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WOMEN'S EMPOWERMENT IN THE AQUACULTURE SECTOR AND ITS DETERMINING FACTORS: EVIDENCE FROM MALAWI

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ABSTRACT

This paper focuses on the status of women's empowerment and the key contributors to their disempowerment in Southern Malawi's aquaculture sector. A cross-sectional survey was conducted on 285 fish farmers (129 women and 156 men) drawn from five fish-producing districts in the Southern Malawi region (Mulanje, Phalombe, Thyolo, Mwanza and Blantyre districts) and achieved a response rate of 100%. The calculation of the 5DE score for women was conducted using both single women as well as those married and living together with their husbands. On the contrary, calculation of GPI excluded single women and considered only the women living together with their husbands. Hence, the target households with both a man and a woman living together were 106, which was adopted in calculating the GPI index. However, the empowerment level of men in the domains was established with an aim of comparing with women as well as calculation of the GPI index for women. The paper used the Women Empowerment in Fisheries and Aquaculture to estimate the status of women's empowerment using five Domains of Empowerment (5DE) and a Gender Parity Index (GPI). Furthermore, a Tobit regression model was adopted to establish the determining factors for women empowerment in aquaculture. Data was analyzed using descriptive statistics. The study findings revealed that in the Southern region of Malawi, only 15% of women were empowered, contrasting with 59% of men. However, 78% of women achieved gender parity with their male counterparts. Excluding work balance, the A-WEFI for women was 0.8009, comprising a 4DE sub-index value of 0.541 and GPI sub-index value of 0.782. Women in aquaculture were approximately two times more disempowered than men. Tobit regression findings indicated that the effect of access to extension services on women empowerment in aquaculture in Malawi was positive and significant ($\beta = 0.031$; P-Value < 0.05). It was also established that the effect of access to markets on women empowerment in aquaculture in Malawi was positive and significant ($\beta = 0.120$; P-Value < 0.05). The study results further showed that level of education had a positive significant effect on women empowerment in aquaculture in Malawi was positive and significant ($\beta = 0.120$; P-Value < 0.05). Input in productive decisions and leadership notably constrained women's empowerment, highlighting the importance of decision-making in productive assets and group membership for women's empowerment. Decisions regarding financial access, particularly access to credit, contributed more to disempowerment among women than men. On the contrary, disempowered men were significantly affected by decisions over the use of income, suggesting limitations in determining expenditure.

Key Words: W*omen's Empowerment, Aquaculture Sector, Domains of Empowerment, Gender Parity Index*

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1. BACKGROUND OF THE STUDY

Aquaculture addresses global food security challenges and fosters economic growth, particularly in developing nations (De et al. 2023). In developing and developed economies, fish consumption has risen by approximately 3 per cent annually since the 1960s, surpassing the growth of other animal protein sources (FAO, 2020). Notably, women have increasingly become active participants in aquaculture, engaging as producers and entrepreneurs. This involvement not only promotes gender equality but also brings positive socio-economic outcomes to households and communities (Gonzalez et al., 2021). Enhancing the status of women leads to heightened agricultural productivity, decreased poverty, and improved nutrition (Diiro et al., 2018). In the context of aquaculture, Louis and Oliveira (2022) state that women's involvement within the sector can contribute to eliminating severe poverty, malnutrition, and food insecurity.

Additionally, Andrada (2015) notes that women's empowerment is pivotal in enhancing aquaculture productivity by fostering inclusivity and leveraging diverse perspectives. When actively involved in aquaculture, women contribute unique skills, insights, and innovative approaches that can lead to more sustainable and efficient practices. Empowering women in the aquaculture sector promotes economic growth, expanding the labor force and enabling a more equitable distribution of resources (Das et al. 2023; Salazar et al. 2023). Moreover, women often play critical roles in household nutrition, and when empowered in aquaculture, they can improve food security by diversifying production and promoting responsible fishing practices (Torre et al., 2019). The enhanced involvement of women in fisheries and aquaculture contributes to heightened empowerment for women and increased productivity and income within this sector (Salazar et al. 2023). This has been documented through empirical evidence in Chile, where integrating women and youth in the salmon industry played a pivotal role in fostering the industry's expansion (Ramirez & Ruben, 2015). Similarly, Choudhury et al. (2017) observed that women's participation in aquaculture in Bangladesh led to an enhancement of socio-economic well-being among women, both within their households and in the broader community. Furthermore, Das et al. (2023) in India and Torre et al. (2019) in Mexico demonstrated that the increased involvement of women in fisheries activities and processes in Mexico resulted in a heightened sense of empowerment for them.

The aquaculture sector has been tipped as a powerful tool for women's empowerment because of their involvement in the entire production process (Kawarazuka & Christopher, 2010). Even in communities where women's mobility is restricted, they can still engage in aquaculture since aquaculture can be a backyard activity (Kaminiski *et al*. 2019). However, despite high hopes for women benefitting from aquaculture, it is becoming increasingly apparent that benefits and opportunities from their participation are not equitably distributed across gender and socio-economic classes (Kruijssen *et al*., 2018). Morgan *et al*. (2016) agreed that in many areas, benefits for women are lower despite their more active participation in aquaculture operations, post-harvest processing and marketing compared to men. In the Malawian context, it has been documented that while women play a significant role in aquaculture production, their contributions remain under-reported (Chiweza & Nagoli, 2017). While studies have illustrated the importance of fish farming for women, the sector is male-dominated in Malawi (Limuwa *et al*., 2018). Fundamentally, limited information about women's empowerment in the Malawian sector exists. Das et al. (2023) similarly agreed that literature on women's contribution to aquaculture and their level of empowerment due to involvement is scarce. This paper will contribute to the literature by quantifying the empowerment level of women involved in aquaculture in the Southern part of Malawi to provide a measurable and objective assessment of the impact of empowerment initiatives, promoting informed decision-making, accountability and advocating for continued support and improvement in gender equality within the industry.

1.1. Measuring Women's Empowerment in Fisheries and Aquaculture

Numerous strategies have been proposed to assess women's empowerment in fisheries and aquaculture, as evidenced by studies by Azmi et al. (2021), Farquhar et al. (2017), Huq et al. (2016), and Shashank et al. (2018). Freeman and Svels (2022) and Haqiqiansyah and Sugiharto (2018) conceptualized women's empowerment by considering resources / preconditions, agency / process, and outcomes / achievements. Although both studies shared a foundational definition of

women's empowerment, the indicators for each category differed, hindering comparisons between the two. Some researchers create scales without validation, leading to inaccurate depictions of women's empowerment in fisheries and aquaculture (Meetei et al., 2016). Other studies focus on limited aspects like participation, offering insufficient insights into women's empowerment in aquaculture (Shah & Bukhari, 2019).

The Women Empowerment in Fisheries Index, derived from the Women's Empowerment in Agriculture Index (WEAI) (Quisumbing et al., 2023), seeks to address these limitations by standardizing the generation of an empowerment index for the fisheries sector. Adapting WEAI to WEFI and its derivatives for various agricultural sub-sectors has proven beneficial and essential for gauging women's empowerment (Cole et al., 2018; Ragsdale et al., 2022). As summarized by Quisumbing et al. (2023), prior to the development of WEAI and its derivatives, most measures of women's empowerment in agriculture and its sub-sectors concentrated on assessing limited aspects of agency and empowerment or were indirect, focusing solely on women's access to economic resources. Consequently, this study adopts WEFI as a gauge of women's empowerment in agriculture, aligning with recommendations and adoptions by previous studies such as Das et al. (2023), Adam et al. (2023), and De et al. (2023).

1.2. Women's Empowerment in Fisheries and Aquaculture Index (WEFI)

Each of the five domains (5DEs) includes multiple interview questions, and a weighted index is calculated using six indicators, with each domain given equal weight (1/5) following the A-WEAI methodology (Figure 1). To evaluate women's agency in the production domain, A-WEFI utilizes indicators such as "Input in productive decisions," assessing participants' involvement and extent of decision-making in fishing and post-fishing activities. Access to productive and financial resources positively impacts women's empowerment and agency in household decision-making. Two indicators are employed to gauge adequacy in the resource domain: "Ownership of land and other assets" and "Access to and decisions on credit." The former examines women's ability to secure sole or joint access to essential areas and ownership of productive assets, while the latter assesses their participation in household credit decisions and financial account access.

The third domain measures adequacy in having "Control over income," determining women's influence in decisions related to fisheries income, wages, employment, or major household expenditures. A-WEFI also considers women's work balance through a detailed 24-hour time-allocation module, defining "work balance" based on the time poverty line of 10.5 hours in the previous 24 hours. The fifth domain evaluates women's potential for leadership and influence in their community by assessing active membership in community groups. Six binary variables, indicating adequacy in each indicator, are generated, and a weighted sum is calculated to derive individual empowerment scores ranging from 0 to 1. A respondent is classified as empowered if their weighted empowerment score is equal to or above 0.8, indicating empowerment in roughly four domains. The individual scores are aggregated to create the 5DE index, emphasizing both the number of disempowered women and the intensity of their disempowerment. The final A-WEFI score comprises two sub-indices: 5DE and GPI, with 90% weight on 5DE and 10% on GPI, reflecting the significance of empowerment and recognizing the importance of gender equality.

2. DATA AND METHODS

2.1. Study Area, Target Population and Sampling Approaches

The study was conducted in the Southern region of Malawi. A multi-stage sampling design was employed to select target respondents. The first stage entailed the selection of districts whereby the fish-producing districts in the province, that is, Mulanje, Phalombe, Thyolo, Mwanza and Blantyre districts, were selected. Secondly, three Extension Planning Areas (EPAs) per district were randomly selected in the five target districts. Thirdly, a random selection of villages was conducted, where ten villages in each of the EPAs were selected. Finally, a random selection of households was conducted in the

villages. The number of households was proportionate to the population of fish farmers. The sampling was based on a frame provided by the Department of Fisheries (DoF). The five districts have an estimated population of 4,721 fish farmers (DoF, 2018), representing 30% of aquaculture farmers nationally (15,465). A sample size of 285 male and female fish farmers was sampled. A structured household survey questionnaire was designed by adopting and modifying the publicly available World Fish's A-WEFI survey where necessary. The questionnaire was then programmed into Kobo Collect Toolbox to facilitate data collection through smartphone devices.

2.2. Data Analysis

The quantitative data was transferred from the questionnaires to Excel. The unit of identification was the individual respondent. The data were then disaggregated by gender to compare responses from women and men. Descriptive statistics such as mean, percentage and frequency were used for description. The level of women's empowerment in aquaculture was measured using the Women Empowerment in Fisheries and Aquaculture Index (WEFI) developed by De et al., (2023). This index comprises six domains: access to and control over resources and services, participation in social and economic activities, ability to make independent decisions, control over income usage, knowledge of aquaculture, and attitude towards aquaculture. A-WEFI is generated as a weighted average of the two sub-indices: (1) the Five Domains of Empowerment (5DE) score and (2) the Gender Parity Index (GPI). The 5DE sub-index measures the extent of individuals' engagement in fisheries and aquaculture in five areas: (1) decisions over production; (2) access to and decision-making power over productive resources; (3) control over use of income; (4) time-use; and (5) leadership (Das et al. 2023). WEFI measures the degree to which women are empowered in these domains, and for those who are not empowered, the percentage of domains in which they are empowered (Alkire et al. 2013).

2.3. Construction of the Gender Parity Index

Other than 5DE index, the second sub-index—the Gender Parity Index (GPI)—measures women's empowerment relative to that of men by comparing the 5DE profiles of women and men in the same households. Gender parity reflects the importance placed by the international development community on achieving gender equality, the third Millennium Development Goal. The gender parity measure is grounded in evidence showing that equalizing access to assets and opportunities for men and women helps achieve better development outcomes—such as better health and nutrition for women and their families, greater investments in education for children, and poverty reduction (Alkire et al. 2013). A woman is assumed to achieve gender parity if her achievements in the five domains are at least as high as those of the primary adult male in her household. Therefore, percentage of women who have 5DE scores equal to or higher than those of the primary adult males in their households reflects gender parity. The GPI reflects the percentage of women who have achieved parity and, in cases of gender disparity, the average empowerment gap that women experience relative to their male counterparts. While the 5DE score is calculated using all women in the sample, the GPI score is not calculated for women living in a household with no adult male. The study adopted a recommendation by Alkire et al. (2013) to calculate GPI as:

$$GPI = 1 - H_w (R_p)$$

H_p = % of women with gender parity

H_w = % of women without gender parity

R_p = average empowerment gap between women and men in their HH

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2.4. Construction of the WEFI Index

The data collection methods employed in the development of other empowerment indices, such as WEAI or A-WEAI following Alkire et al. (2013), suggest querying respondents about their time usage in 15-minute intervals from 4:00 a.m. of the day before the survey to 4:00 a.m. of the survey day to ascertain their time-use. However, recognizing that women in fisheries often multitask (Nabayunga et al., 2021), the data revealed that, contrary to expectations, women typically surpassed 24 hours in daily activities compared to men. In response to this methodological divergence in data, this study adjusted the A-WEFI calculation by excluding work balance, the time domain, as an empowerment indicator. Previous studies such as Adam et al. (2023) excluded time (work life balance) based on the argument. This revised version omits work balance in the computation and reappraises weights for the remaining indicators to maintain consistency by assigning equal weight to all four remaining DEs, aligning with the A-WEAI methodology. Consequently, all the remaining four domains are given an equal weight of ¼, as summarized in Table 1, excluding time.

Table 1: Summary of Indicator Weights Used

Domain	Indicator (s)	Weight	Definition of Adequacy
Production	Input in productive decisions	1 / 4	An individual meets at least ONE of the following conditions for ALL of the agricultural, aquaculture and fisheries activities they participate in 1. Makes a related decision on their own 2. Makes the decision jointly and has at least some input into the decisions 3. Feels could decide if wanted to (to at least a MEDIUM extent)
Resources	Ownership of Land and other resources	1 / 6	An individual owns, either solely or jointly, at least ONE of the following: 1. At least THREE assets 2. Land or pond 3. Gleaning area (access)
	Access to and decisions on credit	1 / 12	An individual meets at least ONE of the following conditions: 1. Belongs to a household that used a source of credit in the past year and participated in at least ONE sole or joint decision about it 2. Belongs to a household that did not use credit in the past year but could have if wanted to from at least ONE source 3. Has access, solely or jointly, to a financial account
Income	Control over the use of income	1 / 4	An individual has control over income if there is AT LEAST ONE activity in which the individual has some input in decisions about income generated, or feels she/he can make decisions regarding wage, employment and major household expenditures
Time	Work Balance	Not Included	
Leadership	Group Membership	1 / 4	An individual is an active member of at least ONE group

The calculation of 5DE followed a recommendation by Alkire et al. (2012) that:

$$5DE = H_e + H_n\,(A_a)$$

Where:

H_e = Percentage of women who are empowered

H_n = Percentage of women who are not empowered (1 – H_e)

A_a = Percentage of dimensions in which disempowered women have adequate achievements

On the other hand, the final WEFI score was constructed as:

WEFI = 0.9 (5DE) + 0.1 (GPI)

2.5. Tobit Regression Model

The study sought to establish the determining factors of women empowerment in aquaculture through a regression analysis. The most suitable regression model was a Tobit model which allows for censoring of the dependent variable (empowerment level) into lower limit (not empowered) and upper limit (empowered) (Amemiya,1984). The study applied the Tobit (1958) model that is a type of censored regression model, developed by James Tobit in 1958. The justification behind a Tobit model in this study as opposed to the Ordinary Least Square (OLS) regression model is that Women's empowerment levels may be categorized into two categories, that is lower limit (not empowered) or upper limit (empowered). This is to say that since the empowerment level is measured on a scale from 0 to 100, and that a score less than 80 means no empowerment and above 80 means empowered, the most suitable model that can truncate the dependent variable (level of empowerment) into the two limits is the Tobit model. The model allows for usage of the real empowerment scores while considering the values in the two limits (unempowered vs empowered). On the contrary, the use of OLS regression would have assumed that the dependent variable is observed without any restrictions, which can lead to biased estimates when the data is censored. To correct for this, Tobit models account for this censoring and provide more accurate estimates in such cases. Therefore, to estimate the determinants of the women's empowerment level in aquaculture, while considering the two limits without a bias (restrictions), the most suitable model was a Tobit regression model defined as;

$$Y = \beta_0 + \sum_{i=1}^{5} \beta X + \varepsilon \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (1)$$

Where i from 1 to 7 is a vector of the independent variables (determinants of women empowerment in aquaculture) and ε is the regression model's error term. In addition, Y is the dependent variable (level of women empowerment in aquaculture) censored to zero (0) (not empowered) if the level of empowerment is less than 0.8 and y* (empowered) if the level of women empowerment in aquaculture is above 0.8 defined as;

$$Y = \begin{cases} y * if \ y > 0.8 \\ 0, if \ y < 0.8 \end{cases} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (2)$$

Considering the argument, the empirical model to estimate the determinants of women empowerment in aquaculture is defined as shown in equation 3. However, to avoid the problem of endogeneity, all the variables that contributed to the construction of the empowerment level that is input in productive decisions, ownership of land and other resources, access to and decisions on credit / finance, control over the use of income and group membership were excluded in the estimation. As a result, the effect of other social-economic factors that is access to extension services (number of extensions visits in a fish farming season), level of education (measured as total years of schooling years), market access (categories of accessible fish markets), source of fingerlings (binary variable; 1 = recycling own fingerlings; 0 = otherwise) and farmer's experience in fish farming (measured in years). The Tobit model specification for this study is:

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$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \ldots\ldots\ldots (3)$$

Where:

Y = Women's level of empowerment in aquaculture, α = Constant term, X_1 = access to extension services, X_2 = level of education, X_3 = market access, X_4 = source of fingerlings, X_5 = experience in fish farming and ε = error term.

3. FINDINGS AND DISCUSSION

3.1. Overview

The study targeted 285 fish farmers (and achieved a response rate of 100%. The calculation of the 5DE score for women was conducted using both single women as well as those married and living together with their husbands. On the contrary, calculation of GPI excluded single women and considered only the women living together with their husbands. Hence, the target households with both a man and a woman living together were 106, which was adopted in calculating the GPI index. However, the empowerment level of men in the domains was established with an aim of comparing with women as well as calculation of the GPI index for women.

3.2. Robustness tests of Association

The study conducted association analysis to determine the level of associations between the four individual indicators that form the composite index, A-WEFI. Such a diagnosis was important to unearth cases of high correlations between the indicators, which, if not addressed, can impose a higher weight on the paired indicator than intended. The findings in Table 2 present the Cramer's V correlation coefficients for each pair of indicators that afterwards yielded the A-WEFI without work balance. The results revealed a weak correlation between all the possible pairs, with all Cramer's V coefficients well below 0.3. This reinforced the importance of the four varied domains in the methodology, as each contributes to determining different facets of women's agency in the productive sphere, particularly in fisheries and aquaculture. Hence, using the four to calculate the A-WEFI index was suitable. This is consistent with the recommendation by Birhanu (2015).

Table 2: Robustness tests of Association

	Input in Productive Decisions	Access to and decisions on financial access	Control over use of income	Leadership	
Input in Productive Decisions	1				
Access to and decisions on financial access	0.004	1.000			
Control over use of income	(0.088)	(0.003)	1.000		
Leadership	(0.043)	0.041	0.078	1.000	1.000

3.3. Women's Empowerment Level Compared with Men in Aquaculture in Southern Malawi

This section describes the key results on empowerment of men and women using A-WEFI methodology discussed under methodology. The study has adopted a cut-off of 0.80 on a scale of 0 to 1 to categorize respondents as empowered if they achieved a weighted score above or equal to the cut-off (Alkire et al., 2012) based on a sample of men and women drawn from all six study districts.

Overall, with work balance (time) excluded, A-WEFI for women was 0.8009, a weighted average of the 4DE sub-index value of 0.541 and the GPI sub-index value of 0.782. The 4DE for women in Table 3 shows that only 15% and 59% of the sampled women and men were empowered, respectively. This suggests that they had individual scores equal to or higher than the adequacy cut-off of 0.8, in keeping with A-WEAI. In addition, 78% of the women achieved gender parity, suggesting that only 22% of the women had lower scores than the primary male respondent from the same household. The findings concur with that of a study by Malapit et al. (2014) who similarly established a similar range in WEFI among Malawian aquaculture farmers at 0.84 as the baseline.

Table 3: Women's Empowerment Level Compared with Men in Aquaculture in Southern Malawi

Indicator	Women	Men
4DE Score	0.541	0.803
Disempowerment Score (1 – 4DE)	0.459	0.197
N (Number of Observations)	129	156
Percentage who have achieved empowerment	15%	59%
Percentage who have not achieved empowerment	85%	41%
GPI Score	0.782	
N (number of dual-adult households)	106	
% of women achieving Gender Parity	68%	
% of women not Achieving Gender Parity	32%	
Average empowerment Gap	22%	
WEFI Score	0.8009	

Guide:
Calculation of 4DE
5DE Score for women = 15% + 85% (46%) = 0.541
5DE Score for men = 59% + 41% (52%) = 0.803
Calculation of GPI
GPI = 1 – 68% (32%)
= 0.782
Calculation of Overall WEFI
GPI = 0.9 (4DE) + 0.1 (GPI)
= 0.9 (0.541) + 0.1 (0.782)
= 0.565

3.4. Determinants of the Gaps in Women's Empowerment

Figure 1 compares male and female disempowerment and illustrates the contribution of each indicator to disempowerment. The results reveal that, overall, women are approximately two times as disempowered as men. Across the 4 domains adopted in the study, it was established that men fare better than women. Productive decisions did not account for any dis-

empowerment in men; they accounted for disempowerment in up to 20% of the women. This implies that women were constrained in decisions about using productive assets, which derailed their empowerment. In addition, it was established that leadership constrained more disempowered women than men (57% versus 47%), which means that belonging to a group played an important role in empowerment, especially for women than men. It was further documented that decisions regarding financial access, such as access to credit, contributed to disempowerment among more women (66%) than men (28%). This implies that most of the disempowered women faced challenges regarding controlling and accessing financial services.

On the contrary, the findings indicated that disempowered men were primarily affected by decisions over the use of income, implying that they may not fully determine the expenditure of income. Overall, women who are not empowered have adequacy in up to 46% of the dimensions, while men who are not empowered have adequacy in up to 52% of the dimensions in Southern Malawi. The findings agree with those of Malapit et al. (2014), who similarly established that among the key constraints for women in the achievement of empowerment are access to and decisions on credit as well as leadership (speaking in public and membership to a group).

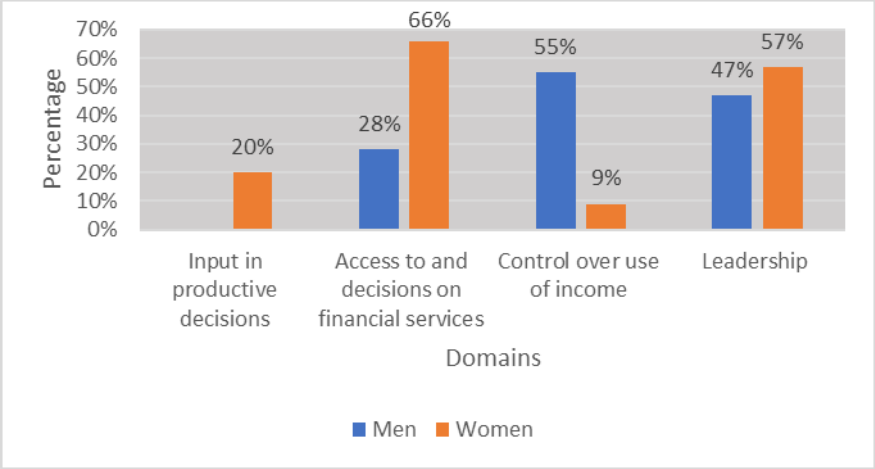

Figure 1: Proportion of Men and Women not empowered and with Inadequate Achievements by indicator

Tobit Regression Model Results

The Tobit regression model findings in Table 4 indicated that the five factors, that is access to extension services, access to markets, source of fingerlings, experience in fish farming and level of education account for up to 20.8% of the variations in women empowerment in aquaculture in Malawi (Pseudo R^2 = 0.208). This implies that the five factors play an important role in contributing towards women empowerment in aquaculture in Malawi. Further findings indicated that the regression model linking the five factors to women empowerment in aquaculture in Malawi was a goof fit (Prob > Chi2 = 0.0002 < 0.05) to imply that the model was sufficient to generalize findings. It was established that access to extension services, access to markets and level of education significantly contribute towards women empowerment in aquaculture. However, the effect of source of fingerlings and experience in farming was not significant. Specifically, it was established that the effect of access to extension services on women empowerment in aquaculture in Malawi was positive and significant (β = 0.031; P-Value < 0.05). This implies that increased extension visits were associated with an increase in women empowerment in aquaculture in aquaculture in Malawi. It has been argued that regular extension visits can provide women with ongoing training and technical support, enhancing their skills in fish farming. Frequent extension visits may also facilitate the adoption of best practices, leading to improved productivity, sustainability, and empowerment. Furthermore, extension visits can contribute to building networks and relationships, creating opportunities for women to connect with

other farmers, experts, and support services.

The findings also established that the effect of access to markets on women empowerment in aquaculture in Malawi was positive and significant (β = 0.120; P-Value < 0.05). This implies that accessing markets is associated with an improvement in women empowerment in aquaculture in Malawi. Market access allows women in aquaculture to sell their produce, generating income and contributing to their financial independence. The ability to participate in the market provides women with economic empowerment, enabling them to make decisions about household expenditures and investments. It was also established that the effect of level of education on women empowerment in aquaculture in Malawi was positive and significant (β = 0.120; P-Value < 0.05). This implies that higher levels of education were associated with an improvement in women empowerment in aquaculture in Malawi. Formal education can enhance women's knowledge and skills in aquaculture practices, leading to improved productivity and efficiency. In addition, education may empower women by increasing their confidence and ability to actively participate in decision-making processes related to fish farming. Educated women may also have better access to information, technologies, and resources, enabling them to make informed decisions in their aquaculture activities.

Table 4: Tobit Regression Model Results

					Number of Observations	129
					LR Chi2 (5)	24.26
					Prob > Chi²	0.0002
					Pseudo R²	0.2081
	Coef.	**Std. Err.**	**t**	**P>|t|**	**95% Confidence Level**	
					Lower	**Upper**
Access to Extension Services	0.031	0.013	2.480	0.014	0.006	0.056
Access to Markets	0.120	0.052	2.310	0.022	0.017	0.222
Source of Fingerlings	0.069	0.052	1.320	0.188	(0.034)	0.172
Experience in Fish Farming	0.002	0.007	0.340	0.732	(0.011)	0.016
Leve of Education	0.047	0.018	2.590	0.011	0.011	0.082
Constant	0.379	0.107	3.530	0.001	0.167	0.592
/ Sigma	0.271	0.022			0.227	0.316

4. DISCUSSION OF FINDINGS

The study findings have provided a comprehensive understanding of the status and determinants of women's empowerment in aquaculture in the Southern region of Malawi. The study findings reflected stark gender disparities in empowerment levels between women (15%) and men (59%) which underscores existing gender disparities in the Southern region of Malawi, emphasizing the need for targeted interventions to address this imbalance. The lower empowerment levels among women may be attributed to historical and socio-economic factors that have limited their access to resources, decision-making power, and leadership opportunities as demonstrated among the 4DEs. In regard to gender parity achieve-

ment, it was demonstrated that the achievement of gender parity by 78% of women, despite lower overall empowerment, suggests progress in reducing gender gaps in certain dimensions in the sector in Malawi. This demonstrates that women may have made strides in specific areas, reaching parity with men in terms of outcomes or opportunities, but the overall empowerment levels remain lower due to persistent challenges in other dimensions.

The empowerment scores highlight that women's overall empowerment is significantly lower (0.8009) compared to men, indicating a need for targeted interventions to enhance women's agency and participation in decision-making. The sub-index values (4DE and GPI) provide a nuanced understanding of the components contributing to women's empowerment, with decision-making in productive assets and group membership emerging as key constraints. Specifically, the study identifies input in productive decisions and leadership, particularly in decision-making regarding financial access, as major constraints to women's empowerment. This implies that limited participation in decision-making processes and restricted access to resources, such as credit, can hinder women's ability to invest in and expand their aquaculture activities. Addressing these constraints is crucial for fostering women's empowerment.

The adequacy levels in 46% of dimensions for non-empowered women and 52% for disempowered men indicate areas of strength and weakness for each gender. Therefore, understanding these dimensions can guide targeted interventions, allowing for a more nuanced approach to address specific challenges faced by women and men in the context of aquaculture. In regard to the determinants of women's empowerment through the Tobit regression model, the study has underscored the significance of access to extension services, access to markets, and the level of education as key contributors to women's empowerment in aquaculture. These determinants reflect the importance of knowledge, market linkages, and education in enhancing women's capacity to engage in and benefit from aquaculture activities. Enhancing these factors can therefore positively impact women's empowerment.

5. CONCLUSION

The study concludes that in the Southern region of Malawi, a small percentage of women, 15% were empowered, contrasting with 59% of men. However, 78% of women achieved gender parity, compared to men, which implies lower scores than their male counterparts in only 22% of cases. Excluding work balance, the A-WEFI for women was 0.8009, comprising a 4DE sub-index value of 0.541 and GPI sub-index value of 0.782. The study further concluded that women were approximately two times more disempowered than men. Input in productive decisions and leadership notably constrained women's empowerment, highlighting the importance of decision-making in productive assets and group membership for women's empowerment. Decisions regarding financial access, particularly access to credit, contributed more to disempowerment among women than men.

On the contrary, disempowered men were significantly affected by decisions over the use of income, suggesting limitations in determining expenditure. Overall, women who were not empowered demonstrated adequacy in 46% of dimensions, while disempowered men showed adequacy in 52% of dimensions in Southern Malawi. These findings align with prior research, emphasizing the significance of access to credit and leadership as key constraints for women's empowerment in aquaculture. In regard to the determinants of women empowerment in aquaculture, it was concluded that access to extension services, access to markets and level of education significantly contribute towards women empowerment in aquaculture.

6. RECOMMENDATIONS AND POLICY IMPLICATIONS

Based on the study findings, the study informs the following policy implications aimed at enhancing women empowerment in aquaculture in Malawi;

i. Given that decisions regarding financial access, particularly access to credit, contribute significantly to disempowerment among women, policymakers should focus on creating and implementing gender-responsive programs to promote access to finance. Interventions may involve ensuring equal access to suitable low-interest credit for women in fisheries and aquaculture, financial literacy programs tailored to women and establishing support mechanisms to enhance women's financial inclusion. The study highlights the importance of decision-making in productive assets and leadership roles for women's empowerment. Program implementers can encourage and facilitate the active participation of women in decision-making processes related to fisheries and aquaculture. This may involve providing training, creating awareness, and implementing policies that promote gender-inclusive decision-making structures within the industry.

ii. The study highlights that group membership plays a significant role in women's empowerment. Policymakers can support and strengthen women's participation in community groups related to fisheries and aquaculture. This can be achieved through targeted initiatives, capacity-building programs, and incentives for forming and sustaining women-centric groups within the sector. The study identifies a constraint in women's empowerment related to input in productive decisions. Policymakers can implement measures to address these disparities, ensuring that women have equal opportunities to contribute to and influence decisions related to productive assets in fisheries and aquaculture. To address the broader issue of gender disparities in aquaculture, policymakers can aim to integrate gender equality principles into national policies related to agriculture and fisheries. This involves mainstreaming gender considerations in policy formulation, implementation, and evaluation to ensure a more inclusive and equitable industry.

iii. Given its importance in enhancing women empowerment, there is a need to invest in and strengthen extension services tailored to the needs of women engaged in aquaculture. This can be done through development and implementation of extension programs specifically designed for women, focusing on technical skills, best practices, and innovative technologies in aquaculture.

iv. In regard to the role of market access in empowering women, the study recommends a need to develop policies that enhance women's access to markets to ensure fair participation in value chains. This can be achieved through establishment of market linkages and networks that connect women aquaculturists directly with buyers and distributors. It can also be achieved through implementation of policies that address gender-based barriers in market access, such as discriminatory practices or lack of information.

v. There is also a need to enhance education opportunities for women through implementation and promotion of programs that encourage and support girls' education. There is also a need to provide scholarships and financial incentives to girls and women pursuing education and training in aquaculture-related fields. Furthermore, the government and policy makers can design and implement inclusive training programs that consider the unique needs and challenges faced by women in aquaculture.

7. LIMITATIONS OF THE STUDY

Conceptually, the study adopted a quantitative approach to establishment of women empowerment in aquaculture through the A-WEFI index. However, there was no consideration of qualitative approaches which can enhance the findings. Given its challenge, as discussed and justified, the study relied on 4DEs in calculation of A-WEFI without time as one of the domains. Even though the justification is empirically true, it is important to note that the findings may differ had it to be included. The geographical coverage of the study was five districts in the southern part of Malawi and hence the findings strongly reflect that region. Therefore, generalization of the findings to other regions of Malawi may need caution. In regard to the variables included in the Tobit model, the role of moderating variables was not considered and hence that assumes a direct relationship. Therefore, there is a need to acknowledge that including moderating variables may signifi-

cantly affect the relationship.

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9. ETHICAL APPROVAL AND CONSENT

All procedures performed in this study were in accordance with the required ethical standards and research protocol / proposal by National Commission for Science and Technology, Malawi.

10. DECLARATION OF CONFLICT OF INTEREST

The author declares that he has no conflict of interest.

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