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INFLUENCE OF FISH FARMING TRAINING ON YOUTH EMPLOYMENT AND SELF-RELIANCE IN KENYA

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Abstract

Youth unemployment remains one of the major socio-economic challenges facing many developing countries, including Kenya. In recent years, fish farming has increasingly emerged as a viable economic activity capable of promoting employment creation, food security, and income generation among young people. Fish farming training programmes offered through Technical and Vocational Education and Training (TVET) institutions, government initiatives, non-governmental organizations, and community-based projects have played a significant role in equipping youth with practical aquaculture skills and entrepreneurial competencies. This review article examines the influence of fish farming training on youth employment and self-reliance in Kenya. The paper synthesizes existing literature on aquaculture education, youth empowerment, entrepreneurship development, and sustainable livelihoods within the fisheries sector. The review explores the contribution of practical fish farming skills, entrepreneurship education, access to training resources, and institutional support towards enhancing youth participation in aquaculture enterprises. The article further discusses challenges affecting the effectiveness of fish farming training programmes, including inadequate funding, limited access to markets, insufficient technical support, and climate-related constraints. The paper concludes that fish farming training has substantial potential in promoting youth self-employment, income generation, and socio-economic empowerment when supported through effective policies, modern training approaches, and sustainable institutional frameworks. Strengthening aquaculture education and expanding youth access to fisheries training opportunities can contribute significantly to Kenya's blue economy agenda and national development goals.

Keywords: *Fish Farming, Fish Farming Training, Youth Employment, Youth Self-Reliance, Aquaculture Development, Youth Empowerment, Skills Acquisition, Income Generation, Sustainable Livelihoods, Kenya Aquaculture Sector*

INTRODUCTION

Youth unemployment continues to pose a major socio-economic challenge in Kenya despite increasing access to education and vocational training opportunities. Many young people experience difficulties securing formal employment due to limited job opportunities, inadequate practical skills, and mismatch between education and labor market demands. Consequently, attention has increasingly shifted toward vocational and entrepreneurial training capable of promoting self-employment and sustainable livelihoods. Among the emerging sectors with significant potential for youth empowerment is aquaculture or fish farming, which contributes to

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food security, income generation, and economic development. Fish farming training programmes offered through Technical and Vocational Education and Training (TVET) institutions, government initiatives, and non-governmental organizations seek to equip youth with practical aquaculture and entrepreneurial skills necessary for participation in the fisheries sector. Through skills acquisition in areas such as pond management, fish breeding, feeding, harvesting, and marketing, youth are increasingly able to engage in self-employment and income-generating activities. Additionally, fish farming aligns with Kenya's blue economy agenda, which emphasizes sustainable utilization of aquatic resources for employment creation and poverty reduction (Obiero et al., 2019). Despite the growing recognition of aquaculture as a viable economic activity, many youths still face challenges including inadequate access to capital, limited technical support, poor market access, and insufficient training facilities, which hinder effective utilization of acquired skills for sustainable livelihoods (Munguti et al., 2014). This section covers the concept of fish farming training, youth employment and self-reliance, the role of aquaculture education in socio-economic empowerment, challenges affecting youth participation in fish farming, and strategies for enhancing the effectiveness of fish farming training programmes in Kenya.

FISH FARMING TRAINING , YOUTH EMPLOYMENT AND SELF-RELIANCE

1. Concept of Fish Farming Training

Fish farming training refers to structured educational and practical learning processes designed to equip learners with the technical, managerial, and entrepreneurial competencies required for sustainable aquaculture production. It involves both theoretical instruction and experiential learning in key areas such as pond construction and management, fish breeding, stocking, feeding regimes, water quality management, disease control, harvesting techniques, and post-harvest handling. In contemporary practice, fish farming training increasingly incorporates agribusiness and entrepreneurship education to enable trainees to transition into self-employment and income-generating ventures within the aquaculture value chain (Coche et al., 2011; FAO, 2020).

In Kenya and other developing economies, fish farming training is primarily delivered through Technical and Vocational Education and Training (TVET) institutions, agricultural training centres, universities, and extension service programmes. These institutions play a critical role in bridging the skills gap in aquaculture by providing competency-based training that emphasizes practical skill acquisition and workplace readiness. The shift toward Competency-Based Education and Training (CBET) has strengthened the relevance of vocational education by aligning training outcomes with labor market demands and industry expectations (Republic of Kenya, 2019; UNESCO-UNEVOC, 2021).

From a theoretical perspective, fish farming training is anchored in vocational education and human capital development frameworks, which emphasize the role of skills and knowledge in enhancing productivity and employability. Human capital theory posits that investment in education and training increases individual productivity and economic returns, thereby

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improving livelihood outcomes (Becker, 1993). Similarly, experiential learning theory underscores the importance of learning through direct experience, reflection, and application, which is particularly relevant in aquaculture where practical exposure is essential for competence development (Kolb, 1984).

In the Kenyan context, aquaculture training is also aligned with national development priorities such as the Blue Economy Strategy, which identifies fisheries and aquaculture as key sectors for employment creation, food security, and economic transformation. Policy frameworks emphasize youth engagement in aquaculture through structured training and capacity-building initiatives aimed at promoting entrepreneurship and sustainable livelihoods (Government of Kenya, 2018; Munguti et al., 2017).

Despite these institutional and policy efforts, the effectiveness of fish farming training is largely dependent on the availability of adequate infrastructure, qualified trainers, demonstration farms, and access to production inputs such as fingerlings, feed, and equipment. Empirical studies indicate that training programmes that integrate practical exposure and industry linkages are more effective in enhancing aquaculture adoption and enterprise success among trainees, compared to those that are largely theoretical in nature (Brummett & Williams, 2000; Kaminski et al., 2018). Conversely, inadequate resources and weak training-to-practice linkages continue to constrain the impact of aquaculture education on youth livelihood outcomes in many developing countries.

2. Fish Farming Training and Youth Employment

Fish farming training has emerged as a significant intervention for addressing youth unemployment by equipping young people with practical, technical, and entrepreneurial competencies required for participation in aquaculture value chains. In many developing economies, youth unemployment is strongly associated with limited access to formal employment opportunities and a mismatch between educational outcomes and labour market demands. As a result, vocational and skills-based training programmes, particularly in agriculture and aquaculture, are increasingly viewed as viable pathways for improving employability and promoting self-employment among youth (Maïga et al., 2020). Fish farming training therefore plays a critical role in shifting youth from job-seeking behaviour to productive engagement in income-generating activities.

In Kenya, fish farming training is primarily delivered through Technical and Vocational Education and Training (TVET) institutions, agricultural training centres, universities, and government extension services. These institutions are mandated to provide competency-based education and training that emphasizes practical skill acquisition and workplace readiness. The Competency-Based Education and Training (CBET) framework adopted in Kenya seeks to ensure that learners acquire demonstrable skills that are directly applicable to real-life economic activities, including aquaculture production and management (Republic of Kenya, 2019). Through this system, fish farming training is increasingly aligned with national development

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priorities, particularly those associated with the Blue Economy strategy and youth empowerment initiatives.

Fish farming training contributes to youth employment by equipping trainees with technical competencies essential for fish production systems. These competencies include pond construction and management, fingerling stocking, feeding regimes, water quality monitoring, disease control, harvesting techniques, and post-harvest handling. Such skills enable youth to participate directly in fish production either as independent farmers or as employees within aquaculture enterprises. Empirical studies have shown that aquaculture development has strong potential to generate employment opportunities when supported by effective training and enabling institutional frameworks (Kaminski et al., 2018). This suggests that skill acquisition is a foundational determinant of youth participation in aquaculture-based employment.

Beyond technical competencies, fish farming training also fosters entrepreneurial skills that are essential for self-employment creation among youth. Entrepreneurship-oriented aquaculture training enables learners to identify viable business opportunities, develop enterprise plans, manage production costs, and engage effectively in fish marketing and value addition. Evidence indicates that youth who receive integrated technical and business training are significantly more likely to establish and sustain aquaculture enterprises compared to those who receive purely technical instruction (Mujuri & Kathomi, 2023). This highlights the importance of integrating entrepreneurship education within fish farming training programmes to enhance employment outcomes.

Fish farming training further contributes to employment creation across the broader aquaculture value chain, extending beyond primary fish production. Employment opportunities exist in supporting sectors such as feed production, hatchery operations, input supply, fish processing, transportation, cold storage, wholesale distribution, and retail marketing. This value chain structure creates both direct and indirect employment opportunities for youth, particularly in rural and peri-urban areas where alternative job opportunities are limited. According to Obiero et al. (2019), aquaculture development in Kenya has progressively enhanced livelihood diversification by creating multiple entry points for youth engagement in fisheries-related economic activities.

However, the translation of fish farming training into sustainable employment outcomes is influenced by several structural and institutional constraints. Although training equips youth with relevant skills, many face challenges in establishing viable enterprises due to limited access to start-up capital, high cost of inputs such as feed and fingerlings, inadequate extension services, and weak market linkages. Research has consistently shown that without adequate financial and institutional support, trained youth often fail to effectively utilize acquired competencies for enterprise development (Atakpa et al., 2024). This indicates that training alone is insufficient to guarantee employment outcomes unless complemented by enabling economic conditions.

In addition, emerging technological advancements are reshaping employment opportunities within the aquaculture sector, necessitating the integration of innovation and digital

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competencies into fish farming training. Modern aquaculture systems increasingly rely on smart technologies such as automated feeding systems, water quality monitoring sensors, and data-driven production management tools. These innovations enhance productivity and efficiency but also require new skill sets among youth entering the sector. Studies suggest that integrating digital and technological competencies into agricultural training programmes improves youth competitiveness and employability in modern agribusiness systems (Yang et al., 2020). Therefore, updating training curricula is essential for aligning youth skills with evolving industry demands.

3. Fish Farming Training and Youth Self-Reliance

Fish farming training plays a central role in promoting youth self-reliance by equipping young people with technical, managerial, and entrepreneurial competencies required for independent livelihood creation. Self-reliance in this context refers to the capacity of youth to generate income, make autonomous economic decisions, and sustain their livelihoods without prolonged dependence on formal wage employment or external support systems. In development literature, self-reliance is strongly associated with skills acquisition and productive capability development, particularly in contexts where formal employment opportunities are limited. Recent studies on youth agripreneurship further emphasize that vocational training in agriculture-based sectors such as aquaculture enhances economic agency and improves transition from education to productive work (FAO, 2022; World Bank, 2023).

In many developing economies, fish farming training is increasingly aligned with entrepreneurship development as a central outcome of vocational and technical education systems. This reflects a shift from traditional employment-focused training models toward enterprise-oriented learning that prepares youth to create their own economic opportunities. Aquaculture training contributes to this shift by integrating technical production competencies with business-oriented skills such as financial planning, enterprise management, and market analysis. Empirical evidence indicates that such integrated training approaches significantly increase the likelihood of youth engaging in self-employment and sustaining small-scale agribusiness enterprises (Herrington & Coduras, 2021; OECD, 2021).

Technical competencies acquired through fish farming training form the operational foundation of youth self-reliance in aquaculture systems. These competencies include pond construction and design, stocking and breeding techniques, feed formulation and management, water quality monitoring, disease control, and harvesting procedures. Mastery of these skills enables youth to independently establish and manage fish production systems that generate income at household and commercial levels. Recent aquaculture development studies highlight that when youth are adequately trained in production systems, they are more likely to adopt fish farming as a livelihood strategy and sustain it as a long-term income source, particularly in rural economies where agriculture remains the dominant economic activity (Kassam & Dorward, 2022; Brummett & Garaway, 2021).

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Beyond technical production skills, fish farming training enhances financial literacy and entrepreneurial decision-making, which are critical for sustaining self-reliant livelihoods. Youth who undergo comprehensive aquaculture training often acquire competencies in budgeting, cost analysis, record keeping, pricing strategies, and market engagement. These skills improve their ability to manage operational risks, optimize resource utilization, and increase profitability of aquaculture enterprises. Recent empirical research in agricultural entrepreneurship demonstrates that financial literacy integrated within vocational training significantly improves business survival rates and strengthens income stability among rural youth entrepreneurs (OECD, 2021; World Bank, 2023).

However, the realization of self-reliance through fish farming training is frequently constrained by structural, financial, and institutional barriers that limit effective application of acquired skills. Despite gaining technical competencies, many youth struggle to establish viable aquaculture enterprises due to limited access to start-up capital, high costs of feed and fingerlings, inadequate extension services, and weak market integration. Contemporary studies on aquaculture development in Sub-Saharan Africa indicate that these constraints significantly reduce the transformation of training outcomes into sustainable livelihoods, thereby widening the gap between skills acquisition and economic empowerment (FAO, 2022; Kaminski et al., 2020). This suggests that training alone is insufficient unless supported by enabling financial and institutional ecosystems that facilitate enterprise development and market participation.

4. Challenges Affecting Fish Farming Training in Kenya

Fish farming training in Kenya has expanded significantly as part of national efforts to enhance youth employment and strengthen the blue economy, yet its effectiveness continues to be constrained by deep-rooted structural challenges. One of the most critical limitations is inadequate practical training infrastructure within many Technical and Vocational Education and Training (TVET) institutions and aquaculture training centres. In several cases, trainees receive disproportionate theoretical instruction with limited exposure to hands-on aquaculture practices due to insufficient demonstration ponds, unreliable water supply systems, inadequate aeration and monitoring equipment, and limited access to basic production inputs such as fingerlings and feeds. This lack of functional training infrastructure significantly weakens the experiential learning process, which is essential in aquaculture where practical competence determines productivity and enterprise survival. Consequently, many graduates leave training institutions without sufficient operational skills to independently establish and manage viable fish farming enterprises (FAO, 2022; Munguti et al., 2021).

A second major challenge is the shortage of adequately trained instructors and extension personnel capable of delivering up-to-date aquaculture knowledge aligned with emerging global practices. Fish farming has evolved into a technologically dynamic sector that increasingly incorporates advanced systems such as recirculating aquaculture systems, biofloc technology, integrated multi-trophic aquaculture, and digital monitoring tools for water quality and feeding optimization. However, many training programmes in Kenya still rely on curricula and instructional approaches that are not fully responsive to these innovations, largely due to limited continuous professional

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development for instructors and weak industry-academia linkages. This results in a skills gap where trainees graduate with competencies that are misaligned with modern aquaculture practices, thereby reducing their competitiveness, productivity potential, and adaptability in commercial fish farming environments (Kassam & Dorward, 2022; World Bank, 2023).

Limited access to financial resources represents another major barrier that significantly undermines the transition from training to enterprise establishment among youth. Although fish farming training equips youth with technical and entrepreneurial knowledge, the capital-intensive nature of aquaculture remains a major constraint, particularly in relation to pond construction, water management systems, feed procurement, fingerlings, and disease management inputs. Many trained youth lack access to affordable credit facilities due to collateral requirements, limited financial literacy, and weak linkages between training institutions and financial service providers. Empirical studies consistently show that lack of start-up capital is one of the strongest determinants of failure in youth-led agribusiness ventures, as it prevents the practical application of acquired skills and disrupts the transition from training to productive self-employment (Kaminski et al., 2020; FAO, 2022).

Market access challenges further weaken the effectiveness of fish farming training by limiting the profitability and sustainability of youth-led aquaculture enterprises. Even when youth successfully initiate fish farming activities, many struggle to access stable, profitable, and structured markets due to fragmented value chains, inadequate cold storage facilities, poor transport infrastructure, and limited bargaining power. In addition, fish prices are often highly volatile, exposing small-scale producers to unpredictable income streams and reducing incentives for sustained investment in aquaculture. The dominance of informal market systems further exacerbates these challenges by creating inefficiencies and limiting opportunities for value addition and scale expansion. Research indicates that weak market integration significantly reduces enterprise viability and discourages long-term youth participation in aquaculture ventures (Brummett & Garaway, 2021; OECD, 2021).

Finally, environmental, institutional, and socio-cultural challenges collectively influence the overall effectiveness of fish farming training programmes in Kenya. Climate variability, including unpredictable rainfall patterns, prolonged droughts, and water scarcity in certain regions, directly affects aquaculture productivity and increases production risks for small-scale youth farmers who often lack access to climate-resilient technologies. At the institutional level, weak coordination between training institutions, fisheries departments, financial institutions, and private sector actors creates fragmented support systems that limit post-training assistance, enterprise scaling, and market integration. Additionally, socio-cultural perceptions that regard agriculture and aquaculture as less prestigious compared to formal employment opportunities discourage some youth from fully engaging in fish farming despite receiving training. These combined environmental, institutional, and socio-cultural constraints highlight the need for integrated, multi-sectoral interventions that strengthen training systems while simultaneously addressing the broader ecosystem required for sustainable aquaculture development (FAO, 2022; World Bank, 2023).

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CONCLUSION

This review establishes that fish farming training plays a significant role in enhancing youth employment and self-reliance in Kenya by equipping young people with technical, managerial, and entrepreneurial competencies required for participation in aquaculture enterprises. Such training enables youth to engage in income-generating activities, transition into self-employment, and participate in value chain development within the fisheries sector. However, the effectiveness of fish farming training is constrained by challenges including inadequate training infrastructure, limited access to finance, weak market linkages, skills gaps among instructors, environmental risks, and socio-cultural barriers. These constraints limit the extent to which acquired competencies are translated into sustainable livelihoods, despite the sector's strong potential for youth empowerment within the blue economy framework.

Fish farming training programmes should be strengthened through investment in modern training infrastructure, including functional demonstration ponds, adequate water systems, and essential aquaculture equipment to enhance practical learning outcomes. Training institutions should enhance instructor capacity through continuous professional development to ensure alignment with emerging aquaculture technologies and evolving industry requirements. Access to affordable credit and financial support mechanisms should be expanded to enable trained youth to establish and sustain viable aquaculture enterprises. Strengthening market linkages and value chain integration is necessary to improve profitability and sustainability of youth-led fish farming activities. Integration of digital technologies and entrepreneurship-focused curricula into aquaculture training programmes should be prioritized to enhance innovation, productivity, and long-term youth self-reliance in Kenya's fisheries sector.

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