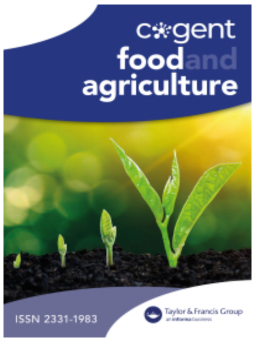

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Determinants of knowledge, attitude and perception towards cage fish farming technologies among smallholder farmers in Uganda

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ABSTRACT

Cage fish farming is essential to increasing fish output, alleviating the declining capture fishery resources, and advancing aquaculture development in Uganda. There are limited studies assessing farmers' knowledge, attitude, and perceptions towards cage fish farming technology. This study assessed the knowledge, attitude, and perceptions (KAP) of fishery-dependent communities around Lake Victoria towards cage fish farming technology. Using a simple random sample approach, 384 respondents from fourteen districts provided information on demographic traits, knowledge, attitudes, and perceptions towards cage fish farming. The analysis utilized descriptive statistics and a multinomial logit model. Results revealed that cage fish farmers' knowledge, attitude, and perceptions were significantly associated with age, level of education, extension visits, social capital, experience, and television access. In conclusion, this study recommends that extension visits be enhanced to develop farmers' knowledge, attitudes, and perceptions towards cage fish farming. The study's implications underscore the importance of developing and implementing farmer-centered policies in the aquaculture sector.

PUBLIC INTEREST STATEMENT

This study focuses on the aquaculture sector in Uganda, specifically the emerging cage fish farming sub-sector and its contribution to national development under the blue economy. The study findings presented are from the 384 smallholder cage fish farmers interviewed during a survey conducted between July 2021 and February 2022. The aim was to understand their knowledge, attitudes and perceptions towards cage fish farming technologies. The study found out that Age, years in practicing cage fish farming, extension services, social capital, access to market information, number of stocked cage units owned by an individual and type of cage technology used had an effect on the fish farmers' knowledge, attitude and perceptions. The study highlights the need for an increase in extension services, education and training on marketing information related to fish produce, and appropriate policy frameworks that favour smallholder fish farmers for inclusiveness and sustainable development of the fisheries industry in general.

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1. Introduction

In fishery-dependent communities across the world, fishing has long been the major source of income and livelihood. Presently, many natural water resources have become depleted due to indiscriminate fishing methods used worldwide (FAO, 2022). As a result, the GDPs of many nations have fallen, and the livelihoods of those who live in fishing communities are at risk. In Uganda, fish is one of the high-value commodities contributing significantly to her economic growth. Uganda has tremendous resource potential for the production of aquaculture and capture fishing due to the fact that over 40% of its surface area is covered by water. According to estimates by the World Bank (2012), the fisheries industry sustains the livelihoods of more than 1.5 million Ugandans with most of the fish coming from Lake Victoria (NaFiRRi, 2020). The decline in fish resources therefore poses a serious threat to the livelihoods of populations depending on fishing near freshwater bodies.

Rearing fish in cages is expected to intensify due to the anticipated rise in demand for fish brought

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about by population increase, lifestyle and dietary changes (FAO, 2021). The Government of Uganda (GoU) has put plans in place to support cage fish farming, however, its full commercialization has not yet been realized (Mbowa et al., 2017). In the 2021/22 budget, for instance, the government allocated UGX 1.7 billion (438,144.33 dollars) towards supporting the aquaculture sector (NAADS, 2021). The aquaculture sector contributes 12% of the agricultural GDP, translating to about 3% of the national GDP. According to Aura et al. (2022), Uganda's fish exports amounted to over USD 127.63 million.

Cage fish production has the potential to increase the fish sold locally and exported (Mbowa et al., 2017). However, its adoption in Uganda has remained low. This has been largely influenced by a number of factors, such as access to training and credit (Orinda et al., 2021), lack of funds, and limited extension services (Kwikiriza, 2018). Additionally, regulatory frameworks that control cage fishing activities are still underdeveloped (Aura et al., 2022). There are also other challenges that have slowed down its uptake, such as limited access to quality feeds, insecurity, low quality seed, and high investment costs. Furthermore, to establish a cage fish farm, the farmers would require specific knowledge, especially on production and harnessing cages into waters. Nevertheless, such knowledge sources are not readily accessed by smallholder farmers. The most common fish reared in cages are the Nile tilapia while catfish is mostly preferred for ponds (Bolman et al., 2018).

Cages are often put in specified offshore locations where there is little interference with other lake users. Before the cages can be effectively installed, several requirements have been obtained, such as an environmental impact assessment report, and licenses. Prior to applying for a permit, a farmer has to develop a proposal and present it to the District Fisheries office along with a suitability assessment acquired from the National Fisheries Resources Research Institute (NaFiRRi, 2018). The prospective farmer additionally obtains permission from the Directorate of Water Resources Management (DWRM). For quicker adoption, therefore, prospective cage fish farmers rely on a smooth flow of relevant information.

This study employed the Knowledge Attitude and practices (KAP) theory, pioneered by John Coster and has been applied in numerous research disciplines (Chen et al., 2021; Cui et al., 2023; Hasan et al., 2022; Liao et al., 2022; Wang & Zhang, 2021). According to the theory, changing behaviour is a gradual process that begins with information acquisition, which helps with attitude development and impacts on behavioural change. Knowledge is defined as acquiring factual information and understanding how an innovation works (Kumar et al., 2018). Perception, on the other hand, relates to farmers' view about a subject (McDowell et al., 2020), while attitude is the product of a person's evaluation of how good or bad a given subject is (Kim et al., 2013).

Therefore, knowledge and perception towards new technology can determine the farmer's attitude (Aldosari et al., 2019). In the same context, this study postulates that knowledge will serve as the cornerstone of the adoption of cage fish technology, which in turn will affect attitudes, beliefs, and perceptions of cage fish technology. Although KAP theory places greater focus on practice, this study hypothesizes that perceptions play a critical role in a person's knowledge understanding as well as in shaping their attitude and influencing their behaviour.

The associations between knowledge, attitude and perceptions and adoption have also been studied in various contexts, such as in agriculture (Li et al., 2019; Ngadjeu et al., 2022; Ouko et al., 2022; Sharifzadeh et al., 2019; Ntshangase et al., 2018; Sun et al., 2022; Tama et al., 2021), in agroforestry (Tokede et al., 2020), water resource management (Oremo et al., 2019) and ICT (Ulhaq et al., 2022) among others. In fish farming, however, knowledge, attitude and perceptions have not been extensively researched. Anaglo et al. (2014) found that attitude towards work played a significant role in determining the success of cage fish farming in Ghana. Also, Landge et al. (2021) found that cage fish farming positively impacted the flow of financial and livelihood capital. Ssekyanzi et al. (2022) assessed KAP in water quality while Waithanji et al. (2020) analysed the use of insects as feed in fish ponds. Therefore, this study aimed at determining factors influencing knowledge, attitude and perceptions of smallholder farmers towards cage fish farming in Uganda.

2. Materials and methods

2.1. Description of the study area

A cross-sectional survey was conducted in fourteen districts sharing Lake Victoria waters in Uganda. The districts were purposively selected because it where cage fish farming is most practiced. They included; Busia (0.261189, 33.986978), Namayingo (0.198695, 33.904346), Bugiri (0.282896, 33.715206), Mayuge (0.483115, 33.400116), Buvuma (0.199646, 33.265001), Jinja (0.431399, 33.235855), Buikwe (0.761029, 33.040723), Kalangala (-0.261384, 32.380537), Wakiso (0.054163, 32.518079), Kampala (0.257534, 32.637307), Masaka (-0.305544, 32.037822), Kyotera (-0.913802, 31.763894), Mukono (0.183249, 32.868301), and Rakai (-0.704984, 31.754762). Besides Cage fish farming and capture fishing, the Lake Victoria basin and its surroundings have diverse economic activities that consist of eco-tourism, water transport, and agriculture. The districts within the basin fall under medium altitude and receive sufficient rainfall throughout the year, which makes them ideal for growing crops such as palm oil, tea, sugar cane, and coffee. Large multinational companies such as Ice-Mark, Kakira Sugar Works, Jofald Rayel, and BIDCO are the major players in the region. Additionally, farmers also cultivate other crops such as bananas, cassava, potatoes, maize, beans, pineapples, and horticulture (tomatoes, vegetables), among others. Livestock farming is also prevalent in the region, with dairy and beef cattle, goats, and poultry being the most common types of livestock (Ministry of Finance Planning and Economic Development. MoFPED, 2020).

2.2. Sample size determination

For the study, the targeted population of smallholder cage fish farmers was selected from the lists generated by respective fisheries officers in the fourteen districts. Random sampling was utilized to select 384 respondents who owned cage fish farms. The sample size was calculated using Kothari (2004) formula, which is commonly applied when the population is unknown, with a 95% confidence interval. The study considers smallholder farmers who rear fish in cages with a stocking density of not more than 50,000 and are either male or female practicing in the study area.

The survey instruments were semi-structured questionnaires administered by trained enumerators. The questionnaire was pre-tested, improved, and validated before data collection. After seeking consent from each respondent as per the guidelines of the National Research Ethical Committee, data was collected on the respondents' Knowledge, Attitudes, and Perceptions (KAP), socioeconomic, institutional, and cage fish farm characteristics. The selection of variables was guided by literature (Ankuyi et al., 2022; Muange et al., 2014; Muleme et al., 2017; Okonya et al., 2019).

The KAP section consisted of 21 questions pertaining to knowledge, attitude and perceptions towards cage fish farming. To assess knowledge about cage fish farming 7 statements were used where respondents could answer 'true', 'false', or 'don't know' to each of the statements. Attitude was also measured using 7 statements with 4 options ranging

Table 1. Description of explanatory variables and their expected signs.

Variable	Description	Unit of Measurement	Expected Sign
Age	Age of a farmer	Years	–
Gender	Sex of a farmer	Dummy: 1 = male; 0 = female	–/+
Education	Farmer's level of educ.	Years in school	–/+
Extension	No. of visits by ext. officer	Number of days in a month	–/+
Experience	Duration in cage fish farming	Years	–/+
Social capital	No. of social ties a farmer has	Number of social contacts	–/+
Phone Access	Farmer owns Phone	Dummy: 1 = Yes; 0 = No	+
Tv Access	Farmer owns a TV set	Dummy: 1 = Yes; 0 = No	+
Farm Size	No. of cage units a farmer owns	No. of stocked cage units	–/+
Output	Amount Harvested fish per cycle	No. of kilograms	–/+
Fish Market	Nearest fish market	Distance in kilometres	+

from 'strongly agree' to 'strongly disagree'. Lastly, 7 statements were also used to assess farmers' perception towards cage fish farming. Each perception statement was measured on the 4-point Likert scale with options ranging from 'very good' to 'very bad'.

To generate knowledge scores, each correct answer was assigned 1 and 0 otherwise, in all the 7 statements. For attitude scores, both 'strongly agree' and 'agree' responses were assigned 1 and 0 otherwise. For perception scores, both 'very good' and 'good' responses were assigned 1 and 0 otherwise. All responses on knowledge, attitude and perceptions were then summed up to generate a total score for each KAP variable which ranged from 0 to 7.

The resulting scores were converted into percentages, where 'high' was considered to be 80% and above, medium' between 50% and 80% and 'low' below 50%. After categorising the scores of the dependent variable as either 'high', 'medium' or 'low', and selecting of independent variables (Table 1), a multinomial logistic model was used in STATA Version 15.0. The MNL was used to determine the statistically significant predictors of medium and high outcomes (as compared to low outcomes) for each KAP variable. The degree of association was quantified using the relative risk ratio (RRR) (95% confidence intervals).

3. Results and discussions

3.1. Statistical analysis

Results revealed that Tilapia fish was the most commonly reared species (98%) in the study area (Figure 1). This preference could be explained by the fact that

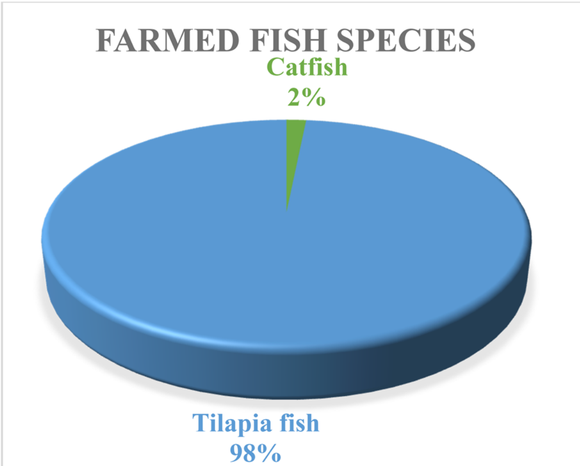

Figure 1. Fish species reared in the study area.

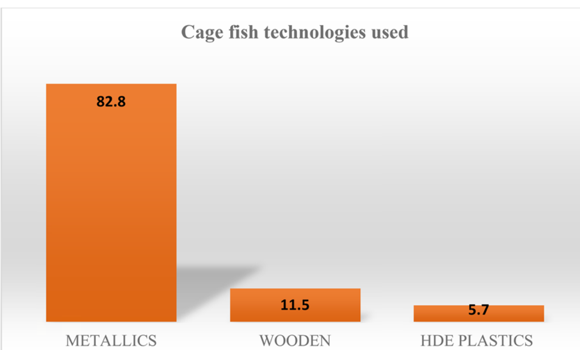

Figure 2. Types of cage fish farming technologies used in the study area.

Tilapia fish grow faster under a confined environment and have a better feed conversion rate than other fish species (NaFiRRi, 2018). Additionally, results in Figure 2 show that the majority of respondents (82.8%) used metallic cage units to rear fish, while 11.5% used wooden and only 5.7% used HDE plastics. This could be explained by the durability and affordability of metallic cages as compared to the other cage types. Furthermore, 29% of the respondents were female, while the majority were male (Figure 3). This male dominance in cage farming could be because production activities, such as feeding and harvesting fish, which is usually done in the lake, limit women's participation. As demonstrated by Rola-Rubzen et al. (2020) farmers' gender is an important factor in decision-making and the rate of technology adoption. As presented in Table 2, the mean age of the respondents was approximately 45±8years, while their education level was equivalent to secondary level (12±3 years). The mean distance to the nearest market where farmers sell their fish produce was 21±19 kilometres. Furthermore, on average, farmers owned around 5±3 cage units each and an average harvest of

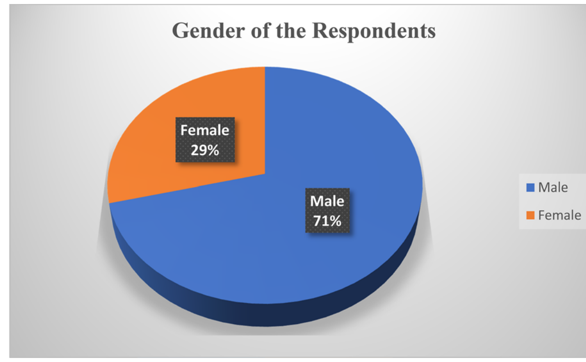

Figure 3. Gender of the respondents.

5518±3174 kilograms of fish, with the least producer harvesting around 1190 per cycle.

Regarding the knowledge variable, results as presented in Table 3 show that 66.15% of the respondents did not agree that fish cage units are difficult to assemble. Additionally, 83.07% did not agree that fish reared in cages had longer maturity while 80% disagreed that fish reared in cages are not given formulated feeds. Majority of the respondents also agreed that cage fish technologies affected the breeding places for the capture fish. These statements showed that majority of the sampled farmers were knowledgeable about the operations of cage fish farming business. Additionally, the findings in Table 3, indicate that there was no significant difference between those who agreed or disagreed with the statements on the cost of setting up cage units and operational costs in terms of labour. This suggests that costs are subjective and may vary depending on an individual's financial situation at a given time.

Results in Table 4 reveal that majority of the respondents had a positive attitude towards cage fish farming technologies. In statements 1, 2 and 4 (Table 4), respondents agreed that cage fish farming was a viable business (96.36%), innovative (89.59%), and better than wild capture fishing (94.8%). Table 5 shows that cage fish farmers had better perceptions of cage fish farming technologies. The majority agreed that it was easy to observe (91.41%) and harvest (86.24%) the fish under cage technologies. However, 79.43% of the respondents perceived cage farming as an expensive venture.

3.2. Econometric analysis

Table 6 shows the results of multinomial logit regression. The MNL model on knowledge outcome was statistically significant with a *p-value* < 0.0000, LR chi^2 (26) = 82.83 and pseudo-R^2 value of 0.20. For attitude outcome, the model was statistically significant with a *p-value* < 0.0001, LR ch^2 (26) = 61.45 and

Table 2. Demographic characteristics of the sampled respondents ($n = 384$).

Variable	Obs	Mean	Min	Max	Stand. Dev
Age (years)	384	44.97	32	63	8.167
Education (years)	384	11.52	7	18	3.078
Distance to Market (km)	384	20.87	2	64	19.433
Number of cage units (No)	384	4.96	1	16	3.096
Fish output (kgs)	384	5518.32	1190	18848	3174.64

Table 3. Farmers' knowledge on cage fish farming technologies.

	Responses			
	I don't know	False	True	Total (384)
Statements	%	%	%	%
1 Fish cage units are difficult to assemble.	11.72	66.15	22.14	100
2 Fish reared in cages take more than a year to mature.	6.51	83.07	10.42	100
3 Fish reared in cages are **NOT** given formulated feeds.	4.17	80.73	15.10	100
4 Cage fish farming is **NOT** a profitable venture.	5.73	69.53	24.74	100
5 Fish cage units are too expensive.	8.33	49.74	41.93	100
6 Cage fish farming is a labor-intensive job.	8.07	43.75	48.18	100
7 Cage fish technologies affect breeding sites for capture fish.	6.77	36.72	56.51	100

Table 4. Farmers' attitudes towards cage fish farming technologies.

	Responses				
	Strongly Agree	Agree	Disagree	Strongly Disagree	Total (384)
Statements	%	%	%	%	%
1 Cage fish farming is NOT a viable business	0.78	2.86	54.95	41.41	100
2 Cage fish farming is Not better than wild fishing	0.52	4.69	78.91	15.89	100
3 Cage fish farming does NOT address food insecurity	13.02	11.20	20.83	54.95	100
4 Cage fish farming technologies are very good innovations	54.17	35.42	6.77	3.65	100
5 Cage fish farming technologies give tangible results	42.19	50.78	6.77	0.26	100
6 I consider cage fish farming a desirable career option	8.59	46.88	37.76	6.77	100
7 Cage fish farming is a time-consuming job	2.60	7.81	53.65	35.94	100

Table 5. Farmers' perceptions towards cage fish farming technologies.

	Responses				
	Strongly Agree	Agree	Disagree	Strongly Disagree	Total (384)
Statements	%	%	%	%	%
1 Fish cage units require comparatively low capital to start	2.60	17.97	53.39	26.04	100
2 It is very easy to harvest fish reared in cage units	20.57	66.67	11.72	1.04	100
3 Easy to observe and sample fish reared in cage units at any time	54.17	37.24	7.55	1.04	100
4 Rearing fish in cage units is NOT labour intensive	9.64	44.01	40.62	5.73	100
5 Using cage units to rear fish is NOT risky (drowning) by the users	5.99	55.73	35.42	2.86	100
6 Cage fish farming technologies are NOT affordable to smallholders	4.95	39.06	41.93	14.06	100
7 Rearing fish cage units does NOT grow faster	8.07	24.74	36.72	30.47	100

pseudo-R^2 value of 0.08. Furthermore, perception was also statistically significant with a *p-value* < 0.0000, LR ch^2 (26) = 104.69 and pseudo-R^2 value of 0.16.

The MNL results in Table 6, show that age, gender, farming experience, education level, wooden cage type, extension visits, social capital, television access and distance to the nearest market were statistically significant and associated with knowledge, attitude and perception outcomes.

The Relative Risk Ratio, (RRR) for 'experience' indicates that for each unit increase in this variable, the risk of falling into a high category is predicted to change by a factor of 1.99. The result for 'experience', indicates that the likelihood of a farmer being in a high category increases with an increase in knowledge gained from experience. The finding corresponds with that of Awotide et al. (2016), who found that an increase in farmers' experience resulted in an

Table 6. Results of the Multinomial logit analysis on the determinants of KAP outcomes.

	Knowledge Scores			Attitude Scores			Perception Scores		
	RRR	z	P > z	RRR	Z	P > z	RRR	Z	P > z
Low (base outcome)									
Medium									
Experience	1.997	1.900	.058*	1.009	.090	.927	1.087	.120	.904
Gender	9.981	1.620	.105	0.723	−1.150	.251	9.129	1.090	.276
Age	0.993	−.130	.893	0.961	−2.690	.007***	0.962	−.370	.711
Education	0.795	−1.830	.067*	1.029	.680	.500	0.772	−1.220	.224
Cage type									
HDE plastic	578658.1	0.01	0.991	.431	−1.49	0.136	1065553	0.03	0.979
Wooden	.170	−1.89	0.059*	3.679	2.93	0.003***	.007	−2.23	0.026
Extension visits	0.287	−2.980	.003***	1.088	.830	.406	0.065	−2.170	.030**
Social capital	1.887	1.910	.056*	0.805	−2.390	.017**	2.048	1.120	.265
Phone access	1.315	.340	.735	1.235	.890	.372	0.441	−.450	.656
Tv access	7.325	2.430	.015**	1.466	1.650	.099*	27.931	2.280	.023**
No. of cage units	0.992	−.070	.944	0.875	−3.180	.001***	0.916	−.300	.762
Farm location	0.924	−.250	.801	0.775	−2.480	.013**	0.881	−.240	.808
Market Distance	1.059	1.690	.091*	0.995	−.740	.457	1.072	1.270	.204
Target Market	0.877	−.280	.783	1.196	1.280	.201	0.348	−1.180	.239
High									
Experience	1.780	1.500	.135	0.904	−.550	.579	1.400	.490	.625
Gender	12.555	1.720	.085*	1.986	1.590	.111	8.636	1.060	.288
Age	0.998	−.030	.973	1.016	.620	.537	.982	−.170	.864
Education	0.748	−2.080	.037**	0.990	−.150	.883	.781	−1.160	.245
Cage type									
HDE plastic	3504320	0.01	.990	.287	−1.02	0.310	539754.4	0.03	0.980
Wooden	.0314955	−2.50	.012**	10.99	4.25	0.000***	.013	−1.96	0.05**
Extension visits	.331	−2.520	.012**	1.032	.190	.852	.058	−2.260	.024**
Social capital	1.885	1.800	.071*	1.022	.130	.896	1.920	1.020	.310
Phone access	1.032	0.040	.971	1.769	1.370	.172	0.419	−.470	.636
Tv access	2.510	1.050	.293	1.163	.370	.711	32.190	2.380	.017**
No. of cage units	0.988	−0.100	.923	1.024	.390	.699	0.897	−.370	.710
Farm location	1.152	0.420	.674	0.933	−.400	.689	0.908	−.190	.853
Market Distance	1.057	1.600	.110	0.990	−.860	.393	1.052	.920	.357
Target Market	0.590	−1.020	.309	1.080	.320	.745	0.444	−.900	.366

Asterisks: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ Reference Category-Low KAP Scores.

Observations	384	384	384
LRchi^2 (26)	82.83	61.45	104.69
Prob > chi^2	0.0000	0.0001	0.0000
Pseudo R^2	0.2019	0.0860	0.1683
Log-likelihood	−163.74732	−326.60602	−258.70952

increase in the level of awareness of new technologies and innovations in the agricultural sector.

Education level was negatively associated with a cage fish farmer being in medium and high knowledge categories. The results imply that for a unit increase in schooling years, the relative risk for medium knowledge category in relation to the low would decrease by a factor of 0.80. Similarly, for a unit increase in schooling years, the relative risk for the high knowledge category relative to the low would also decrease by a factor of 0.75, holding all other factors constant. Contrary to expectations (Aldosari et al., 2019: Jha et al., 2018: Mittal & Mehar, 2016; Mmbando & Baiyegunhi, 2016), this finding could imply that additional years of schooling does not positively influence knowledge about cage fish farming. This could be explained by the fact that highly educated farmers could not be directly engaged in cage fish farming as compared to those with low or no education.

Additionally, owning a wooden cage type (as compared to a metallic cage) was negatively associated with being in medium and high knowledge categories as compared to a low category by factors 0.170 and 0.032, respectively. This finding implies that cage fish farmers who owned wooden cage types were more likely to be associated with low knowledge. This is because construction of the wooden cages does not require higher technological know-how as compared to HDE Plastic and Metallic cages.

Extension visits were negatively associated with a cage fish farmer being in medium and high knowledge categories. The RRR shows that one unit increase in extension visits decreases the relative risk for being in medium and high categories by a factor of 0.29 and 0.33, respectively. This implies that cage fish farmers who are in the medium and high categories were less dependent on extension services as compared to those in the low category. This finding is contrary to past studies (Altalb et al., 2015; Schut et al., 2015), which found a positive association between extension and level of awareness.

Social Capital was positively associated with a farmer being in medium and high knowledge categories as compared to low knowledge category. The finding shows that a unit increase in social capital increases the relative risk for being in the medium and high category by a factor of 1.89 and 1.90 respectively. This implies that cage fish farmers who had many social networks were more likely to be knowledgeable in cage fish farming. Social capital, therefore, plays a key role in increasing farmers' knowledge as also evidenced by Cofré-Bravo et al. (2019), Li et al. (2019), Magnan et al. (2015) and Muange et al. (2014).

The findings further show that television access was positively associated with a cage fish farmer being in medium knowledge category as compared to low. Therefore, a one unit increase in television access increases the relative risk of a farmer's being in medium knowledge category by a factor of 7.33 as compared to low category. This implies that a cage fish farmer who had more access in terms of hours spent watching agricultural programmes was more knowledgeable. This implies that ICT plays a key role in increasing farmers' knowledge (Kante et al., 2019; Ndimbo et al., 2023; Tambo et al., 2019).

The distance to the nearest fish market was positively associated with being in the medium category. The finding shows that an additional distance to the market increases the relative risk of a farmer being in the medium-level category by a factor of 1.06. The finding could imply that cage fish farmers who are located far from the markets but close to the shores were more knowledgeable about cage fish farming compared to those who were closer to the physical markets. This is because cage fish production is carried out in lake waters, which are distant from fish markets.

Gender was positively associated with a farmer falling in the high knowledge category. Being a male cage fish farmer increased the relative risk of falling in the high knowledge category by a factor of 12.5 as compared to the low category. This could be explained by the fact that cage fish farming is practised mainly by male gender. This finding agrees with Gebre et al. (2019) who showed the influence of culture on gender roles and labour divisions in the agricultural sector. The finding, however, contradicts Oyawole et al. (2021), who found no significant relationship between technology awareness and the gender of the farmers.

In regards to attitude, age was negatively associated with a farmer being in an average attitude category. The finding shows that a unit increase in age decreases the relative risk of a cage fish farmer being in the average attitude category as compared to a low attitude by a factor of 0.96. The result agrees with Morris et al. (2017) who stated that younger people are likely to be aware of emerging technologies because they are more receptive to new ideas and are less risk-averse than older people. The finding also agrees with that of Husen et al. (2017) who found that as the farmers' ages approach 60, their risk-taking level decreases and their attitudes tend to favour acquainted with farming technologies.

4. Conclusion

The study identified determinants of knowledge, attitude and perceptions towards cage fish farming in Lake Victoria Uganda. In conclusion, factors such as age, gender, farming experience, education level, ownership of a wooden cage type, number of extension visits, size of social capital, television access, and distance to the nearest market were found to be associated with knowledge, attitude and perception outcomes. In addition, the study revealed that majority of respondents had average knowledge, better attitude and perceptions towards cage fish farming. To promote cage fish farming in fishery-dependent communities, this study provides relevant information concerning KAP, which forms the first step in the adoption process. Based on the findings, social capital provides a significant source of knowledge among cage fish farmers. It is thus important that policymakers recognize the importance of improving services such as extension as a mechanism to positively enhance knowledge on cage fish farming and up-scaling. Therefore, the study recommends a need to develop appropriate policies and strategies to enhance extension services and gender inclusiveness in the sector.

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Authors' contributions

This study was conceptualized and developed by all three authors listed on the first page. All authors read and approved the final manuscript and unanimously agreed to publish it in this journal.

Ethical approval and consent to participate

Ethics approval for the study was received from the Office of the President and Uganda National Council for Science and Technology (UNCST), Kampala. The smallholder cage fish farmers interviewed were also asked for consent before the commencement of the interviews.

Disclosure statement

The authors declare that they have no competing interests.

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Data availability statement

Data for this study are available from the Department of Agricultural Economics and Agribusiness Management, Egerton University in Kenya and the authors. Data can be accessed on special request with the department's and the authors' permission.

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