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Review Article

A Mini-Review of the Economic Aspects of Fish Cage Farming In Lake Victoria

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Abstract

In recent years, governments, researchers and policy makers have encouraged the use of net cages for fish production in an effort to increase aquaculture production by utilizing the enormous natural waters on the planet. As a result, fish cage farming has seen a rapid growth in different oceans, lakes, and reservoirs across the globe. The cost and availability of inputs, as well as the demand and sales value of the farmed fish, all have important roles towards the success of fish cage farming. However, there is a dearth of information on the economics of the fish cage farming industry, especially in Lake Victoria. In light of this, researchers are increasingly emphasizing more studies on the economics of fish cage farming towards improving food security and alleviating poverty in the Lake Victoria region. To ensure its success and boost investments in the sector, the fish cage farming industry should abide by economic principles. In this review, we highlight the important economic aspects including capital and operating costs, revenue, marketing, and profitability indicators that influence management choices in fish cage farming.

Keywords: Costs; Fish cage farming; Fish marketing; Profitability; Revenue

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Introduction

Production and consumption of aquatic foods has been on an upward trend in recent years, driven by the increasing global demand for food [1] Both capture fisheries and aquaculture provide the much needed protein-rich aquatic foods, thus contributing significantly to the sustainable development goal number 2 of improving global food and nutrition security [2,3]. However, the recent decades have seen a decrease in yields from capture fisheries due to the decline in fish stocks in the natural waters, majorly caused by overfishing and deterioration of the functional integrity of the aquatic ecosystems due to climate change and environmental factors [1,4]. Aquaculture has grown as a remedy to the declining wild fish stocks to keep the supply and demand of fish and fish products at an equilibrium [5,6]. It is the fastest growing food production sector, accounting for more than 50% of the global fish production [1]. Mainstreaming aquaculture into the global food system strategies and policies has been promoted, a move aimed at making it a major "game changer" towards sustainably meeting future food demand. Developing nations are the major fish producers with more than half of the world's aquaculture output coming from low to middle income countries [1,5,7].

The use of net cages for fish production has been promoted in the recent years to enhance aquaculture production by making use of the vast natural waters in the world [8,9]. Consequently, there has been a sporadic growth of fish cage farming in various lakes and reservoirs in many parts of the world [10]. The East African region has taken advantage of Lake Victoria, the largest freshwater lake in the world, to grow fish cage farming in the region, with Nile tilapia being the dominant species. Recent studies have demonstrated the potential of fish cage farming in Lake Victoria in improving food and nutrition security, and livelihoods in the region [11-14]. Remarkably, little is known regarding the economic aspects of fish cage farming industry, notwithstanding the fact that a business's success is mostly dictated by economic viability [13,15] Due to lack of economic indicators in the industry, an absence of economic knowledge on cage fish farming may deter potential investors from engaging in the cage culture business. Additionally, it might prevent financial institutions like banks and insurance companies from providing cage fish farmers with credit and insurance.

The acceptance and viability of a novel aquaculture practice or technology will largely depend on its likelihood of yielding profit. As a result, research initiatives are beginning to put more emphasis on the economics of fish cage farming [13,16-18]. Just like in any other commercial enterprise, the cage farming business should adhere to the economic principles, both at microeconomic and macroeconomic levels. The microeconomic level entails all the economic implications of production at the farm level including farm input costs and operation costs, whereas the macroeconomic level entails the economic implications beyond the control of the farmer, for instance, the domestic and international market, government regulations, variations in climatic conditions, among others [17,19]. Any variations in the external environment are just as important as the variations in the farm level environment, implying that the availability and cost of farm inputs is just as significant as the price and demand of the cage farmed fish.

The economic parameters that need to be taken into account while assessing the production from fish cage culture systems include the costs (capital costs and operating costs), gross income/revenue and profitability, variation in costs and revenue, and marketing of fish and fish products [20,21]. Management decisions pertaining to these parameters take into consideration the uncertainties involved in the input supplies and the demand for the produced fish [22]. Several econometric studies on aquaculture have been undertaken in the past, highlighting various economic parameters that are considered when evaluating the production from fish culture systems [16,23-26]. This mini-review summarizes the key economic parameters and their significance in fish cage farming within Lake Victoria.

Key Economic Elements in Fish Cage Farming

Costs

The primary concern of a farm manager should be cost and cost structure. This section will highlight the significance of having a basic knowledge of how costs determine profitability and will go over management tactics for increasing profitability. Aquaculture is basically a commodity business, and because of this, product diversification strategies are challenging to execute [27,28]. As a result, the majority of farmers must establish a competitive advantage through cost leadership. Because it is a commodity business, it would not be an overstatement to say that the fish farmer with low-cost production will be the most likely to survive. It is therefore essential to assess the impact of cost and cost structure on farm management strategies by doing a cost structure analysis.

Cost structure analysis

The cost structure of a business is the measure of the weight of each form of cost on the total cost of production [29]. The term "cost structure" refers not only to the division of costs needed to produce a commodity, but also considers the financial resources used throughout the production and marketing chain [24,29]. Like several manufacturing and other businesses that do not involve farming, the cost structure in fish cage farming is marked by low fixed costs, accounting for a low percentage of total costs, and a high percentage of variable costs [18]. This makes fish cage farming a low-fixed-cost business. This cost structure significantly impacts management decisions in fish cage culture. One implication is that conventional "cost control" methods work better in low-fixed-cost businesses [16]. Strategies that by definition target variable costs have a higher likelihood of succeeding when a significant proportion of the costs are variable since variable costs make up a larger portion of the total cost. Variable costs should be the primary focus of cost control in fish cage culture since they make up a bigger fraction of the total and have a strong probability of affecting profitability [18]. Another aspect is that a business with low fixed costs is more adaptable and versatile [30]. Such a business finds it simpler to adapt to shifting economic situations, new market situations, or new technology and business concepts [13,18]. A business that has a greater ability to respond to change, adjust, and be flexible has a higher chance of surviving in the ever changing aquaculture industry.

In fish cage farming, the major components of capital costs (fixed cost) include the cost of cage construction (including labour and construction materials), harvesting nets and bird nets [18,30,31]. The variation in fixed costs among different farms in a production cycle are mainly due to the difference in cage sizes, and the number of harvesting and bird nets used. Fixed costs make up a negligible proportion of the total cost of production. However, they cannot be ignored when a farmer is doing cost control by minimizing costs. Fixed costs can be controlled by sourcing each cost item from reliable suppliers, in terms of price, quality and logistical issues. Operating costs (variable costs) primarily consist of cost of feeds, fingerlings, labour, extension and marketing [13,18]. Cost of feeds and cost of fingerlings account for a large proportion of the total costs. Just like in various aquaculture production systems, cost of feeds alone takes up more than 50% of the total cost of production in cage fish farming. Therefore, differences in variable costs in cage fish farming are mainly due to cost of feeds and cost fingerling, costs which vary according to stocking rate, quality (in terms of crude protein content) and unit price of feeds, size and unit price of fingerlings at stocking, and the duration of a production cycle [16,32]. In order to achieve profitability in fish cage farming, these cost items should be given focus when controlling costs since they are the major component of total production costs.

Revenue and profitability

Revenue, also known as gross income, is comprised of recurring income and/or sales earnings at the completion of a given production period [33,34]. It is computed by multiplying the product's unit price by its overall quantity (the number of units produced) [35], as illustrated in equation (1).

$$TR = P*Q \quad (1)$$

where TR is the total revenue; P is the unit price of fish and Q is the quantity of fish sold.

Profitability can be determined from gross income since it is the difference between gross income and total costs. Net farm income, gross margin analysis, and profitability ratios are frequently used methods for profitability analysis in fish farming [36-38].

Net farm income

Profitability is assessed using both enterprise budget and income statements (also referred to as a profit and loss statement), although income statements, whose key metric is net farm income, are preferred when evaluating farm profitability or losses [18,37]. A positive net farm income indicates a profit, while a negative net farm income indicates a loss. The total cost is subtracted from the total revenue to determine net farm income [39,40], as illustrated in equation (2).

$$NFI = TR - TC \quad (2)$$

where NFI is the net farm income; TC is the total cost

Gross margin analysis

Gross margin is a profitability metric that uses data from a single point in time to examine a business's gross profit in relation to its revenue [41-43]. Gross profit is calculated by subtracting the cost of product sold from the gross income [18,44]. Fish cage farming is a low-fixed-cost business and therefore its gross margin is calculated by subtracting the total variable cost from the gross income, and is expressed as a percentage [39,43]. The percentage is computed by dividing gross margin by revenue. The bigger the gross margin, the more capital the fish cage farming enterprise retains, as illustrated in equation (3).

$$GM = TR - TVC \quad (3)$$

where GM is the gross margin; TR is the total revenue and TVC is the total variable cost

Profitability ratios

Profitability ratios are also used to gauge the profitability of fish cage farming. They are financial analyses that compare the cost incurred with the revenue for a given time period to determine if a business can generate a profit [16,45]. Profitability ratios offer insight into a business's potential to produce an adequate profit and return on investment by measuring the business's financial performance and how well it controls its resources [18,45]. Therefore, a profitability ratio is a tool for measuring whether or not a business is making enough profit. Because long-term investors care about profitability appraisal, investors are drawn to businesses with high profitability ratios [38,46]. The commonly used profitability ratios in fish farming are benefit cost ratio (BCR), return on investment (ROI), gross revenue ratio (GRR) and expense structure ratio (ESR) [21,40,47].

The expense structure ratio (ESR) analyzes the percentage of total cost that is fixed cost to calculate the profitability of an investment. It is calculated by dividing the fixed cost by the total variable cost, as illustrated in equation (4).

$$ESR = \frac{FC}{TVC} \quad (4)$$

The gross revenue ratio (GRR) is used to determine the percentage of the profits that is spent. It is calculated by dividing the total cost by the total revenue, as illustrated in equation (5).

$$GRR = \frac{TC}{TR} \quad (5)$$

The return on investment is a profitability ratio that indicates the amount earned for each unit of capital invested. It is calculated by dividing the profit by the total cost of investment, as illustrated in equation (6).

$$ROI = \frac{P}{TC} \quad (6)$$

where P is the profit, which is the difference between the total revenue and the total cost, as illustrated in equation (7).

$$P = TR - TC \quad (7)$$

Break-even analysis

Break-even analysis, which is an important aspect of revenue and profitability analyses, uses BCR [20]. The break-even point is reached when the gross income is equivalent to the total cost of production. A business operates at a profit above the break-even point. A BCR below one indicates that the business is operating at a loss, a BCR of one indicates that the business is at the break-even point, while a BCR of more than one indicates profit [18,33]. BCR is determined by comparing the overall revenue from fish sales to the total cost of producing fish over the duration of the production cycle, as illustrated in equation (8).

$$BCR = \frac{TR}{TC} \quad (8)$$

Break-even analysis is important in fish cage farming business since it can be used in the early stages of the farming business in order to assess how accurate the initial projections were and to keep track of whether the firm is headed in the correct direction or not [13]. The efficiency and efficacy of the fish marketing techniques used by a farmer can also be evaluated using this analysis as an extra management decision support tool [20,33].

Revenue in relation to costs

A production model that can be used to ascertain the link between income and costs is input-output analysis [48,49]. Inputs and outputs play a major role in its linkages in production systems. To evaluate how changes in other variables, which are the input variables, affect the output variables, sensitivity analysis, feasibility testing, and consistent forecasting all require input-output analysis [27,50].

Production output in fish cage farming is influenced by a variety of aspects, including general management practices and production-related costs [19,35,51]. Regression model can be applied to determine the input-output relationship in fish cage farming [18].

Given a cage fish production model with n inputs, and output Y_i, as in equation (9).

$$Y_i = \beta_0 + \beta_1 x_1 + \ldots\ldots \beta_n x_n + e_i \quad (9)$$

where Y_i is the dependent variable (revenue); x_1 to x_n are the independent variables (costs); β_0 is the intercept; β_1 to β_n are the coefficients of the respective explanatory variables; e_i is the stochastic error term.

Sensitivity analysis

According to a specific set of assumptions, sensitivity analysis evaluates how various values of an independent variable impact a specific dependent variable [13,30]. In other words, sensitivity analysis, also referred to as what-if analysis, examines how different sources of uncertainty in an economic model impact the overall uncertainty of the model, thereby raising the level of confidence in the predictions [22].

Given a cage fish production model with n inputs, and output Y, using the function f, as in equation (10).

$$Y = f(X) \quad (10)$$

$X = (x_1, \ldots\ldots, x_n)$

A sensitivity analysis considers how variations in the output Y can be related with the variations in inputs $X = (x_1 \ldots\ldots x_n)$.

In fish cage farming, sensitivity analysis can be used to determine how revenue is affected based on changes in input costs [13]. It is a way to predict the outcome of farm management decisions given the costs and revenue [30]. By considering a given set of cost items, for instance, cost of feeds, cost of fingerlings or labour costs, a farmer can determine how changes in each of the cost items affect the farm's revenue.

Marketing

Marketing marks the culmination of the farm production process. When a farmer markets their produce, they receive a return known as revenue. Fish marketing includes all of the processes involved in moving fish or fish products from the farmer to the consumer [52,53]. It consists of a number of procedures needed to get fish or fish products from the producer to the consumer. Aquaculture marketing is frequently overlooked, and the majority of fish farmers focus more on production than on the market [54,55]. However, in the fish farming businesses, marketing is just as crucial as production, finance, cash flow, and other elements that affect profit [41]. Due to the escalating level of competition within the industry, a market-driven approach should be more crucial for aquaculture producers. In order to keep their competitiveness and profitability, fish farmers must create and retain competitive advantages over other producers.

Marketing plan

Similar marketing plans can be used for both small-scale and large-scale fish farming [23]. A marketing plan should be devised before starting production or choosing a specific marketing option, taking into account some broad market strategies [56]. Producers who have a solid marketing plan and prioritize marketing over production will unquestionably be at a financial advantage over those who do not [23,57].

The business's collection of marketing elements and the arrangements for their application are combined in a marketing plan, which also outlines the firm's marketing objectives and describes how they will be met, ideally within a predetermined timeline [58,59]. The plan chooses the target market groups, market positioning, and allocates resources along each marketing element [60]. It works best when it is implemented as a crucial element of the entire business strategy, outlining how the business will effectively interact with clients, prospects, and competitors in the marketplace [61]. Marketing plans are created to indicate the strategic course the marketing function will follow over the given period. The plan needs specific goals that align with the overall objectives of the business [62].

Developing a marketing plan

Development of a marketing plan involves assessing the current condition, deciding on the ultimate marketing goals, and creating a logical plan to move from the current position to the ultimate goal [23,63]. The most effort and time are frequently expended on assessing the current condition [63]. It is necessary to comprehend and evaluate a certain market, take into account the significance of supply and demand, and have up-to-date knowledge of the state of the market and its trends. Deciding on the ultimate marketing goals is done based on evaluations done when assessing the current condition [23]. If realistic marketing goals are not set, the producer could ramble through sales prospects. The farmer should link objectives to expenses incurred and establish targets that will at least cover expenditures and be aware of the costs associated with various levels of operation [23,59]. Goals and other personal and professional objectives will determine the extent to which objectives exceed operating costs. The farmer must next create a logical plan to move from the current position to the ultimate goal after taking into account all viable options [62]. Analyze each option's operating, labour and budgetary needs, as well as additional benefits and drawbacks. The decision to choose one or more marketing options should be based on the market evaluations, the magnitude of the operation, and individual financial situations [23].

Conclusion

This paper concludes that fish cage farming business in Lake Victoria should adhere to the economic principles in order to ensure its success and improved investments in the industry towards improving food security and alleviating poverty in the region. All the key economic elements of a business including capital costs and operating costs, revenue, marketing and profitability indicators need to be taken into consideration when making management decisions in fish cage farming.

Conflict of interest

The authors declare that there are no conflicts of interest

References

1. FAO (2022) The State of World Fisheries and Aquaculture 2022: Towards Blue Transformation. Rome FAO 1-11.
2. Balami S, Sharma A, Karn R (2019) Significance Of Nutritional Value Of Fish For Human Health. Malaysian Journal of Halal Research 2: 32-34.
3. Tacon AGJ, Metian M (2013) Fish Matters: Importance of Aquatic Foods in Human Nutrition and Global Food Supply. Reviews in Fisheries Science 21: 22-38.
4. Gownaris NJ, Pikitch EK, Ojwang WO, Michener R, Kaufman L (2015) Predicting species' vulnerability in a massively perturbed system: The fishes of Lake Turkana, Kenya. PLoS ONE 10: 1-24.
5. FAO (2020) The State of World Fisheries and Aquaculture 2020: Sustainability in Action. In Rome Sustainability in action.
6. Tran N, Chu L, Chan CY, Genschick S, Phillips MJ, et al. (2019) Fish supply and demand for food security in Sub-Saharan Africa: An analysis of the Zambian fish sector. Marine Policy 99: 343-350.
7. FAO (2016) The State of World Fisheries and Aquaculture 2016*:* Contributing to food security and nutrition for all. Rome Italy.
8. Kaminski AM, Genschick S, Kefi AS, Kruijssen F (2018) Commercialization and upgrading in the aquaculture value chain in Zambia. Aquaculture 493: 355-364.
9. Njiru JM, Aura CM, Okechi JK (2019) Cage fish culture in Lake Victoria A boon or a disaster in waiting? Fisheries Management and Ecology 26: 426-434.
10. Devic E, Leschen W, Murray F, Little DC (2018) Growth performance, feed utilization and body composition of advanced nursing Nile tilapia (Oreochromis niloticus) fed diets containing Black Soldier Fly (Hermetia illucens) larvae meal. Aquaculture Nutrition 24: 416-423.
11. Aura CM, Musa S, Yongo E, Okechi JK, Njiru JM, et al. (2018) Integration of mapping and socio-economic status of cage culture: Towards balancing lake-use and culture fisheries in Lake Victoria Kenya. Aquaculture Research 49: 532-545.
12. Mary O, Erick O, Martin A (2021) Cage fish culture in the lake victoria region: Adoption determinants, challenges and opportunities. International Journal of Fisheries and Aquaculture 13: 45-55.
13. Musa S, Aura CM, Okechi JK (2021) Economic analysis of tilapia cage culture in Lake Victoria using different cage volumes. Journal of Applied Aquaculture 1-19.
14. Opiyo MA, Marijani E, Muendo P, Odede R, Leschen W, et al. (2018) A review of aquaculture production and health management practices of farmed fish in Kenya. International Journal of Veterinary Science and Medicine 6: 141-148.
15. Moura RST, Valenti WC, Henry-Silva GG (2016) Sustainability of Nile tilapia net-cage culture in a reservoir in a semi-arid region. Ecological Indicators 66: 574-582.

16. Engle CR, Kumar G, van Senten J (2020) Cost drivers and profitability of U.S. pond, raceway, and RAS aquaculture. Journal of the World Aquaculture Society 51: 847-873.

17. Gál D, Kucska B, Kerepeczki É, Gyalog G (2011) Feasibility of the sustainable freshwater cage culture in Hungary and Romania. AACL Bioflux 4: 598-605.

18. Obiero K, Brian MJ, Okoth OK, Okech D (2022) Economic feasibility of fish cage culture in Lake Victoria, Kenya. Aquaculture Fish and Fisheries 484-492.

19. Gomes LDC, Chagas EC, Martins-Junior H, Roubach R, Ono EA, et al. (2006) Cage culture of tambaqui Colossoma macropomum in a central Amazon floodplain lake. Aquaculture 253: 374-384.

20. Chowdhury MA, Roy NC, Chowdhury A (2020) Growth, yield and economic returns of striped catfish (Pangasianodon hypophthalmus) at different stocking densities under floodplain cage culture system. Egyptian Journal of Aquatic Research 46: 91-95.

21. Osundare F, Adedeji T (2018) Economic Analysis of Market Performance of Fresh Fish in Lagos State Nigeria. International Journal of Environment Agriculture and Biotechnology 3: 594-599.

22. Currie M, Miller C, Scott M, Hills A (2020) Sensitivity analysis approaches to investigate uncertainty in process-based models with application to aquaculture. The 35th International Workshop on Statistical Modelling.

23. Mutambuki MK, Orwa BH (2014) Marketing Strategies of Commercial Fish Farming under Economic Stimulus Programme in Kenya An Empirical Study of Kitui County. International Journal of Humanities and Social Science 4: 111-121.

24. Nostbakken L (2004) Cost structure and capacity in the Norwgian fisheries. Institute for Research in Economics and Business Administration 1: 1-26.

25. Olagunju FI, Adesiyan IO, Ezekiel AA (2017) Economic Viability of Cat Fish Production in Oyo State Nigeria. Journal of human ecology

26. Sumbule EK, Ambula MK, Osuga IM, Changeh JG, Mwangi DM, et al. (2021) Cost-effectiveness of black soldier fly larvae meal as substitute of fishmeal in diets for layer chicks and growers. Sustainability 13: 1-20.

27. Asche F, Oglend A (2016) The relationship between input-factor and output prices in commodity industries: The case of Norwegian salmon aquaculture. Journal of Commodity Markets 1: 35-47.

28. Pitcher TJ, Lam ME (2014) Fish commoditization and the historical origins of catching fish for profit. Maritime Studies 14: 164-182.

29. Anderson SW (2006) Managing Costs and Cost Structure throughout the Value Chain: Research on Strategic Cost Management. Electronic Journal 2: 481-506.

30. Azazy GE, Hebicha H , Nasr-Allah AM (2012) Estimated costs and returns for commercial cage production of fingerlings and table-size mullet (Mugil cephalus) in Dakhlia Governorate, Egypt. Egyptian Journal of Aquatic Research 2: 1-14.

31. Petersen EH, Luan TD, Chinh DTM, Tuan VA, Binh TQ, et al. (2014) Bioeconomics of Cobia, Rachycentron Canadum, Culture in Vietnam. Aquaculture Economics and Management 18: 28-44.

32. Munguti JM, Kirimi JG, Obiero KO, Ogello EO, Sabwa JA (2021) Critical Aspects of Aquafeed Value Chain in the Kenyan Aquaculture Sector- A Review. Sustainable Agriculture Research 10: 87.

33. Aheto DW, Acheampong E, Odoi JO (2019) Are small-scale freshwater aquaculture farms in coastal areas of Ghana economically profitable? Aquaculture International 27: 785-805.

34. Olaoye OJ, Ashley-Dejo Fakoya SS, Ikeweinwe NB, Alegbeleye WO, Ashaolu FO, et al. (2013) Assessment of Socio-Economic Analysis of Fish Farming in Oyo State , Nigeria. Global Journal of Science Frontier Research Agriculture and Veterinary 13.

35. Aswathy N, Joseph I (2019) Economic Feasibility and Resource Use Efficiency of Coastal Cage Fish Farming in Kerala. Economic Affairs 64: 151-155.

36. Adewuyi SA, Phillip BB, Ayinde IA, Akerele D (2017) Analysis of Profitability of Fish Farming in Ogun State , Nigeria Analysis of Profitability of Fish Farming in Ogun State. Nigeria 9274.

37. Britton DK (1970) The Analysis of Net Farm Income: an Examination of Farm Management Survey Data. Journal of Agricultural Economics 21: 351-389.

38. Engle CR (2012) Determining the Profitability of an Aquaculture Business: Using Income Statements and Enterprise Budgets. Southern Regional Aquaculture Center (SRAC) 4402: 1-6.

39. Omobepade B, Adebayo OT, Amos TT, Adedokun BC (2015) Profitability analysis of aquaculture in Ekiti State, Nigeria. Nigerian Journal of Agriculture Food and Environment 11: 114-119.

40. Kawala M, Hyuha TS, William E, Walekwa P, Elepu G, et al. (2018) Determinants for Choice of Fish Market Channels: The Case of Busia (Uganda/ Kenya) Border. Journal of Agricultural Science 10: 118.

41. Renna M, Schiavone A, Gai F, Dabbou S, Lussiana C, et al. (2017) Evaluation of the suitability of a partially defatted black soldier fly (Hermetia illucens L.) larvae meal as ingredient for rainbow trout (Oncorhynchus mykiss Walbaum) diets. Journal of Animal Science and Biotechnology 8: 1-13.

42. Wango VN (2016) an Analysis of Profitability and Factors Influencing Adoption of Agro-Ecological Intensification (Aei) Techniques in Yatta Sub- Count. Kenya.

43. Abah D, Zaknayiba DB, Simon E (2013) Economic Analysis of Fish Marketing in Lafia Local Government Area of Nasarawa State, Nigeria. Production Agriculture and Technology Journal 9: 54-62.

44. Lesáková Ľ (2007) Uses and Limitations of Profitability Ratio Analysis in Managerial Practice. International Conference on Management 259-264.

45. Husain T, Sarwani Sunardi N, Lisdawati (2020) Firm's Value Prediction Based on Profitability Ratios and Dividend Policy. Finance & Economics Review 2: 13-26.

46. Safina N, Gertrude A, Lawrance O, Ronald W, Alphonse C, et al. (2018) Profitability and Viability Analysis of Aquaculture Production in Central Uganda: A Case of Urban and Peri-Urban Areas 22: 1-11.

47. Mkong CJ, Molua EL, Mvodo S (2018) Determinants of Profitability of Fish Farming in Cameroon 7: 89-93.

48. Baliyan K (2021) Input-Output Relationship and Economies of Scale in Agriculture: Empirical evidence from Eastern UP. International Conference of Agricultural Economists 1-25.

49. Christ CF (1955) A Review of Input-Output Analysis. In Input-Output Analysis: An Appraisal 1.

50. Miernyk WH (2020) The Elements of Input-Output Analysis. Web Book of Regional Science 65.

51. Islam GMN, Tai SY, Kusairi MN (2016) A stochastic frontier analysis of technical efficiency of fish cage culture in Peninsular Malaysia. SpringerPlus 5.

52. Awuor FJ, Obiero K, Munguti J, Oginga JO, Kyule D, et al. (2019) Market linkages and distribution channels of cultured, captured and imported fish in Kenya. Aquaculture Studies 19: 57-67.

53. Lwenya C, Yongo EO, Abila RO (2006) Assessment of the Cross-border Fish Marketing Channels for the Major Commercial Fish Species of Lake Victoria: Case of Kenya Assessment of the Cross-border Fish Marketing Channels for the Major Commercial Fish Species of Lake Victoria: Case of Kenya.

54. Abila R, Ojwang W, Othina A, Lwenya C, Oketch R, et al. (2013) Using ICT for fish marketing: The EFMIS model in Kenya. Food Chain 3: 48-63.

55. KMAP (2016) Report on Market Study of the Aquaculture Market in Kenya. In Kenya Market-Led Aquaculture Programme (Kmap) 9.

56. Cheffo A, Wubie A (2021) Value Chain Analysis of Fish Production and Marketing from GSJ.

57. Muhaimin AW, Wijayanti V (2019) Analysis of Market Structure, Conduct and Performance of Corn (Zea Mays L.) in Kedung Malang Village, Papar District, Kediri Regency, East Java. International Journal of Civil Engineering and Technology (IJCIET) 10: 10-16.

58. Quagrainie K, Dennis J, Coulibaly J, Ngugi C, Amisah S (2007) Developing Supply Chain and Group Marketing Systems for Fish Farmers in Ghana and Kenya. Technical reports investigations 198-210.

59. Sigei GK, Hillary BK Jonah KO, Timothy O (2015) Factors Influencing the Choice of Marketing Outlets among Small-Scale Pineapple Farmers in Kericho County, Kenya. International Journal of Regional Development 2: 1.

60. Dibb S (2014) Establishing the scope of marketing practice: Insights from practitioners. European Journal of Marketing 48: 2380-2404.

61. Brodie RJ, Coviello NE, Winklhofer H (1996) Contemporary Marketing Practices research program: A review of the first decade.

62. Dibb S, Simkin L, Wilson D (2008) Diagnosing and treating operational and implementation barriers in synoptic marketing planning. Industrial Marketing Management 37: 539-553.

63. Asogwa VC, Asogwa JN (2019) Marketing of fish products. Journal of Aquaculture & Marine Biology 8: 55-61.

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