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The Conditional Effects of Financial Risk on the Relationship between Infrastructure Financing and Financial Performance of Aquaculture Enterprises in the Lake Region Economic Bloc, Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Financing structure for aquaculture aims at promoting and facilitating the availability of capital and its contribution to fisheries financial performance that leads to poverty reduction of aquaculture enterprises in the Lake Region Economic Bloc in Kenya. The purpose of this study is to

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analyze the effect of infrastructure financing on the financial performance of these enterprises as moderated by financial risk. The problem is, financing aquaculture has been limited because of the financial risk involved and lack of knowledge of how the aquaculture industry benefits the society today, this has made the infrastructure develop slowly in Kenya.

Materials and Methods: This study applied a cross-sectional survey research design and purposive sampling technique in collecting data from 248 fishermen and 10 county officers in the fisheries department. The study collected primary data through the interviews and questionnaires hence both qualitative and quantitative data was use in the study.

Results: The results indicate that Infrastrucuture. Financing (β=.480,P .000),with R2 .230,F=65.708 P=.000) and FR (β =.391,P=.000) with R2 of .378 and change in R of .148 with F 51.903 P=.000 positively influences Financial Performance. In addition the moderation effect was found to be significant with β .309, P=.000 with R2 of .474 change in R2 .097,F =40.017 P=.000.The moderation model accounts for more variance of 47.4% in FP than the direct effect model at 23% explained by Infrastructure finance.

Conclusion: The study informs financial institutions to know the changes in infrastructural financing requirements specific to aquaculture, sources of financing and ways to increase its availability.

Keywords: Aquaculture; infrastructure financing; financial risk; financial performance.

1. INTRODUCTION

"Financing aquaculture infrastructure projects is important for growth of an economy. Financing of aquaculture infrastructure provides a conducive atmosphere for growth and expansion of businesses as a result of improved efficiency and reduced risk due to improved transport and communication network" [1]. "Investments in production facilities such as; ponds, cages and infrastructure input supplies e.g. hatcheries and post-harvest facilities may be necessary to improve farm performance and add value to products and the small holder business. Such improvements will often require access to loans with longer payback periods" (World fish center, 2011).

"Private investment in aquaculture can be a growth pole as many countries have experienced. By generating employment income, commercial farming of salmon has created multiplier effects in the more remote regions of Chile, Norway or the United Kingdom. Other countries have enjoyed a similar stimulus to economic growth from the commercial cultivation of species such as catfish, eel, shrimp or tilapia" [2]. "Kenya is endowed with numerous aquatic resources with aqua cultural potential. It has highly varied climatic and geographic regions, covering a part of the Indian Ocean coastline, a portion of the largest freshwater lake in Africa (Lake Victoria), and several large rivers, swamps, and other wetlands, all of which support an abundance of native aquatic species" [3,4].

"Infrastructure financing will, to a greater extent, reduce the costs or raise the incomes of fishers and other sector recipients either directly through transfers such as fuel tax exemptions or grants for construction or modernization or indirectly through the government provision and funding of management services and infrastructure" [5]. "Infrastructural development highly contributes to investment in fisheries and aquaculture, which aims to promote efficient utilization and value-addition of the resources by increasing investment in the fisheries and aquaculture sector. Financing aquaculture infrastructure focuses on improving the business environment and private sector investment in the fishery and aquaculture sector, to enhance value addition" [6].

"Financial risk refers to the potential loss associated with an aquaculture investment. Aquaculture enterprises may be public or private run and managed by stakeholders, including individual farmers, shareholders, farm enterprises, financial institutions and government institutions" [7]. "There are several types of quantitative methods used for financial risk assessment. Financial analysis method include capital budgeting, enterprise budgets, cash flow analysis, financial performance ratios and partial budget analysis. Numerous examples from aquaculture research illustrate methods for probabilistic risk estimation and non-probabilistic risk estimation Evaluation methods based on

decision analysis principles are well-established in financial risk analysis. Examples for assessing financial risk in aquaculture include the use of decision trees and Bayesian decision networks, risk, programming, stochastic efficiency and multiple criteria analysis" [7].

"The United Kingdom aquaculture industry receives aid from the EU under the Financial Instrument for Fisheries Guidance (FIFG). FIFG operates under Council Regulation (EC) 2792/1999 laying down the detailed rules and arrangements regarding Community structural assistance in the fisheries sector. FIFG supports investments in the fisheries sector, including aquaculture private production projects. A financial participation from the private investor is generally requested, which can range between 40 percent and 60 percent of the total investment according to the area. FIFG also allows for the financing of measures which aim to create a favorable environment for the industry to develop itself. For instance, pilot projects aiming to establish and distribute technical and economic knowledge on new species or technologies may be eligible for aid. FIFG also finances measures to find and promote new markets for aquaculture products. This may include, inter alia, operations associated with quality certification, product labelling, and product standardization and promotion campaigns" [3,8].

1.1 Statement of the Problem

"Fish workers in the small-scale fisheries sector in India, Bangladesh and Sri Lanka have always been very poor and amongst marginalized communities. Their low social status is a result of poverty as well as exploitation by middlemen and merchants. Middlemen have control over credit and fish marketing that drains away the surplus generated and thus make them often indebted. The overall output remains almost the same but the investment and operational costs have gone up considerably. This has resulted in fishermen getting increasingly dependent on loans to finance their expenditures and also as a coping mechanism. Key expenditures include, purchase of boats, launches, nets and engines, medical, emergency and other expenditure for family including education" [7].

"In Eastern Africa, aquaculture can generally be described as being under-developed, though it should be noted that considerable success has been achieved through farming of Nile Tilapia in Uganda. The under-developed status of aquaculture in Eastern Africa can be explained by several problems namely: knowledge mobility and know-how and lack of markets, lack of capital and poor infrastructure" [9]. "East African countries are amongst the poorest in the world. The economies of these countries depend mainly on agriculture, which includes fisheries. The countries are harnessing their agricultural resources to improve the welfare of their citizens" [10].

Objective: The determine the effect of Infrastructure financing on the financial performance of aquaculture enterprises in the Lake Region Economic.

Hypothesis:

H_{01}: Infrastructure financing has no significant effect on financial performance of aquaculture enterprises in the Lake Region Economic.

H_{02}: Infrastructure financing has no significant effect on financial performance of aquaculture enterprises in the Lake Region Economic as is moderated by financial risk.

1.2 Significance of the Study

A review of the aquaculture financing structure will aid the financial institutions to know the changes in financing requirements, issues specific to aquaculture, sources of infrastructure financing and ways to increase its availability. This research will provide the aquaculture enterprises with an insight on the available financing options and how to utilize them in order to increase their portfolio while mitigating the financial risk they are exposed to hence financial performance. The study will also be an expository to scientific enquiry and methodological improvement in the areas of aquaculture financing structure. It will bring out the peculiarities of aquaculture financing models in Kenya as compared to the developed economy.

1.3 Theoretical Framework

Social Infrastructure theory: "The theory was developed by Karl Marx in 1890. The term social capital was in occasion use in 1890 by Karl Marx who expressed the value of labor in terms of monetary value. The theory identifies social capital within communities on the basis of two forms of social capital: The structural and cognitive aspects. Structural aspects in

infrastructure financing are addressed through studying the dynamics of power as it is characterized by membership and networking among practicing groups. This theory will be used by this study to guide the effect of infrastructure financing on the social economic development of fishing community" [11].

This social capital theory contributes to the research by investigating into the role of infrastructure financing and how it influences improvement in livelihoods of fishing communities. Focus is centered on infrastructure financing as a cooperative activity that predominates financing of fishing activities for low-income earners. As a process infrastructure financing is punctuated by stages including pooling of funds for loan allocation to its members, investment into buildings, the systems needed for energy and water supply, waste disposal, transportation and traffic as well as communication network for information and generation of knowledge. Additional other infrastructure needs could be required depending on the special case. The demand of all kinds of infrastructure depends on local conditions, cultivated species, production volume, processing capacity and technical parameters of the planned aquaculture farm.

Theory of risk: The study is guided by Robert Hamada 1972, who developed an equation explaining the relationship between risk and capital structure. He is informed by the Modigliani-Miller theorem on capital structure and further does an analysis to quantify the effect of financial leverage on a firm. He used Beta as a measure of volatility or systemic risk relative to the overall market. The Hamada equation, shows how the beta of a firm changes with leverage. The higher the beta coefficient, the higher the risk associated with the firm. The Hamada equation is used in finding optimal capital structures, however the equation doesn't consider default risk. While there have been modifications to account for such a risk, they still lack a robust way to incorporate credit spreads and the risk of default [12].

The results reveal that floods and credit constraints were perceived as the most important sources of risk. For risk management, increased reliance on personal savings, crop insurance and assurance of bank loans were considered as the most important strategies to mitigate risks. Empirical evidence shows that farmers engage in multiple management strategies to reduce production risk. The study concluded that the aquaculture industry needs new insurance products that achieve both financial gains, in terms of reduced production and revenue risk, and environmental wins, in terms of incentivizing improved management practices. Aquaculture is immature compared to terrestrial crop and livestock sectors thus it lags behind as far as the specific financial management tools are concerned. This study sought to create new risk management products in relation to financing structure of aquaculture.

2. LITERATURE REVIEW

Financing of aquaculture infrastructure provides a conducive atmosphere for growth and expansion of businesses as a result of improved efficiency and reduced risk due to improved transport and communication network. Infrastructure financing will, to a greater extent, reduce the costs or raise the incomes of fishermen and other sector recipients either directly through transfers such as fuel tax exemptions or grants for construction or modernization or indirectly through the government provision and funding of management services and infrastructure [5].

Tan, Sethupathi, Leong, and Ahmad [13] did a study on a sustainable model for infrastructure development of offshore aquaculture bases in Malaysian Waters. This study presents a review on the challenges of marine aquaculture and a systematic framework to tackle the issue of robust infrastructure development for open seas. The study findings indicated that while aquaculture has clearly established itself today by sheer volume of contribution to the marine products we ingest, much innovation in technologies and methodologies is required to sustainably meet further increases in demand. The design of floating aquaculture systems for the open sea is a feat that borrows its technologies from years of maritime and oil-gas experience. The future of aquaculture is without a doubt, brewing with potential, only if such works are conducted in a responsible and diligent manner.

Waweru [14] "conducted a study on the impact of infrastructure development on economic competitiveness in Kenya. The results indicated that transport and energy infrastructure relationship is positive and significant in driving economic competitiveness of Kenya while ICT

and Water and Sanitation were found to be insignificant. Further, GDP and labour force which were considered as control variables were found to be imperative in determining economic competitiveness of Kenya".

Olemoyaki (2015) "did a study on the nexus between road infrastructure financing and economic growth in Kenya. The study results found that for every one shilling spent on road infrastructure by the government GDP per capita increases by Ksh. 572.753 holding other factors constant. The study therefore recommends for more adoption and sensitization of the PPP programme that has now a legal framework following the enactment of PPP act 2012. In addition, the annuity financing aspect in road infrastructure needs to be fast truck by the government in order to realize the dream of 10,000 km now tarmac roads by the government. This will greatly improve the access to markets by the fishermen thus increased sales and profits in the long run".

Bostock, Lane, Hough, and Yamamoto (2016) "did an assessment of the economic contribution of EU aquaculture financing and the influence of policies for its sustainable development. The study used primary analysis statistical data from the Food and Agriculture Organization of the United Nations which has been re-categorized according to species groups established by the European Aquaculture Technology and Innovation Platform (EATIP) and by culture system type using expert knowledge. Additional data sources for the analysis include the European Market Observatory for Fisheries and Aquaculture Products (EUMOFA) and the European Commission Scientific, Technical and Economic Committee for Fisheries. The study findings indicated an overall increase in production by 55% is possible by 2030 based mainly on expansion of marine cage-based farming using larger systems in more exposed sites and similarly shellfish farming using larger-scale suspended systems".

FAO (2010) "conducted a study on enhancing the contribution of small scale aquaculture to food safety, poverty alleviation and socio economic development in Papua New Guinea. Survey method was used to determine the active fish farms, the annual production of the farms in New Guinea. Most farmers were found to be inexperienced and had never received training in fish farming" (Smith et al., 2007). Three kinds of fish farmers were identified in the surveys: (i) inexperienced fish farmers who had not harvested, (ii) established farmers and (iii) experienced, pioneer farmers. The findings indicated that poor roads, lack of infrastructure and lack of disposable income are the major reasons why farmers in the distant regions of Papua New Guinea do not receive adequate extension and support. Poor infrastructure cannot be overcome in the short term.

Ogun (2010) "investigated the impact of infrastructural development on poverty reduction in Nigeria. The paper employs secondary data for the period 1970 to 2005 and the structural vector autoregressive (SVAR) technique is adopted. The study without doubt finds that infrastructural development leads to poverty reduction. Results also show that though infrastructure in general reduces poverty, social infrastructure explains a higher proportion of the forecast error in poverty indicators relative to physical infrastructure".

Financial risk and financing structure on financial performance of aquaculture enterprises: Rahman, Nielsen, Khan, and Ahsan [15] "did a study on perceived risk and risk management strategies in pond aquaculture in India. The growing aquaculture industry is facing several challenges including risks and uncertainties. Studies exploring farmers' risk perceptions and risk management strategies are, limited within pond aquaculture, though they are well elaborated within the field of agriculture. The data was analyzed using principal component analysis and multivariate regression. The findings indicate that price variability and financial risks are perceived as the most influential risk factors. Farm management and financing are perceived as the most effective risk management strategies. Fish farmers need to focus on more than one risk management strategy to address a particular type of risk. This study provides knowledge that can be used to develop better and more focused risk management strategies".

Alam and Guttormsen [16] "looked at the Bangladesh fish farmers' perception for risk sources, risk management strategies, and the relationship with socio-demographic variables. Data was collected from a sample of 350 farmers in Bangladesh. Exploratory factor analysis of a set of perception measurement items was used to assess farmers' attitudes towards risk and their risk management strategies. The results

reveal that floods and credit constraints were perceived as the most important sources of risk. For risk management, increased reliance on personal savings, crop insurance and assurance of bank loans were considered as the most important strategies to mitigate risks. Empirical evidence shows that farmers engage in multiple management strategies to reduce production risk".

Watson, Armerin, Klinger, and Belton [17] "conducted a study on resilience through risk management: cooperative insurance in small-holder aquaculture systems. The theory of risk pools was used applying it to an aquaculture community in Myanmar, using empirical data recently collected from a comprehensive farm survey. The data was used to parameterize numerical simulations of this aquaculture system with and without a risk pool. Results highlight the benefits and costs of a risk pool, for various combinations of key parameters. The study concluded that the aquaculture industry needs new insurance products that achieve both financial gains, in terms of reduced production and revenue risk, and environmental wins, in terms of incentivizing improved management practices. Aquaculture is immature compared to terrestrial crop and livestock sectors thus it lag behind as far as the specific financial management tools are concerned. This study sought to create new risk management products in relation to financing structure of aquaculture".

Sikveland and Zhang [18] "did study on the determinants of capital structure in the Norwegian salmon aquaculture industry, they found out that salmon aquaculture is exposed to production risk and price risk that contribute highly cyclical profitability. High debt ratio makes the cycles in profitability more pronounced as debt can contribute to increasing profitability in good times and reduce it in low economic times". A high debt ratio increases the fixed obligations and therefore financial risk. Therefore, salmon farming firms with a lower debt ratio have a better ability to withstand industry downturns and shocks. Firms with lower debt ratios may, therefore, have higher financial and operating flexibility, and be better able to respond to demand changes, and therefore contribute to a more stable supply of seafood.

3. MATERIALS AND METHODS

This study adopted the positivist research paradigm that is characterized by a belief in theory before research, an empirically testable objectives, a statistical justification of the conclusions is made which is the core foundation of social science Cooper and Schindler [19]. The study was based on ontological philosophy which utilizes positivist, paradigm and the research approach is deductive utilizing the quantitative approach and case study strategy.

Research design: The study employed cross-sectional survey research design. Cross-sectional survey research design is a design in which a group of subjects (sample) is selected from a defined population (source population) and contacted at a single point in time. This design is good in assisting the researcher observe more variables at the point in time and is useful for describing a relationship between two or more variables (Breakwell, Hammond & Fife-Schaw, 1995).

Target population: The target population for the study will be all the fishing community in Lake Region Economic Bloc, Kenya. This is because of the proximity to the largest fresh water body in Kenya, Lake Victoria. The accessible population for this study is the beach members of registered fishing groups in Kisumu County. Others targeted include the county officers working in the fisheries department Kisumu County. Therefore, the accessible population will be all the 700 members of the beach management unit groups and 10 county officers from the fisheries department.

Sampling size and sampling techniques: The study used simple random sampling technique to access the 700 registered Beach management unit members and ensure that all the respondents are given an equal chance of participating in the study while purposive sampling was used to pick the 10 county officers, The study employed Krejcie and Morgan (1970) Table (Appendix I) to sample the group 248 members from the 700 members. The following formula was used to determine the sample size. The 700 members will be the

$$n = \frac{X2 * N * P * (1-P)}{(ME2 * (N-1)) + X2 * P * (1-P))} \quad \text{Equation (1)}$$

Where:

n represents sample size
X^2 represents Chi square for the specified confidence level at 1 degree of freedom.
N represents population size
P represents Population proportion
ME represents desired margin of Error (expressed as a proportion)

The unit of analysis are the aquaculture enterprise, units of observation being 700 fishermen and traders and are members of the 2 largest beach management units in Dunga beach, and Ogal beach. Therefore 248 group members and 10 county officers will be selected to participate in the study making a total sample of 258 respondents.

Data collecting instruments: This study used both primary and data collection sheet for secondary data collection. Primary data was collected using interview schedule and questionnaires. The focus groups complemented the secondary data as well as the financial statements that were used to analyze financial performance. Secondary data was obtained from audited financial reports of the largest registered Beach management units with the area of study. These include Dunga Beach Management Unit and Ogal Beach management Unit along the shores of Lake Victoria that have organized structures for those practicing aquaculture.

In this study, 258 questionnaires were administered on the sampled respondents who participated in the study out of personal consent. 223 questionnaires were duly filled and returned to the researcher. This represented 86.4% response rate. Lack of response to the questionnaire by potential respondents in a sample or population is referred to as non-response bias Fincham [20]. According to Fincham [20], non-response bias is a deadly blow to both the reliability and validity of survey study findings. This study therefore only suffers a 13.6% non-response bias. Brick and Kalton [21], suggested that one way of dealing with lack of representativeness is to weight the study sample segments to reflect the greater population attributes.

4. RESULTS

4.1 Reliability Test Results

This study assessed the internal consistency of the research questionnaire of three items as presented in Table 1.

From the results on reliability in Table 1, it is indicated thatall the variables i.e independent variables, infrastructure, the dependent variable- Financial performance and the moderating variable- Financial risk all have Cronbach's alpha coefficient of greater than 0.7. Therefore, the research questionnaire met the reliability threshold with all the constructs recording a Cronbach's alpha coefficients > 0.7 (Nunnally, 1978).

Descriptive statistics for infrastructure financing: The study analyzed the views of the respondents in respect to Infrastructure Financing and financial performance of aquaculture enterprises. Table 2 shows the results of the analysis.

From Table 2, the results indicated that the weighted Mean = 4.06. This meant that the respondents agreed with the statements under study in the infrastructure financing as a variable. The results indicated that the respondents strongly agreed (Mean = 4.52; Std Dev = 0.670) with the statement that County development funds have enabled aquaculture to thrive and the end products are accessible for sale. In a Likert scale used, the mean of 4.52 indicated a strongly agreed position on the statement with a standard deviation of 0.670 which can be seen as a lower variation in terms of the dissenting voices on the statement. On the other hand, the lowest agreed with statement at (Mean = 3.74; Std Dev =0.692) was that availability of funds to construct value addition factories for aqua culturists would help reduce losses and increase profitability of the enterprises. This mean meant an agreed position since it is on average towards 4th measure in the Likert. The results showed that this statement also did not register lots of contrary voices on it since its Standard deviation was also not quite high at 0.692. Thus, the statement was well agreed upon by the respondents.

Financial risk: The study analyzed the views of the respondents in respect to moderating factor of Financial Risk of aquaculture enterprises. Table 3 shows the results of the analysis.

The results in Table 3 indicated that the respondents agreed generally the statements under financial risk in the aquaculture enterprises in Kenya. The respondents agreed with a weighted mean of 3.56. This mean is at the fence of agreed and neutral. The respondents thus weren't are sure of their agreement as they were of non-agreement. The weighted mean of 3.56 can be seen as a weak mean and thus could mean that most of the respondents had high dissenting voices on most of the statements posed.

The respondents from the various statements agreed (Mean = 3.65; Std Dev 0.469) with the statement that Financial risk has affected the availability of infrastructure finance to

aquaculture enterprises from financial institutions. Much as this is not the 1st ranked statement agreed on in terms of mean, would rank overall 1st because of its standard deviation which is the lowest. This means that a good number of the respondents had almost a common stand on the statement. This make the average level of agreement stronger than even those with a higher agreement mean on the other statements. The results also indicated that the respondents were not sure or almost disagreed with (Mean = 2.53; Std Dev = 1.436) on the statement that Financial risk affects the availability of trade credit to aquaculture enterprises. These findings indicated that as low as the mean was in terms of being neutral on the posed statement, the standard deviation was quite high at 1.436. This therefore means that the contrary voices on the statement were also quite diverse. A good number of the respondents thus may not have given a synonymous response in the statement. They could have strongly disagreed or even strongly agreed. The average however pointed towards being neutral to the statement.

Table 1. Reliability of the research questionnaire

Variables	Cronbach's Alpha	Test Items
Infrastructure Finance	0.767	8
Financial Performance	0.729	8
Financial Risk	0.711	8

Table 2. Descriptive statistics for infrastructure financing

	N	SA (%)	A (%)	U (%)	D (%)	SD (%)	Min	Max	M	Std. Dev
Availability of asset financing to construct cold rooms would increase the return on investment.	223	20.6	59.6	14.3	1.8	3.6	1	5	3.92	.861
Private financing of aquaculture will grow aquaculture enterprises significantly as well as their returns.	223	55.6	35.0	1.3	2.2	5.8	1	5	4.32	1.041
County development funds would enable aquaculture to thrive and the end products are accessible for sale.	223	54.7	38.6	0.4	2.2	4.0	1	5	4.38	.931
Project financing would increase the ability of constructing aquaculture cages thus grow the enterprises.	223	17.9	60.5	14.3	6.7	0.4	1	5	3.89	.789
Institutions financing aquaculture infrastructure will assist the enterprises grow and improve their financial performance	223	18.8	55.2	21.1	3.6	1.3	1	5	3.87	.805
Infrastructure financing for road network, boat acquisition will facilitate operations of aquaculture enterprises.	223	17.9	61.9	14.3	3.6	2.2	1	5	3.90	.813
Availability of funds to construct value addition factories for aqua culturists would help reduce losses and increase profitability of the enterprises.	223	9.4	57.0	29.1	3.1	1.3	1	5	3.70	.738
Availability of asset financing to construct aquaculture cages would increase the production output hence profits earned from the enterprise.	223	16.1	57.0	22.4	3.1	1.3	1	5	3.83	.779
Valid N (Listwise)	223									
Weighted Mean	**4.06**									

Table 3. Descriptive statistics for financial risk

	N	SA (%)	A (%)	U (%)	D (%)	SD (%)	Min	Max	Mean	Std. Dev
Credit risk affects the availability of debt financing capital.	223	18.4	44.8	18.4	8.5	9.9	1	5	3.53	1.177
Liquidity risk affects the availability of funds for group financing.	223	19.7	44.4	11.7	17.5	6.7	1	5	3.53	1.185
Operational risk has an effect on infrastructure financing of the aquaculture enterprises.	223	30.0	32.3	17.9	9.4	10.3	1	5	3.62	1.285
Operational risk affects the Government financing options to aquaculture enterprises.	223	22.9	47.5	8.5	12.6	8.5	1	5	3.64	1.207
Financial risk has affected the availability of infrastructure finance to aquaculture enterprises from financial institutions.	223	31.4	32.7	6.7	11.2	17.9	1	5	3.43	.695
Operational risk has affected the availability of finance to aquaculture enterprises from financial institutions.	223	20.2	37.7	14.3	13.0	14.8	1	5	3.35	1.337
Financial risk affects the availability of trade credit to aquaculture enterprises.	223	13.9	12.6	16.6	22.9	34.1	1	5	2.49	1.423
Credit risk affects the amount available for financing from groups to aquaculture enterprises.	223	11.2	33.2	11.2	21.5	22.9	1	5	2.88	1.380
Valid N (Listwise)	**223**									
Weighted Mean	**3.56**									

Table 4. Chi square test results for infrastructure financing

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1660.673[a]	1023	.000
Likelihood Ratio	379.800	1023	1.000
Linear-by-Linear Association	43.207	1	.000
N of Valid Cases	222		

a. 1078 cells (99.1%) have expected count less than 5. The minimum expected count is .00

Chi-square tests between infrastructure financing and financial performance: The chi square test between Infrastructure Financing and financial Performance of aquaculture enterprises in the lake region economic bloc, Kenya was performed. This was to examine the strength of associations between the bivariate categorical variables. The results were presented in Table 4.

Table 4 shows a Chi-Square value of χ^2 = 1660.673, p = 0.000 < 0.05. The p value is less than 0.05 and hence there is a statistically significant association between infrastructure financing and financial performance. The p-value of 0.000 means that the probability of obtaining the observed data or more extreme results by chance alone is extremely low. Typically, if the p-value is less than a predetermined significance level (often denoted as α) of 0.05, it is considered statistically significant (Mascha, & Vetter, 2018). Based on the results, the p-value of 0.000 is less than 0.05, suggesting a statistically significant association between infrastructure financing and financial performance. This means that the data provides strong evidence to conclude that there is an association between infrastructure financing and financial performance of aquaculture enterprises in the lake region economic bloc

Table 5. Infrastructure financing

		Financial Performance
Infrastructure Financing	Pearson Correlation	.480**
	Sig. (2-tailed)	.000
	N	222

***. Correlation is significant at the 0.01 level (2-tailed)*

Table 6. Financial risk

		Financial Performance
Financial Risk	Pearson Correlation	.467**
	Sig. (2-tailed)	.000
	N	222

***. Correlation is significant at the 0.01 level (2-tailed)*

Table 7. Regression model summary for infrastructure financing

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.480[a]	.230	.226	.87949827	.230	65.708	1	220	.000
2	.614[b]	.378	.372	.79257305	.148	51.903	1	219	.000
3	.689[c]	.474	.467	.73019184	.097	40.017	1	218	.000

a. Predictors: (Constant), Zscore(InfrastructureFinI)
b. Predictors: (Constant), Zscore(InfrastructureFinI), Zscore(FinRisk)
c. Predictors: (Constant), Zscore(InfrastructureFinI), Zscore(FinRisk), X2

The Model 1 results in the Table 6 indicates that there is a positive effect of Infrastructure financing on financial performance ($R = 0.480$, $R^2 = 0.230$) and ($F(1,220) = 65.708$, $p = 0.000$). The R^2 explains the variations in the dependent variable that can be explained by the independent variables. R^2 of 0.230 indicates that 23.0% of the variations in the financial performance of aquaculture enterprises in the lake region economic block can be accounted for by infrastructure financing.

Correlation tests between infrastructure financing and financial performance: The correlation between infrastructure financing and financial performance of aquaculture enterprises in the Lake Region economic bloc, Kenya was performed. The results presented were presented in Table 5.

Table 5 indicates a correlation coefficient of $r = 0.480$ at $p = 0.000$ between infrastructure financing and financial performance of aquaculture firms enterprises in the lake region economic bloc, Kenya. This positive correlation suggests that there is a tendency for higher levels of infrastructure financing to be associated with improved financial performance of aquaculture enterprises as it indicates a moderate positive correlation between these two variables. This means that changes in infrastructure financing may have a moderate impact on the financial performance of aquaculture enterprises in the lake region economic bloc, Kenya.

Correlation tests between financial risk and financial performance: The correlation between financial risk and financial performance of aquaculture enterprises in the Lake Region economic bloc, Kenya was performed. The results presented were presented in Table 6.

From Table 6, the results indicate a correlation coefficient of $r = 0.467$ and $p = 0.000$ between the moderating variable financial risk and financial performance of aquaculture enterprises in the lake region economic bloc, Kenya. This is a moderate positive association which indicates that financial risk may have an impact on financial performance. The implication of this correlation is that financial risk could play a role in influencing financial performance. Therefore, aquaculture enterprises willing to take on higher levels of financial risk might see improvements in their financial performance.

Effect of infrastructure financing on financial performance of aquaculture enterprises: The findings shown on Table 7 reflect a three-model summary for infrastructure financing on financial performance of aquaculture enterprises in the lake region economic block, Kenya when moderated by financial risk and when the role of the moderating effect is excluded.

Model 2 in Table 7 shows the results after the interaction of the moderator (Infrastructure Financing*Financial Risk) was introduced in the model. The results show that there is a significant effect of infrastructure financing on financial performance of aquaculture enterprises in the lake region economic block with ($R = 0.614$, $R^2 = 0.378$) and ($F(1,219) = 51.903$, $p = 0.000$). An R^2 of 0.378 indicates that 37.8% of the variations in the financial performance of aquaculture enterprises can be accounted for by the interaction between Infrastructure Financing*Finance Risk. The adjusted R-square is a modified version of R-squared that has been adjusted for the number of predictors in the model. The adjusted R-squared increases only if the new term improves the new model and it is always lower than the R-squared. Table 8 shows adjusted R-square of 0.226 for model 1 and 0.372 for model 2. These results indicate a clearevidence that the moderating variable Financial Risk improved the un moderated model.

Model 3 in Table 7 shows the inclusion of the interaction term therefore resulted in a R^2 change of .467 which indicates that the moderating effect explains 40.017% of the variation in the financial performance above and beyond the variation explained by the Infrastructure financing. The results obtained show a significant presence of the moderating effect of financial risk on the effect of infrastructure financing on financial performance in aquaculture enterprises in the lake region economic block, Kenya. Table 7 shows the significance test results with two models, the model with the inclusion of the interaction term and the other model without the moderator.

Model 1 indicates that effect of infrastructure financing on financial performance was significant ($\beta1=0.480$, $p = 0.000$, Beta = 0.480). Equation 2 shows the regression equation for model 1. For every unit increase in infrastructure financing, financial performance is predicted to increase by 0.480.

OLS model: Financial Performance = 015 + 0.480 Infrastructure Financing Equation (2)

This implication of this is that an increase in factors pertaining to infrastructure financing leads to an improvement in financial performance in aquaculture enterprises. The null hypothesis states that infrastructure financing has no significant effect on the financial performance was failed therefore to be rejected at 95% significance level. The study therefore failed to reject the alternative hypothesis and concludes that infrastructure financing has a significant effect on financial performance of aquaculture enterprises in Kenya.

Table 8. Significance test results for infrastructure financing

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	015				
	Zscore (Infrastructure FinI)	.480	.059	.480	8.106	.000
2	(Constant)	-015	.053		.000	1.000
	Zscore (Infrastructure FinI)	.407	.054	.407	7.494	.000
	Zscore (FinRisk)	.391	.054	.391	7.204	.000
3	(Constant)	-6.072	.961		-6.318	.000
	Zscore(InfrastructureFinI)	-.509	.153	-.509	-3.325	.001
	Zscore(FinRisk)	.094	.069	.094	1.365	.174
	X2	.309	.049	1.061	6.326	.000

a. Dependent Variable: Zscore (Financial Performance)

Model 2 shows that the moderating effect of Financial Risk on the effect of infrastructure financing on financial performance of aquaculture enterprises in lake region economic block, Kenya was not significant (β1=0407, p = 0.000, Beta = 0.407). Equation 3.0 shows the regression equation with the inclusion of the moderator. The equation implies that for every unit increase in infrastructure financing, financial performance is predicted to have a change of 0.309 on condition that Financial Risk is kept constant. This is quite minimal a change that it cannot show any signs of statistical significance. The p-value of .000 > 0.05 meaning the test was significant at 95% level of confidence. The null hypothesis therefore failed was rejected at 95% significance level and it was concluded that Financial Risk does moderate the effect of Infrastructure Financing on Financial Performance on aquaculture enterprises in Kenya [22].

MMR model: Financial Performance = 015**+** 0.407 Infrastructure Financing **+** 0.094 Financial Risk… Equation (3)

5. CONCLUSION

Aquaculture is immature compared to terrestrial crop and livestock sectors thus it lag behind as far as the specific financial management tools are concerned. This study sought to create new risk management products in relation to financing structure of aquaculture. This study seeks to fill the gap of financing options for aquaculture enterprises. The results indicate that an increase in factors pertaining to infrastructure financing as an option leads to an improvement in financial performance of the aquaculture enterprises. However, the significance level test failed to reject the alternative hypothesis and concludes that infrastructure financing has a significant effect on financial performance of aquaculture enterprises in Kenya. It was also concluded that Financial Risk does not moderate the effect of Infrastructure Financing Financial Performance on aquaculture enterprises in Kenya. It is recommended that, infrastructure financing is an option of financing that financial institutions and organizations can adopt to help grow aquaculture enterprises in Kenya. Financial institutions are encouraged to develop tailor made products that suit the operations of aquaculture enterprise. Having in mind the operational and financial risk they face. The study also informs financial institutions to know the changes in infrastructural financing requirements specific to aquaculture, sources of financing and ways to increase its availability The Government can also develop subsidies and insurance policies that protect the aqua culturists against unforeseen risks like climatic changes and other natural attrition in addition to the financial risk they are exposed to.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (Chat GPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Appendix I: Krejcie & Morgan Table

Table for determining sample size from a given population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	373
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	234	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	383

Note: "N" is population size
"S" Sample size
Source: *Krejcie& Morgan (1970)*

$$n=\frac{X^2*N*P*(1-P)}{(ME^2*(N-1))+X^2*P*(1-P)}$$

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