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Research Article

Inclusive Strategies for Socio-Economic and Political Support to Enhance Aquaculture in King Cetshwayo District Municipality

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Abstract

Aquaculture has been identified as a key source for meeting future demand, especially when it comes to food security, employment generation, health and wellbeing, and poverty reduction. Aquaculture faces challenges like a lack of technical knowledge, low water quality, and low hatching rates, low seed production, and financial constraints, necessitating further examination of political aspects. Moreover, investigating the application of the legislative framework and governance issues meant to promote sustainable agricultural practices and development is another necessity. This paper employed the Political Economy as the theoretical framework to build integrations on sustainable aquaculture development, policies, regulations, and their institutions in the production of economies and markets. This paper used qualitative methods, collected data using semi-structured interviews, and analysed data using thematic and content analysis. The findings show that South Africa does not have dedicated legislation that supports aquaculture development; however does have policies and strategies that aim to promote both commercial and small-scale developing producers, as well as to expand the aquaculture sector through a value-chain approach. The findings further revealed that the existing regulatory framework does not create an atmosphere that is conducive to the sector's growth, and the laws are restrictive and impeded by the regulatory structure. The paper suggests that designated areas like Aquaculture Development Zones (ADZs) are crucial for enhancing investor confidence and economic benefits, while also considering coastal and open spaces for aquaculture, despite the current focus on maritime and harbour use.

Keywords

Aquaculture Development and Policy, Sustainable Aquaculture Practices, Economic Impact of Aquaculture, Small-Scale Fisheries Governance, Regulatory Framework for Aquaculture

1. Introduction

Global fish production is approximately 154 million tons per year, with an annual consumption level of 18.5 kg per capita. Fish does not only contain high-quality protein but also a variety of essential micronutrients, minerals, and fatty acids [65]. Governments, producers, the broader industry, scientists, and the public must collaborate to facilitate the design of food systems that decouple health benefits derivable from consuming aquatic protein from the negative environmental, organismal, and societal impacts that may arise as a result of a rapidly expanding and unregulated sector [56]. In addition to

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directly providing high-quality food, fisheries and aquacultures generate economic value through the production, trade, and marketing of wild and farmed fish [18, 45]; however assert that animal protein is the most deficient or undersupplied nutrient in the diets of the country's rural communities in general.

According to the Food and Agriculture Organization -FAO, consumption of fish and seafood in general has numerous nutritional and health benefits [25]. The meat of the fish contains several essential amino acids, highly unsaturated fatty acids, a high level of iron, calcium, and iodine, as well as Vitamin A. Furthermore, fish meat has been shown to boost intelligence, treat skin conditions, improve brain development, and lower the risk of heart disease, asthma, Alzheimer's disease, cancer, obesity, and diabetes, among other things. Fish is a primary source of essential nutrients for pregnant women and children, particularly omega-3 fatty acids, which are essential for early brain development [60].

The South African fisheries sector's worth is R6 billion, thus accounting for 0.1% of the national GDP [22]. The Western Cape is estimated to account for 90% of the industry value, employment, and income, with primary commercial fisheries (as well as main fisheries ports, and other associated industry services) being concentrated along South Africa's west and south coasts [32, 36]. Furthermore, the livelihoods framework has been used to design programmes that aim to increase the contribution of small-scale aquaculture to ensure poverty reduction, improved livelihoods, and increased food security in coastal communities [20]. The success or failure of aquaculture development depends on local support, acceptance, and willingness to adopt; all these are heavily influenced by community members' perceptions of the activity [23]. Aquaculture is important, and it provides a valuable source of income for smallholders. Indonesian lobster farming is, for instance, still in its early stages and hampered by a lack of farming skills and knowledge, a lack of access to support networks and credit, and incompatible policy and regulatory frameworks. The community's emphasis on engagement and social responsibility as being more important than the potential for financial gains in achieving local benefits from aquaculture indicates that participation and equity are important [23]. Poverty is a major contributor to food insecurity; therefore, eradicating it is critical to improving food access. This demonstrates how tilapia aquaculture can help to achieve SDGs 1, 2, 3, and 5. The aquaculture industry is beneficial as a source of income, food, and job creation [11]. Additionally, aquaculture requires knowledge and skills in a variety of production areas, including spawning, feed production, pond construction, and management [25].

2. Literature Review

Aquaculture development is part of the blue economy narratives, and it has the potential to improve the lives of coastal residents and the public [16]. Aquaculture plays an essential role directly or indirectly in the livelihood of millions of people. Aquaculture has been identified as a key source for meeting future demand, especially when it comes to food security, employment generation, health and wellbeing, and poverty reduction. Local socio-economic ramifications of aquaculture expansion sometimes take a second seat to trade, ecological, and technological incentives, especially in the light of contemporary initiatives toward sustainable aquaculture intensification [54].

The significant role that women play in African aquaculture is rarely given enough credit or adequately documented in the statistics of the continent's fisheries development initiatives. In the production, trade, industrial processing, and retail of fresh aquatic goods, women account for 47% of the workforce worldwide [26]. Furthermore, specific actions are required to empower women in the processing, marketing, and production of aquaculture. Gender mainstreaming in aquaculture programs is already being promoted by certain African states and development partners, and this is a good start. The African Women Fish Processors and Traders Network (AWFISHNET) was founded in 2017 as a forum to support gender-responsive policies and practices in the fisheries industry through the African Union Inter-African Bureau for Animal Resources (AU-IBAR). AWFISHNET unites female non-state actors involved in the fish industry, including fish farmers, fishermen, fish processors, and traders of fish and fish products. Along the whole fisheries and aquaculture value chain, "from field to fork," it works with strategic partners to develop innovations and technologies, encourages interdisciplinary community dialogues, and facilitates advocacy for enhanced inclusion of women and adolescents in problem-solving. By supporting i) policy frameworks, ii) research and development, and iii) financing small-scale community activities, it upholds the rights of women and girls working in the fishing industry and recognizes their needs to achieve the UN Sustainable Development Goals of ending hunger, promoting women's economic empowerment, and guaranteeing gender equality in national development planning. Women continue to be marginalized in many countries when it comes to accessing and controlling resources, despite recent efforts to strengthen gender dimensions in the fisheries sector [27].

Although coastal aquaculture contributes significantly to employment and export earnings, its significance is eclipsed by negative environmental and social consequences [38]. Aquaculture faces challenges like a lack of technical knowledge, low water quality, and hatching rates, low seed production, and financial constraints, necessitating further examination of political aspects. Moreover, investigating the application of the legislative framework and governance issues meant to promote sustainable agricultural practices and development is another necessity.

2.1. Aquaculture Skills Development

The FAO (2001) recommends that African governments prioritize capacity building for aquaculture development,

focusing on species that align with poverty alleviation, food security, skill development, and job creation goals, with a centralized office for coordination [25]. Krogdahl et al. (2003) point out that Norway has established Centres of Excellence funded by the Norwegian Research Council, focusing on aquaculture, system designs, feed and disease research, and vaccine development, guided by government interventions and sound legislation [39]. Promoting economic integration, human capacity building, information sharing, and technology transfer in aquaculture operations, and fostering partnerships between academia, civil society, government, and industry, is crucial for sustainable aquatic food systems [37, 58]. China's aquaculture institutions offer global partnerships and opportunities for deep understanding, creativity, and rapid change, attracting students and partners from around the world [19].

Few South African universities, including Limpopo, Stellenbosch, and Rhodes, have not integrated aquaculture into their curricula in the past two decades, causing uncertainty in research priorities and expert mix [41]. The Chinese government spent millions developing technology for GIFT tilapia, a genetically improved strain of tilapia [7]. Farmers harvest nearly 2 million tons of GIFT tilapia annually [61]. Noticeably, many fish grown in rural South Africa have poor genotypic and/or phenotypic quality due to a lack of hatchery skills to produce the best seed that can grow in a reasonable amount of time for the entrepreneur to realize his or her investment returns. Relatedly, uncontrolled hatcheries, which are common throughout the country, have the potential to produce fish that grow 40% slower than their wild counterparts [17]. South Africa's aquaculture farm management is a scarce skill, requiring young entrepreneurs to be prepared and trained to manage small-scale farms, crucial for its growth.

2.2. Good Governance and Policy Integration

Governance is critical for accomplishing social, economic, and environmental goals in aquaculture. Governments can help achieve the Sustainable Development Goals by incorporating sustainable aquaculture development into larger food security strategies and leveraging systems thinking and open innovation methodologies [35]. For aquaculture businesses to be self-sustaining, ecologically conscious farming methods and strong corporate leadership and management are essential components of success. Fostering successful aquaculture businesses requires enabling regulations and a supportive business environment [15].

South Africa's water resource management policies are regarded as among the best on the continent [51]. Although innovative, these policies have not been widely implemented, and issues such as fish migration, environmental flows, and river connectivity are not generally addressed in water resource management plans [51].

Most South African rivers have been heavily modified and have reduced ecological functionality [63, 24]. South Africa's estuaries are also in poor condition. Many KwaZulu-Natal's open/closed estuaries now have extended periods of mouth closure, most likely because of excessive water abstraction [53]. Human impacts typically increase down the river continuum, and the headwaters of the KwaZulu-Natal River are in better ecological condition than the lowland reaches [4]. Indeed, estuaries in KwaZulu-Natal are deteriorating due to decreased freshwater inputs and increased pollution [53]. Approximately 19% of KwaZulu-Natal's estuaries are in poor condition [66]. Additionally, the resulting prolonged closures of estuaries have an impact on their biodiversity and the life cycles of species that rely on connectivity between freshwater and marine ecosystems [53]. *Anguilla bicolor* is a coastal species that may have been lost from much of its range since the 1950s, as it has only recently been discovered in the Matigulu, Mfolozi, and Mlalazi catchments. Despite their critical role in maintaining healthy and sustainable ecosystems, riverine fish migrations appear to be widely ignored in South Africa [51].

Climate change is posing a growing danger to the aquaculture industry [42]. South Africa has over 4,000 formal dams with impoundments and over 1,400 gauging weirs [51]. Observably, climate change is likely to increase the inter-annual variability of rainfall in South Africa, with extremely wet periods and more intense droughts [40].

The formulation of legal fishing rights for small-scale fishers is a critical issue for the development and formalization of a small-scale fisheries sector [14]. Most of the current permit systems that allow communities to fish on dams are based on recreational fishing permits. One of the most important issues addressed by the Inland Fisheries Policy will be determining and legalizing the types of fishing rights as well as the regulations and fishing techniques that should govern such rights. Determining the fishing rights must therefore consider the current harvesting rates of both 'informal' small-scale fishers and recreational anglers (particularly those who take the fish away for personal consumption or sale). Most waterbodies have limited room for growth according to current data and models [14, 44]. It is also essential that open access be prohibited, and that the fishing rights be based on limiting fishing efforts and output volume. Other African countries' experiences have equally shown that open access and unlimited output lead to overcapitalization and eventually overexploitation of small-scale fisheries.

Meanwhile, policy interventions should aim to conduct a cost-benefit analysis of the development of long chains, such as cold chains, to ensure that fish reach inland regions, particularly those far from coastal and aquaculture production zones. The policy is based on the principles of inclusivity, inland fisheries as an economic sub-sector, equitable access to freshwater aquatic resources, transformation, and sustainable development. The policy likewise takes an ecosystem approach to fisheries, embraces the precautionary principle approach, encourages the value chain approach, and supports good governance. Brugere et al. (2021) assert that appropriate

benefit-sharing mechanisms must be implemented in the pursuit of greater equity to close the people-policy gap in aquaculture and that policy coherence is essential [16]. This is a necessary condition for this to occur.

Furthermore, the recent COVID-19 epidemic has shown the sector's lack of readiness for sudden shocks that severely disrupt value chain activities. Strategies to create resilience, adaptation, and mitigation measures, especially for vulnerable small-scale farmers, are still largely absent [42]. Likewise, the market-driven, rural fish farming that is being practiced in many South African regions should be supported by the aquaculture development strategy [42]. Through crop diversity, enhanced livelihoods and nutrition, higher income, and better water resource management, initiatives can also significantly contribute to increased farm resilience. Though they frequently lack the resources to expand their output market and seize new chances, rural farmers are typically well-integrated into larger farming landscapes [42]. Strategies should also promote the emergence of new entrants and entrepreneurs, youth, and women.

One of the most crucial aspects of these strategies is encouraging decent work in aquaculture, as it can result in more efficient and responsible management of the industry, better livelihoods, food security, and nutrition for workers and the communities around them, as well as improved responses to market demands [48]. According to [47], an evaluation of the current administrative and legislative frameworks is necessary to guarantee the efficacy of the institutional arrangements and regulatory processes.

3. Theoretical Framework - Political Economy

A fusion of Political Economy discussions is an ideal strategy to build integrations on sustainable aquaculture development, policies, regulations, and their institutions in the production of economies and markets [12]. Political economy has a major impact on the development of sustainable aquaculture through regulations, rules, and industry-related incentives. According to [41], green labels, lower-interest loans, tax breaks, and other political and economic incentives can help aquaculture systems become sustainable. This demonstrates how economic policies and political choices can encourage ecologically friendly practices in the aquaculture industry. Political Economy asks questions about power, institutions, and agency, such as who benefits or loses from the economic spin-offs of the aquaculture sector, what are the drivers that propagate unsustainable aquaculture practices, and where are the meaningful intervention points that can have the intended effects? Understanding power dynamics is crucial for developing solutions, based on strong government institutions and economic stability, which attract foreign investment.

The political economics perspective focuses on important actor interactions and how these influence resource allocation and project results [8]. This also implies that the practical implications of achieving sustainable aquaculture are dependent on powerful actors such as national governments, large corporations, and institutions that together shape contemporary politics, policy, and markets [5]. Drawing from the PE, the paper has laid out a framework for understanding the environment, ensuring a more equitable distribution of goods and services provided by the oceans [52], important for creating enabling political environments necessary for aquaculture to thrive. This approach is well situated as the organizing frame of sustainable aquaculture, and the characteristics of the political economy approach make it suitable for research framing.

3.1. Understanding Political Economy

According to political economy theories, it is necessary to consider economic, social, and political aspects all at once. The discipline of comparative political economy (CPE) examines variations in national institutions, policies, and economic results [28]. Political stability, effective government policies, and efficient government operations are required. Good leadership principles, including accountability, openness, inclusivity, member consultations and dialogue, and the execution of agreements, must be upheld by the initiatives [1]. It strives to understand why some nations experience greater incomes or economic growth than others, why there are various levels of inequality, and how these connect to variations in the institutions that structure financial systems, welfare regimes, and industrial relations.

While aquaculture can increase resilience by diversifying livelihoods and food systems provide poor households with a sustainable source of income, replace over-fished wild fisheries, and improve health through increased fish consumption, it can also increase inequality and instability by increasing the privatization of shared resources [62, 46]. Integrating aquaculture into rural development necessitates government involvement and support for regional projects to examine aquaculture's impact on poverty alleviation to make better policy decisions [55]. Mario et al. (2018) highlight the impact of policies, regulations, trade agreements, institutional setups, finance, technology, land availability, and local infrastructure on aquaculture and fisheries businesses, promoting collaboration and technology use [43].

3.2. Aquaculture Governance and Legislative Framework

Aquaculture governance is a set of procedures used by jurisdictions to manage resources, promote better public-private ties, and ensure sustainability by balancing environmental, economic, societal, and technological demands, according to [35]. Globally, policies regarding aquaculture have predominantly emphasized safeguarding the environment and re-

sources, resulting in excessive regulation and impeded expansion of the industry in numerous developed nations [2, 6]. According to Hishamunda and Varadi, the aquaculture industry's excellent governance is based on four main principles [33, 64]:

i. Efficient and productive—executing the necessary tasks with excellence.
ii. Equity: Needs to take future generations' safety and the needs of many current generations.
iii. Accountability: This describes how much public officials must answer to the public for their deeds.
iv. Predictability of the rule of law: decisions are made in a clear, open, and transparent manner, and laws and regulations are applied fairly and consistently.

Government regulations significantly influence aquaculture growth, species types, technologies, and infrastructure distribution. Four main policy areas include trade policies, aquaculture value chains, infrastructure investment, research and development, and environmental protection [29]. Public investments in infrastructure and research and development are crucial for aquaculture innovation and growth in all producing nations, focusing on genetic improvements, fish nutrition, and health. The legislation that governs the aquaculture and fisheries business is diverse and complex, as numerous elements influence its regulation [31]. Public investments in infrastructure and research and development are crucial for aquaculture innovation and growth in all producing nations, focusing on genetic improvements, fish nutrition, and health.

Grimett Suggests the following steps required before the aquaculture may be developed [31]: Before the sector can be developed: i) the development of an Aquaculture Bill, which streamlines many of the time-consuming, fragmented processes. ii) The development of a single point for aquaculture development to streamline permit applications, compliance monitoring, and output testing. iii) Proper training of all those who want to participate in aquaculture development. This will mean that a degree or diploma in aquaculture studies be taught through the various tertiary institutions. A bursary or support initiative for students from previously disadvantaged backgrounds who aspire to enter the sector may be required. iv) Awareness of the complexity of aquaculture and the different legislative compliances. This can be done through workshops, seminars etc. v) proper marine spatial planning and thorough market research to be done on the feasibility of farming different fish crops, for both the local and domestic markets.

According to Jolly, most countries have regulatory frameworks for aquaculture, with Ghana having a separate Ministry of Fisheries and Aquaculture development [35]. South Africa's Department of Forestry, Fisheries and Environment (DFFE) oversees aquaculture, while most other ministries oversee forestry, livestock, or agriculture. The below is South Africa’s legislative framework that governs aquaculture development.

3.2.1. National Aquaculture Framework

The National Aquaculture Strategic Framework (NASF) was developed in 2012 as a road map for the aquaculture industry's long-term development, taking into account South Africa's current position in global aquaculture production, challenges in creating an enabling environment for aquaculture development, national food security, and wealth and job creation [3].

The current NASF policy of DEFF aims to achieve the following objectives: (i) Encourage responsible and sustainable aquaculture development that is globally competitive (ii) Facilitate and support the optimal growth of the aquaculture industry to foster economic growth, and food security and wealth creation (iii) Encourage private sector participation through the provision of required support services (iv) Investment in research and development to aid industry growth, diversification and sustainable production (v) Promote sustainable aquaculture development from a macroeconomic perspective (vi) Promote adaptive aquaculture management that can promote innovations, data collection and knowledge transfer (vii) Promote good governance for the full development of the aquaculture industry under a supportive regulatory framework. The objectives above include doubling aquaculture production by 2020, promoting commercial and small-scale producers, and expanding the aquaculture sector through a value-chain approach [3]. The aquaculture strategy aims to promote both commercial and small-scale developing producers, as well as to expand the aquaculture sector through a value-chain approach.

3.2.2. The National Water Act No 36 of 1998

Primarily, the National Water Act, No. 36 of 1998, governs the usage of water bodies for aquaculture. Water use must be sustainable, and the Act assigns the government the duty to guarantee equitable access to and distribution of water. The National Water Act no 36 of 1998 is significant because it gives the national government authority over all national water. According to the Act's provision 3(3), the Minister, on behalf of the National government, is authorized to control, manage, and restrict the use of all water resources within the Republic. Aquaculture and mariculture operations related to water were not covered by the Act; however, later legislation permitting aquaculture overrides the restrictions imposed by this Act. The National Water Amendment Bill Act No. 27 of 2014 made certain changes to this Act. From the aforementioned provision, it can only be assumed that even though aquaculture has not been mentioned as a feasible use of national water, such water usage cannot be granted as a bona fide right and will instead need to be assessed under NEMA and its regulatory structures due to the potential negative environmental impacts of aquaculture development. This provision's second effect is that it would take away the ability to act for all other environmental regulating agencies that operate outside of the NEMA Framework. This amendment

ensured that environmental control in South Africa was under the national government by putting all environmental concerns under NEMA, giving clarity and assurance. According to The National Water Act (36 of 1998c), the common consensus is that rather than creating an atmosphere that is conducive to the sector's growth, the too-restrictive laws and regulatory structure may be impeding it.

3.2.3. The Marine Living Resources Act 18 of 1998

The Constitution of the Republic of South Africa (1996) and the Marine Living Resource Acts are essential in the governance of the aquaculture sub-sector as they have a direct impact public socially and economically. The Marine Living Resources Act's Section 3 addressed how the Act should be applied, stating that it should be applied to all individuals, both foreign and South African, as well as to all fishing vessels and aircraft, including foreign ones, on, in, or in the airspace above South African waters. It also covered fishing operations conducted in, on, or in the airspace above waters outside of South African territorial seas, including waterways governed by other states, using indigenous fishing boats or South African aircraft. Fish located in South African interior waters were exempt from its application. Since the national government is in charge of the marine environment, any provincial plans that could have an impact on it in any manner need to coordinate with the national government and take into account plans for the development and protection of future national fisheries. Any actions that have a detrimental effect on the mission of a marine protected area have been outlawed since their creation. It makes sense that these protected zones cannot be used for fishing, aquaculture, or mariculture. If fishing and mariculture are permitted, they must also fall within the minister's purview.

Environmental laws and regulations in South Africa that affect the aquaculture industry are intricate and challenging for the industry to follow. The laws and regulations do not satisfy producers for a variety of reasons, including disjointed bureaucracy and ineffective permitting procedures. The institutional arrangements, such as ineffective permitting, protracted strategic environmental assessments, and environmental impact assessment (EIA) procedures, have not done much to assist producers in adhering to the law [13]. According to the Act's clauses 13 and 18, anyone must ask for permission before engaging in commercial, subsistence, mariculture, fishing settlement, or recreational fishing. The Marine Living Resource Act (18 of 1998a) permits the Minister to further demand that someone carry out the EIA that the applicant has submitted.

3.2.4. Small-Scale Fishers Policy

In South Africa, small-scale fishers and fishing communities have long suffered from marginalization and discrimination. The Marine Living Resources Act 18 of 1998 did not cater to small-scale fishers and artisanal fishers. The Small-scale fisheries policy provided recognition of fishing communities. The Small Scale Fisheries policy addresses and highlights the vulnerability of small-scale fishers as well as the marginalization faced by many in the sector, including women, youth, and migrant fishers, however, it lacks initiatives that could assist in minimizing vulnerability and marginalization in the sector [9]. South Africa's small-scale fisheries policy addresses some, but not all, issues faced by local fishermen. The policy includes a requirement for community monitors but does not specify their powers to arrest or distribute fines. Since the SSF Policy was first implemented in 2012, the socio-political landscape has changed, and some authors have called for a review and expansion of the existing regulatory framework [57].

There are numerous variables at play when examining poverty issues in small-scale fisheries. Small-scale fishermen and the communities that depend on them for their livelihoods are susceptible to a variety of shocks and trends that could put them in danger of poverty. These include depletion of resources, changes in the climate, and fluctuations in the market, hazardous working conditions, health issues, and isolation from other places. Small-scale fishermen and fishing communities, or portions thereof, are frequently subjected to social exclusion and marginalization, which significantly lowers their capacity to improve their lot in life, including by fighting for better access to resources or even the realization of fundamental human rights. The DEFF is required by the SSF to educate communities on several significant issues. These consist of informational campaigns using media like radio and newspapers, or community workshops [22]. According to DAFF 2016a: regs. 2(6) (a) and (d), the department must help fishing communities register as cooperatives and apply for fishing rights. Management plans also need to outline the training and support requirements, as per the regulations 4(4) (c) (iii)).

The current regulatory regime creates many impediments to the transfer of fishing rights to small-scale fishermen. Fishing rights are often denied to vulnerable small-scale fishers due to stringent requirements such as age, community, nationality, and fishing practices. This reflects a power imbalance in the fishing sector, favouring the large commercial and recreational sectors.

According to McCafferty, small-scale fisheries in inland regions are underdeveloped [44]. This has led to missed opportunities for livelihood development [14]. However, inland fisheries have the potential to contribute to the National Development Plan - 2030 goals of eliminating poverty and reducing inequality, especially in developing the rural economy and social protection through food security [49]. In 2016, South Africa launched a consultative process to develop an inland fishery policy that aligns with its development goals. This resulted in the development of a National Freshwater (Inland) Wild Capture Fisheries Policy. The policy on inland fisheries emphasizes the potential "socio-economic benefits," which encompass employment opportunities, rural liveli-

hoods, food security, and economic growth through small-scale fishing. Recreational fishing value chains [21].

Some of the major challenges identified with the legislative framework include a lack of alignment and policy coherence, limited implementation, a lack of coordination and clarity on how policies will be implemented collaboratively, and a lack of public sector capacity and funding [10]. When compared to other food production sectors, the aquaculture sector is over-regulated, which is one of the key anti-enabling conditions impeding aquaculture expansion in South Africa. Because of fragmented policies from various tiers of government departments, a prospective aquaculture venture will require at least thirteen different permits/licenses from various government departments to operate, which are issued in a cascading order, extending the period of permit issuance unnecessarily. As a result of the complex and unclear regulatory environment, potential aquaculture ventures face difficulties in attracting investment.

3.2.5. Promotion of the Aquaculture Sector

South Africa's aquaculture product marketing system was designed by primary processors. These companies created their cold storage facilities and supply network primarily to assist their core aquaculture operations, but there are also fully integrated marketing and merchandising organizations that handle retail distribution [20, 21]. South Africa's aquaculture business is adequately prepared in terms of institutions and programs to meet international product health requirements. South Africa does not currently export shellfish goods to the European Union (EU); nevertheless, the South African Shellfish Monitoring Programme has been established under the supervision of the South African Bureau (SABS), which will pave the way for EU certification of shellfish exports. The South African Bureau of Standards (SABS) is recognized as the competent entity for auditing the application of standards for products exported to the EU and other nations. These standards mostly include the HACCP (Hazard Analysis Critical Control Point) and ISO standards. The SABS is also actively involved in the issuance of "health certificates" for products like abalone that are shipped to Asian countries. In the case of aquaculture, the SABS certifies live, fresh, frozen, and canned products, whereas the HACCP method encompasses the complete production process from the live production tank/cage to the processing factory and buyer [27].

3.2.6. Economic Results of Aquaculture Development

Through initiatives like Operation Phakisa: Ocean's Economy (Aquaculture work stream), the South African government and private sector invested more than R1.2 billion in the aquaculture industry. Among the 35 catalytic projects that were funded, 28 of them involved Small, Medium, and Micro-sized Enterprises (SMMEs). Operation Phakisa aims to within the maritime context, aims to promote entrepreneurship development and the establishment of maritime SMMEs and is regarded as a high-impact sector with the potential to contribute to the country's economic development. Twelve of these were either new or expanded Saldanha Bay bivalve shellfish (oyster and mussel) production operations [21]. In 2018, 6366 tons of freshwater and marine aquaculture were produced, valued at R1.12 billion [22].

4. Research Methodology

This article employed a qualitative approach. This paper was based on an ontology and epistemology that postulates that knowledge and truth are based on the subjective meanings and experiences of the study participants. This paper used the purposive sampling technique and employed the exploratory and descriptive case study designs to generate new insights, identify patterns, and explore potential relationships or factors that may influence the phenomenon under investigation. This paper purposively sampled and interviewed 12 representatives and institutional participants who are key role players in the aquaculture sector, such as the national government, provincial government, local government officials, sector representatives, industry bodies, farmers, and research institutions offering aquaculture-related courses through semi-structured interviews to collect the data. The data was analysed using thematic analysis and content analysis.

5. Findings and Discussion

5.1. Policy and Legislative Framework Support a Sustainable Aquaculture Development

South Africa lacks dedicated legislation for aquaculture development, despite policies promoting commercial and small-scale producers. However, these policies are bureaucratic and difficult to follow. Key departments need to review their policies to remain relevant and pro-aquaculture. The complex environmental laws and regulatory structure may hinder the sector's growth. The comments below are evident:

> *In general, TKZN does support the development through policy and legislative framework, but at the same time, most coastal areas are protected against aquaculture development. The key department and entities that needs to review some of their policies and check if they are still relevant and pro-aquaculture development include DWS, Umgeni, and Ezemvelo Wildlife (Thulani Zungu, 2023).*
>
> *Currently, there is no dedicated piece of legislation to support aquaculture development in South Africa. There is the Marine Living Resources Act for Marine Aquaculture and ~36 pieces of legislation managing the Fresh Water sector. The former DAFF developed the Aquaculture Development Bill, which it followed all due processes and placed the Bill before the 5th Administration of Parliament,*

which took no action for 1 year and 7 months. The Bill was then lapsed and had to be revived by the current Minister of DFFE. The Minister then withdrew the Bill and requested further engagement and realignment of the Bill to the current Departmental Mandate. The Bill has been supported by the Cabinet Committee to be tabled for the full Cabinet (David Reed, 2023).

Our policy should reduce nature invasion policies for sustainable aquaculture practices (Sam Ngidi, 2023).

I find that sometimes when we have policy initiatives, we always put the policy initiatives before we look at the legislation and the land as policy initiatives and we have to marry the two because yes, we can push a budget, we can get the communities very excited and then when they're faced with costs for EIAs or costs for your different licenses and your permits and they're stuck with three or four months for our bureaucracy when they push a permit through, they are faced with those headaches.

That's the policy makers. And you know, these are things we have to really, really take into account (Jennifer Craig, 2023).

To be candid, the policies appear supportive for sustainable aquaculture development on paper but in reality it is bureaucratic and difficult (Patrick Omotoso, 2023).

We haven't seen a policy as yet we are still to be work-shopped as municipal officials and asked questions and push towards ensuring that a policy and framework does create a conducive environment for aquaculture development more especially for communities along the coast (Thulani Zungu, 2023).

It will provide a framework for aquaculture entrepreneurs on how to best approach aquaculture development with minimal effects on the physical environment. A policy and framework are in place that seek to create that harmony. We need to harness opportunities within oceans economy. We cannot have a policy that says this area is protected, end of story, we have people that existed, after a decade or two decades, you just say it's protected, a mitigating strategy. We want everyone in the mainstream economy. If it can be developed in that manner (Siboniso Shange, 2023).

In addition to the sentiments shared above it can also be noted that the Small Scale Fisheries policy addresses and highlights the vulnerability of small-scale fishers as well as the marginalization faced by many in the sector, including women, youth and migrant fishers, however, it lacks initiatives that could assist in minimizing vulnerability and marginalization in the sector [9]. South Africa's aquaculture development is hindered by coastal protections, outdated policies, and a lack of dedicated legislation. Current policies are bureaucratic and high-cost, limiting community involvement and sustainable growth. To fully realize aquaculture's potential, policy alignment, reduced bureaucratic hurdles, and realistic financial support are needed.

5.2. Aquaculture Exports and International Markets

The aquaculture exports and opportunities in the international markets do exist, but require an improvement in terms of production, particularly in KZN. The participants have demonstrated their understanding, and their views are articulated below:

Yes, there is access to export and international market; however, we are still grappling with extremely low production output that is not sufficient for local consumption let alone export (Patrick Omotoso, 2023).

KZN is part of South Africa, so there are agreements that exist within the continent and international but the main issue is that KZN lacks competency on the sector (Thulani Zungu, 2023).

This can be done by researching the international marketing needs and secure enough farming space to grow the required product in order meet the international market needs (Sipho Gumede, 2023).

Market access for export products/services can leverage the international (bilateral and multilateral) agreements that South Africa has (the DTIC and DIRCO) (Sizwe Buthelezi, 2023).

We have huge access since we have farms in South Africa that are ranked third abroad for abalone. South Africa has about 11 farms and if all farms can work together with those in other provinces, we can progress and have access to international markets (Sam Ngidi, 2023).

We do have access through RIDBZ and the routes that link both Richards Bay Harbor and King Shaka Airport, which will make it easier for exports and imports (Sipho Gumede, 2023).

TIKZN does have an Export Promotion sector that can play a significant role in bringing international markets (Thulani Zungu, 2023)

We need to produce high-quality species and the market can be penetrated.

Since we have farms in other parts of the country that are already exporting, we can seek knowledge and links on how to access the international markets (Sam Ngidi, 2023).

We do have access to export and international Trade and Investment KZN. Through TIKZN. There is No support in place for entrepreneurs to explore oceans economy (Siboniso Shange, 2023).

Because of the red tape and not really. Land use zone schemes does create to venture into activities. The policy does not allow for such. (Siboniso Shange, 2023).

KZN faces challenges in meeting local demand and export needs due to low production output and a lack of aquaculture expertise. Collaboration among farms and leveraging insights from successful exporters is crucial for international market access, despite red tape and restrictive land use policies.

5.3. Land Zoning for Aquaculture Development in King Cetshwayo District Municipality

Hutchings explained that Aquaculture Development Zones (ADZs) aim to boost investor confidence by offering investment-ready platforms with strategic environmental clearances and management policies, eliminating lengthy approval processes [34]. The question probed the participant on whether the KCDM has enough land zoned and water for aquaculture development was articulated in the responses below;

Land use planning is a local government function, and aquaculture can form part of Agriculture or Industrial, dependent on system and scale. This is also not a fixed value, as the municipality can be approached with an application to change land use (David Reed, 2023).

KCDM has enough land but it is not zoned or invested for aquaculture practices, it is only for entertainment and tourism. Mthunzini has about a 19.35 km stretch, and there is no designation for aquaculture development (Sam Ngidi, 2023).

Yes, it does have enough land and water since it is rich in oceans and has enough rivers in rural areas (Sipho Gumede, 2023).

The growth of the aquaculture sector requires a designated area, the National Aquaculture Policy Framework for South Africa (2013) is supported by the development of the Aquaculture Development Zone (ADZ).

In terms of legislation, every time you have an Aquaculture Development Zone (ADZ), because that is the way DFFE wants to go, they are trying to identify aquaculture development zones. One of the mandates or prerequisites of an aquaculture development zone is that it must not negatively impact developments or the environment within an area. So because you have, like most of the areas, either protected areas or restricted areas in some ways, they probably would not want to put an ADZ in the middle of those regions just for the very reason that you have extremely sensitive sand dunes and you have your nature reserves. And so there would be negative impacts on those areas (Jennifer Craig, 2023).

There is an ADZ around Amatikulu however, there is not enough freshwater for conventional commercial aquaculture development due to the competitive demand for limited freshwater resources available (Patrick Omotoso, 2023).

The City of uMhlathuze does have enough water but does not have enough land zoned for aquaculture, it only lands within specific areas. But will not find Inkosi Mkhwanazi land zoned for aquaculture development that is one big issue with me. Our land use scheme seems to be a continuation of the apartheid spatial planning approach because, how is it that a limited piece like UVS land is the only piece of land zoned for agriculture? Land within traditional authority is zoned as having less potential. There is a big discrepancy in our current policy they seem to be in an approach of maintaining the status quo and not an approach of inclusivity (Siboniso Shange, 2023).

Siboniso Shange and Nyikahadzoi argue that South Africa's black population has not significantly benefited from policy interventions addressing economic inequality and colonialism legacy. Aquaculture expansion and governance are crucial for sustainable development, but political dynamics continue to influence resource distribution, despite redistribution [50].

Aquaculture Development Zones require enough water and the required temperature. If you're not looking at aquaculture per se, then maybe you can look at your cage farming within your dams within the area for example, Eshowe Phobane Dam can be looked at closely as a way of developing communities within the vicinity of rivers and dams. (Jennifer Craig, 2023).

You can't just put an aquaculture development zone where the impacts, risks, benefits, and percentages are skewed negatively in terms of the positive (Jennifer Craig, 2023)

Participants agreed that Aquaculture Development Zones (ADZs) are necessary for local economic benefits, job creation, and environmental sustainability. They suggested considering rivers and dams, aligning with the EE theory. Aquaculture zones require adequate water and suitable temperatures, benefiting nearby communities.

5.4. Sea Space for Aquaculture in KCDM

The responses from participants highlight the foundational strengths of KCDM for aquaculture, particularly the availability of clean seawater. However, the limited sheltered bays pose a significant challenge. This suggests a need for innovative solutions to utilize the available coastline effectively and sustainably. The participants expressed their views as follows;

No, there are very few sheltered bays that are suitable for aquaculture, and they are mainly used for shipping and maritime activities. South Africa generally has a very high-energy coastline characterized by strong waves, therefore not suitable for aquaculture.

While aquaculture is critical for development, Soto highlight sea level rise as a challenge for aquaculture development [59]. Gentry argues for potential expansion in coastal and open oceans, emphasizing a 17 km coastline, urban/rural settings, and an abundant labour pool [30]. The participants articulated their views as follows;

KCDM has value proposition elements (17km coastline, with urban and rural, abundant labour pool) that can enable the successful implementation of aquaculture (Sizwe Buthelezi, 2023)

It is sufficient we have a lot of clean quality sea water and only one harbour that can pollute the water. If you can take 5 kilometers of seawater for aquaculture in Mthunzini, it can make a huge difference (Sam Ngidi, 2023).

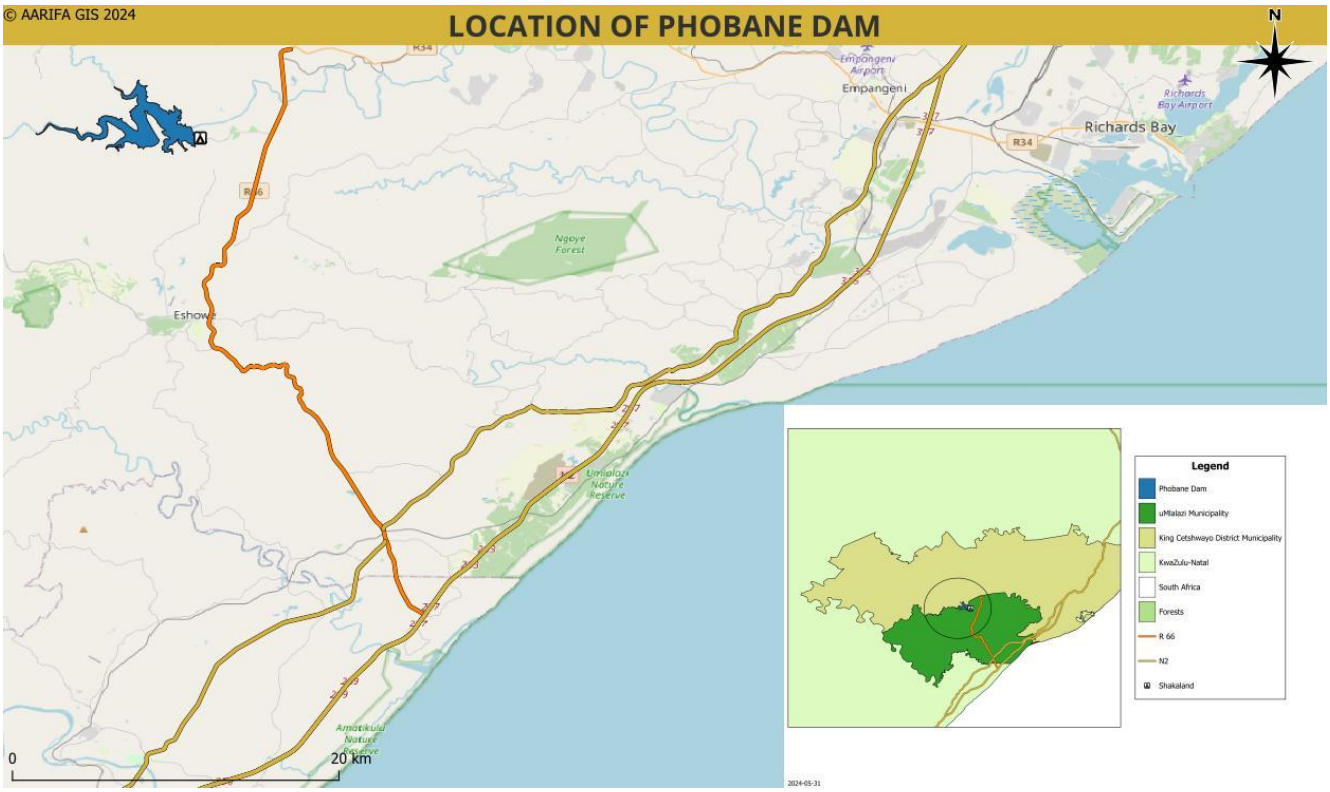
The perspective by Ngidi focuses on the potential impact of a relatively small sea space allocation, emphasizing the importance of water quality. This suggests that targeted and well-managed aquaculture zones could yield substantial ben-

efits, provided pollution risks are managed.

The failure of previous aquaculture projects in KCDM highlights the need for thorough EIAs and strict adherence to regulations. Future projects should focus on sustainability and compliance, utilizing the municipality's resources for a sustainable aquaculture industry. Stringent marine protection policies are designed to safeguard marine ecosystems from potential harm caused by industrial activities, including aquaculture. Also what emerged is the failure of the dusky Kob project due to environmental issues, indicates that the implementation of aquaculture in KCDM requires careful consideration of local environmental conditions. The following views were shared by one of the participants;

Due to marine protection policies that are in place, it is very difficult to tell. For example, the dusky Kob sea cage project failed in Richard's Bay Port due to some environmental issues and another commercial aquaculture at Mthuzini (Zini Farm) took a knock due to issues (Thulani Zungu, 2023).

Based on the above data, it can be said that South Africa's coastline, characterized by strong waves and few sheltered bays, presents significant obstacles for aquaculture due to competition with shipping and maritime activities. Nevertheless, KCDM's 17 km coastline, coupled with urban and rural areas and a substantial labor pool, offers potential for successful aquaculture ventures. Although clean seawater is abundant, leveraging a 5-kilometer area off Mthunzini could be highly beneficial. However, marine protection policies and previous environmental challenges such as the failure of the dusky Kob sea cage project in Richards Bay and issues with Zini Farm in Mthunzini pose difficulties for developing aquaculture in the region. The map below shows Phobane Dam suggested by a participant although it is on land it could be used as well as an alternative.



Source: Author's construct (2024)

Figure 1. *Phobane Dam (uMlalazi Local Municipality).*

5.5. Institutions That Offer Aquaculture Courses

The participants, when asked about the institutions that offer aquaculture, seemed to be unsure. Many of them mentioned the University of Zululand; however, only the theoretical part of it and this is because there is not much aquaculture within the district and institutions like Makatini Research Station, Ethekwini Agro-processing hub are far. This is also very alarming.

The responses are as follows:

The Provincial Department of Agriculture has the Makatini Research Station, which is located close to Jozini Dam. UKZN does research in Aquaponics. Ethekweni has a Agro-Hub. But for KCDM specifically, I don't know of

any. One has to ask if there is a mandate and appetite for KCDM to have a higher research institution for Aquaculture (David Reed, 2023).

I think partially we do remember that - the University of Zululand has a Department of Zoology Unit and Agriculture, where you only find Lecturers that provide lectures on aquaculture, but I don't think they have no capacity to focus on the business side of aquaculture. As a municipality, we did approach the University of Zululand where you find aquaponics projects (Siboniso Shange, 2023).

UniZulu does offer aqua and marine-related qualifications. Mfolozi TVET seeks to introduce boat-building qualifications in the aqua/marine sector (Sizwe Buthelezi, 2023).

The University of Zululand provides more theory than practicals and KCDM does not have farms and is forced to move to Eastern Cape and Western Cape.

Yes, UNIZUL is involved in the sector but there may be a need to strengthen their involvement and also encourage community outreach programs so they partner with the communities and provide short courses on the sector and awareness in general of the sector (Thulani Zungu, 2023).

The above data demonstrate that the Provincial Department of Agriculture operates the Makatini Research Station near Jozini Dam, and UKZN conducts aquaponics research, while Ethekwini hosts an Agro-Hub. However, KCDM lacks a dedicated research institution for aquaculture. The University of Zululand provides theoretical courses in aquaculture and marine studies but does not emphasize practical training or the business aspects. Mfolozi TVET plans to introduce a boat-building qualification related to the aqua/marine sector. Currently, there are no undergraduate aquaculture programs available, highlighting the need for enhanced involvement from UNIZUL, including community outreach and short courses to support local aquaculture development. KCDM's aquaculture potential is acknowledged, but gaps in educational infrastructure, practical training, and community involvement need to be addressed for sustainable economic growth.

5.6. Geographic Concentrations Suitable for Aquaculture Development in the KCDM

The table below shows geographic concentrations suitable for aquaculture in the KCDM according to the information obtained from participants, although there is no study conducted on the aquaculture producers are making a living and practicing aquaculture, and as such the information provided is tabled below:

Table 1. *Geographic concentrations suitable for Aquaculture in the KCDM.*

UMlalazi Municipality	City of uMhlathuze	uMfolozi Municipality
Mthunzini	Richards Bay Ocean	Madlanzini
Gingindlovu	Port Durnford Ocean	uMzingazi
Phobane Lake	uMhlathuze River	
uMlalazi River	Empangeni River	
uMlalazi Coastline	Emangezi River	
	Kwa-Dube Area	
	Insuze River	
	Esikhaleni	

Source: Fieldwork (2024)

I don't think there is anyone in SA who will be able to answer this question. This would fall in the scope of doing an Aquaculture Strategic Environmental Assessment for KCDM. No one has done this at a district level (David Reed, 2023).

Empangeni, Dlangezwa, Port Dunford, Esikhaleni, Enseleni, Madlanzini, uMzingazi, uMlalazi LM, Gingindlovu area (Thulani Zungu, 2023)

Both the offshore and inshore in lakes and sea since there is enough space and logistics (Sam Ngidi, 2023)

It is evident from the data above that there is no Aquaculture Strategic Environmental.

Assessment (SEA) conducted at the district level for KCDM, which limits our ability to address specific aquaculture development questions. Such an assessment is essential for evaluating the environmental impacts and potential opportunities for aquaculture in the region (David Reed, 2023).

6. Conclusion

South Africa does not have dedicated legislation that sup-

ports aquaculture development; however does have policies and strategies that aim to promote both commercial and small-scale developing producers, as well as to expand the aquaculture sector through a value-chain approach. The supportive government policies and incentives tailored to promote sustainable practices are essential for creating an enabling environment for aquaculture development. The findings further revealed that the existing regulatory framework does not create an atmosphere that is conducive to the growth of the sector, and the laws are restrictive and impeded by the regulatory structure. It was also revealed that international and export markets do exist, but require significant improvement in terms of production.

Land zoning for aquaculture is important for the growth of the sector. A designated area, such as ADZs, is critical for enhancing investor confidence and, thus, is supported by the National Policy Framework for South Africa (2013). The ADZs are necessary to give economic benefits to the local communities by creating jobs and must not, therefore, negatively impact the environment. The space in the sea is occupied and used for maritime and harbour activities, however, coastal areas and open spaces should be considered for aquaculture. The University of Zululand emerged as one of the institutions that offer aquaculture, however, only the theoretical part of it, and other establishments are unfortunately very far from the KCDM people.

Abbreviations

ADZ	Aquaculture Development Zone
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
KCDM	King Cetshwayo District Municipality
UNIZULU	University of Zululand
SABS	South African Bureau of Standards
SMMEs	Small, Medium, and Micro-sized Enterprises
HACCP	Hazard Analysis Critical Control Point

Author Contributions

Khonzile Mthiyane is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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