets	Longline with lantern nets	Floating bags and lantern nets in a wood rack	Floating bags and lantern nets in a wood rack	Double longline with lantern nets
Annual production (dz.)	200,000	100,000	100,000	20,000	15,000
Farm area (ha)	2.4	3	0.8	0.3	0.3
Annual spat volume	5,000,000	4,000,000	3,000,000	1,000,000	400,000
Employees	14	7	8	1	-
Sale price	R$12.00 dz^{-1}	R$10.00 dz^{-1}	R$6.00 dz^{-1}	R$7.15 dz^{-1}	R$7.15 dz^{-1}
Sanitary inspection	Municipal inspection	No inspection	No inspection	No inspection	Outsourced
Selling channels	Local fish shops, restaurants, and delivery	Processor	Processor	Distributors, local fish shops, and restaurants.	Distributors, local fish shops, and restaurants.

asset, there will be a need to replace the invested capital. For the producer to remain in the activity in the long term, it is necessary to consider an annual cost of replacement of the equity, based on the useful life of their assets. In this analysis, the straight-line depreciation method will be used for all marine farm assets.

Opportunity Cost (OC): It is a term used in economics to indicate the cost of something in terms of a missed opportunity, as well as the benefits that could be obtained from this "left out" opportunity.

Capital Remuneration: In the operating cost method, the opportunity cost of capital is calculated from the operating profit obtained in the project using Equation 1: Capital Compensation Rate = (Operating income) / Σ Average capital stock). Where the mean capital stock: Improvements and machines = (acquisition value + residual value) / 2

Results and discussion

Labor expenses represent the largest component of the Effective Operating Cost (EOC), varying from 42% to 44% of the production cost. Farm 5 has no employees, using family workforce, and their pro labore represented 56% of the EOC. Input expenses, with mean 16.25% of EOC, and selling expenses, with mean 14.5%, appear as the most important components after labor (Figure 1).

Farms 3 and 4 have no expenses with marketing and sell their product at farm gate to a processor. Having the lowest production volume and expenses with outsourced processing, Farm 5 has a proportionally higher marketing cost, with 19.7% of the EOC. Farm 1 has the largest production volume, its own processing plant with sanitary inspection and a lower share of the marketing cost among the farms with processing and marketing expenses. In fact, the survey shows that the minimum volume for an oyster farm to be profitable with its own processing plant is around 150,000 dozen per year. Table 2 presents the components of the operating cost and the economic indicators calculated for the five farms.

The lowest net margin, of only 9.6%,

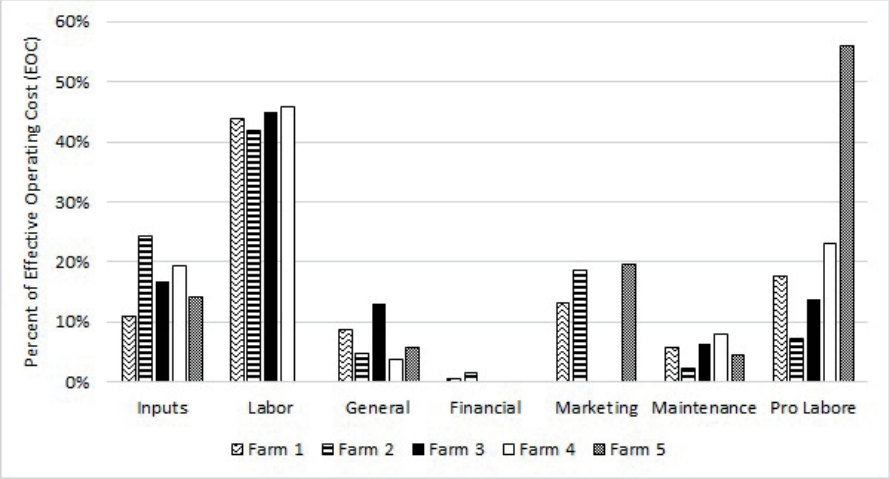

Figure 1. Percentage participation of the Effective Operating Cost (EOC) components of the five oyster farms analyzed in Florianópolis, Brazil

Figura 1. Participação percentual dos componentes do Custo Operacional Efetivo (COE) das cinco fazendas de ostras analisadas em Florianópolis, Brasil

Table 2 . Operating cost components and economic indicators calculated for five oyster farms in Florianópolis, Brazil

Tabela 2. Componentes do custo operacional e indicadores econômicos calculados para cinco fazendas de ostras em Florianópolis, Brasil

Operating costs components	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5
Inputs	150,000.00	120,000.00	90,000.00	30,000.00	12,000.00
Labor	598,000.00	206,375.00	243,100.00	71,500.00	-
General expenses	116,960.00	23,340.00	76,220.00	5,760.00	4,980.00
Financial expenses	6,840.00	6,840.00	-	-	-
Marketing expenses	305,000.00	91,308.00	-	-	16,854.00
Maintenance	76,800.00	10,500.00	33,600.00	12,436.00	3,800.00
Pro labore	240,000.00	36,000.00	74,400.00	36,000.00	48,000.00
Effective Operating Cost	1,493,600.00	494,363.00	517,320.00	155,696.00	85,634.00
Depreciation	174,236.67	108,515.83	53,170.00	9,789.64	11,130.97
Total Operating Cost	1,667,836.67	602,878.83	570,490.00	165,485.64	96,764.97
Gross profit	2,400,000.00	1,000,000.00	600,000.00	143,000.00	150,000.00
Gross margin	37.8%	50.6%	13.8%	-8.9%	42.9%
Net profit	732,163.33	397,121.17	57,510.00	-22,485.64	53,235.03
Net margin	30.5%	39.7%	9.6%	-15.7%	35.5%
Leveling productivity (dz.)	138,986	60,288	95,082	23,145	9,676

was observed for Farm 3, with sale price slightly above their production cost. In this case, the farmer is also a partner in an oyster bar, and his strategy profit more from the restaurant than the farm.

Analyzing the cost components per dozen of oyster produced, it is noticeable that the larger production volume of Farm 1 enables a dilution of cost components per unit, particularly in the input cost – the lower between the five farms. This is mainly because of the good management and survival rate of oyster seeds, the main item in the input components. Farm 1 has the highest survival rate (48%), while Farm 4 has the lowest rate, with 24%. The other producers have intermediate rates, ranging from 30% to 45%.

Farm 2 is the most economically efficient due to holding the lowest cost per unit in five of eight cost components (Table 4). Total Operating Cost (TOC) ranged from R$5.70 to R$8.34 $dz.^{-1}$ among the five producers, with R$6.96 $dz.^{-1}$ as the mean.

Leveling production varies between 60% and 69% of the volume currently produced annually in each farm, except for Farm 4, whose production of 20,000 dozen per year remains below the leveling point. With a sale price 20% below R$9.03 $dz.^{-1}$, the mean price, and the lower production volume between the farms analyzed in this study, Farm 4 remains unprofitable with their current production cost.

A sensitivity analysis of the net profit margin for a variation of plus or minus 10% and 20% in selling price reveals that Farm 3 becomes unprofitable with a 10% reduction in the price. Farm 1, 2 and 5, on the other hand, remain with positive net profit margins even with a 20% reduction in the price (Figure 2).

The subtropical seawater temperature found in Santa Catarina allows local farmers to start harvesting oysters after six faming months and to conclude the farming cycle within 18 months. This is a great advantage considering that *C. gigas* farmers take 12 to 36 months to complete a growing cycle in other countries, with most oysters taking two years to reach commercial size (BARILLÉ et al., 2020; O'CONNOR & DOVE, 2009).

Comparing the profitability identified in this study with oyster farms in other countries, we can see that the 30 to 40% profit margins observed in Santa Catarina are well above the 10 to 17% margins reported for oyster producers in Australia (AUSTRALIA VENTURE CONSULTANTS, 2016). The annual capital return rate for Farm 1 was 149%, 127% for Farm 2, 10% for Farm 3, -48% for Farm 4, and 74% for Farm 5. Capital remuneration of Farms 1, 2 and 5 are much higher than the rates reported for oyster farms in the United States (13%) and Australia (27%) (PARKER et al., 2020; MAGUIRE & NELL, 2007). Oyster farming in Brazil could be even more profitable when considering that the local oyster price is well below mean price paid to producers in the United States and Australia (R$33,00 dz^{-1}; US$0,50 per oyster) and in France ($48,50 dz^{-1}; US$7,30 dz^{-1}) (PARKER et al. 2020; O'CONNOR & DOVE, 2009; STATISTA, 2020).

Table 3. Operating cost components per dozen of oyster produced in five oyster farms from Florianopolis, Brazil. Values in green and red indicates the lowest and the highest cost per unit between the five farms

Tabela 3. Componentes do custo operacional por dúzia de ostras produzidas em cinco fazendas de ostras em Florianópolis, Brasil. Os valores em verde e vermelho indicam o menor e o maior custo por unidade entre as cinco fazendas, respectivamente

Operating costs per unit (R$/dz.)	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5
Inputs	0.75	1.20	0.90	1.50	0.80
Labor	2.99	2.06	2.43	3.58	-
General expenses	0.58	0.23	0.76	0.29	0.33
Financial expenses	0.03	0.07	-	-	-
Marketing expenses	1.53	0.91	-	-	1.12
Maintenance	0.38	0.11	0.34	0.62	0.25
Pro labore	1.20	0.36	0.74	1.80	3.20
Depreciation	0.87	1.09	0.53	0.49	0.74
Total production cost	8.34	6.03	5.70	8.27	6.45

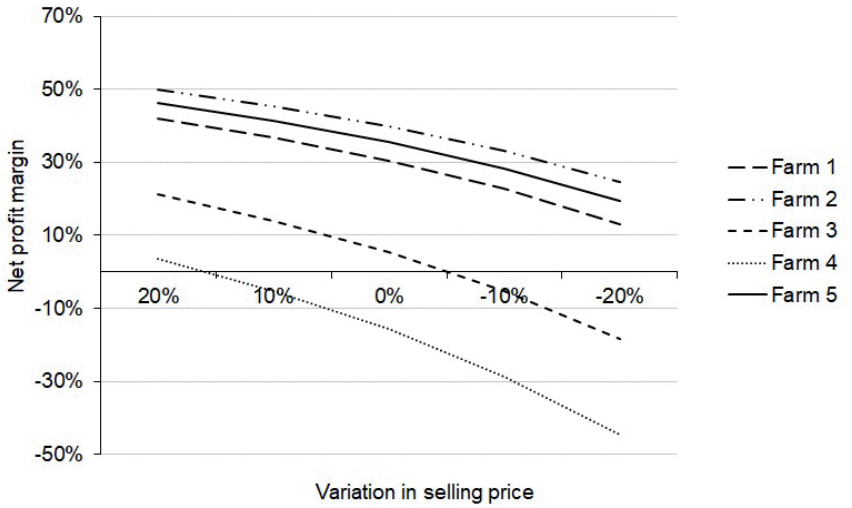

Figure 2. Sensitivity analysis of the net profit margin of five oyster producers in Florianópolis, for ±10% and 20% variations in the sale price of oysters

Figura 2. Análise de sensibilidade da margem de lucro líquido de cinco produtores de ostras em Florianópolis, para variações de ± 10% e 20% no preço de venda das ostras

Conclusion

Although oyster farming can be a very profitable business in Santa Catarina, such profitability depends on good planning with carefully definition of production scale, processing strategy and sales price, as shown by this economic analysis.

The comparative analysis highlights the importance of monitoring and controlling the components of effective cost of production and depreciation expenses, to support farm management decisions and ensure business profitability.

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