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CHALLENGES FACING EMERGING AQUACULTURE ENTREPRENEURS IN SOUTH AFRICA AND POSSIBLE SOLUTIONS

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ABSTRACT

Despite aquaculture being hailed as the fastest growing farming sector in the world, South African aquaculture is still lagging behind. This article aims to highlight challenges (mostly beyond their control) that South Africa's emerging aquaculture entrepreneurs have to endure in order to find a breakthrough into the industry. Availability of necessary resources such as land, water, infrastructure, financial support and access to markets, as well as crime are among challenges faced by these entrepreneurs on a daily basis. Limited human resources in capacity building, skills and aquaculture expertise also hinders the development and expansion of aquaculture in South Africa. Complex legislation governing aquaculture further limits the development of this sector to prospective investors. Fish and machinery theft in fish farms has an adverse effect, which had resulted in many enterprises closing down in recent years. South Africa is not a traditional fish-eating nation and this phenomenon has seen many emerging entrepreneurs struggling to locally commercialize their produce. It is well known that fish consumption provides human nutrition with essential nutrients necessary for normal body function. Thus, aquaculture has the potential to contribute to food and nutrition security and alleviate poverty in rural communities. However, plenty of initiatives need to be developed by government and the private sector to develop a sustainable aquaculture industry. These initiatives should involve the establishment of an aquaculture friendly legislation that would support emerging aquaculture entrepreneurs. Several financial institutions view aquaculture as a high-risk business, and as a consequence, decline financial support or loan requests from emerging farmers. Focused research as a strategic initiative to develop aquaculture species that would be first priority for local markets is encouraged. This article explores the challenges facing emerging entrepreneurs and suggests possible solutions that might assist in the development of the aquaculture sector in South Africa. We postulate that constructive and regular engagements between the government and private sector is a key to a sustainable and prosperous aquaculture sector in South Africa.

Key words: young entrepreneurs, infrastructure, legislation, finance, land, aquaculture, theft, South Africa

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INTRODUCTION

Even though small in production, the South African freshwater aquaculture started in late 1800, with Rainbow trout (*Oncorhynchus mykiss*) farming being the first. The first fertilised eggs of trout were imported to the country in 1896 and first formulated feed in 1956 [1]. The Western Cape and Mpumalanga provinces are the two major producers of trout, with 950 tonnes recorded in 2010 [2] and 1497 tonnes in 2015 [3]. In terms of marine aquaculture, oyster farming was the first to be initiated in 1673 [1]. However, shellfish abalone (*Haliotis midae*) is by far the largest marine aquaculture subsector in South Africa. This subsector was initiated in the early 1990s in Hermanus in the Overberg region of the Western Cape. The 2015 figures show that 1479 tons of abalone were harvested from 18 abalone farms across the Western Cape [3].

Over the years, more freshwater species such as Mozambique tilapia (*Oreochromis mossambicus*), Nile tilapia (*Oreochromis niloticus*), African catfish (*Clarias gariepinus*), common carp (*Cyprinus carpio*) and a host of ornamental fish (cichlids, cyprinids and livebearers) were introduced to the aquaculture farming sector in South Africa [4, 5, 6, 7]. Most of the freshwater species meant for human consumption are farmed using mud ponds. Aquaculture has been lauded for contributing to the livelihoods of poor communities in Africa [8] through improved food supply, employment and income generation [9]. Although fish provides far less animal protein for global nutrition than terrestrial livestock, communities in Africa and Asia are highly dependent on fish as part of their daily protein source [10]. Fish also provides highly digestible energy and most fish are sources of fat, water soluble vitamins, minerals and essential fatty acids [11]. In the past, aquaculture has immensely contributed towards poverty reduction in poor societies around the world, more especially where it is traditionally practised, for example, China, Vietnam and Indonesia [9].

Even though this farming sector shows some upward growth trends in South Africa, most entrepreneurs or potential investors face multiple constraints. Common and major challenges faced by emerging entrepreneurs, especially the youth and emerging farmers, are access to water, land, technology, production plans, business plans, high transaction costs, as well as the lack of supporting policies and legislation. This article seeks to highlight some of the challenges facing emerging entrepreneurs and suggests possible solutions that might assist in loosening the red tape that currently hampers the development of this farming sector in South Africa.

ACCESS TO FINANCE AND FARM LAND

South African agricultural (aquaculture included) development has a long and well documented history of discrimination based on gender and race [12], which somehow affected the manner in which the land was distributed. Without the ownership of land, young and mostly black entrepreneurs find it hard to penetrate the agricultural sector as a whole, even harder for less known sectors such as aquaculture. Emerging aquaculture entrepreneurs in South Africa require more intensive, co-ordinated institutional support and direct involvement of both the government and the private financial institutions to achieve rapid and sustainable aquaculture development [13]. Financing from the private

sector is slow in South Africa compared to other countries such as China [14]. Many private lenders are sceptical in financing a farming sector that is still trying to cement its place within the South African agricultural sector. This often limits new entrepreneurs' access to credit due to the interest on so-called bankable projects, which are usually highly technical commercial farms. Most handicapped financially are the prospective fish farmers in areas that have poorly developed policy, institutional support and regulatory systems [15].

A key area that has over the years been increasingly overlooked in South Africa for the prospective edible fish farmers is the non-provision of credit due to a lack of sureties and financer trust (back payment commitment and insecure market) – even when a good business plan and skills set record are offered. This financial uncertainty condemns new aquaculture ventures to failure. Moreover, market accessibility and *niche* development are severely limited, leaving uneconomical options such as poor gate sale prices at non-profitable level [14]. It is, therefore, evident that sustainable production stability is dependent on properly financed infrastructure and educated production management, supportively backed by logistics, value chain and established market pillars.

South Africa has a strong financial system comprising five major banks that can provide services to neighbouring countries; however, these institutions have limited experience necessary to evaluate aquaculture business plans, suggesting the need to develop linkages between the aquaculture sector and financial agencies or institutions. This would aid in the procurement of technical specialists that are able to assess aquaculture business proposals, rather than comparing them to traditional livestock or crop farming. Mechanisms to meet collateral needs often required for micro-credit or loans also need to be explored in order to accommodate rural entrepreneurs, who are often left out of formal sources of funding due to stringent requirements. Without an effective funding model for aquaculture, emerging entrepreneurs will continue to have difficulties in successfully playing a meaningful role in the development of the aquaculture sector [16]. The South African national government has in the past few years funded banks such as Development Bank of Southern Africa and the Land Bank, which offer prospective farmers loan opportunities for general agricultural development. However, Sebola [17] lamented the fact that these government funded banks do not seem to benefit emerging entrepreneurs, as they present stringent requirements that so far have resulted in only a few acquiring funding. One of these stringent requirements is audited bank financial statements along with a proven track-record of farming, which in turn forces emerging entrepreneurs to use well-established farmers as front men or women.

The issue of land in South Africa is a sensitive matter, but it is of importance to be highlighted because aquaculture, like any other form of farming practice, requires land resources to maximise production. Black *et al*. [18] suggested that the success of farming in any country is heavily dependent on the availability of infrastructure, in which the land occupies the top spot, yet historically, most black South Africans do not enjoy this privilege. Since the end of the apartheid system and its predecessor colonialism, South Africa is still struggling to adequately distribute agricultural land to black beneficiaries and without this basic infrastructure, most young entrepreneurs will have a limited to no role to play in the development of aquaculture.

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SUPPORTING SOUTH AFRICAN AQUACULTURE: WHO IS IN CHARGE?

Besides financial assistance, the issue of policy and legislative framework remains thorny for young people who wish to pursue fish farming. A popular question that most government officials often encounter and, in most cases, fail to address, is: "who is in charge of aquaculture development in South Africa?". This particular question has plagued the aquaculture sector for many years. Despite being practised formally for many years in South Africa, with well-developed abalone and oyster farms in the Western Cape province, aquaculture is yet to find a one stable department, whether nationally or provincially. As the country's national government changes every five years, freshwater aquaculture policy makers have been housed in the Departments of Agriculture, Land Reform and Rural Development, Fisheries, Nature Conservation and Environmental Affairs, with the Department of Trade and Industry being entrusted in "funding" aquaculture projects.

From afar, it seems as if a lot of initiatives are in place to provide a platform for the growth of the aquaculture sector and yet, the opposite is the reality [19]. Each department has a number of protocols that are supposedly aimed at smoothening aquaculture development. For example, engaging in fish farming requires that one has to acquire water rights from the Department of Water Affairs, which is practically standard and understandable [20]. However, from the same water, the Department of Nature Conservation demands a permit to remove brood-stock fish. A long distance away from Nature Conservation Department [21], the Agriculture Department will require veterinary certificate and biosecurity papers [22]. The Department of Environmental Affairs [23] shall not allow any fish farming to take place, especially for those that aim to produce between 20 and 200 tons of fish before a basic assessment is done. It is important to note that a basic assessment can take up to six months to be completed and reported cases confirm a cost of 10 000 USD [24]. Production units with an annual produce of more than 200 tons requires a detailed Scoping and Environmental Impact Report, which can take up to 12 months at a cost of more than 40 000 USD.

Additionally, the Department of Trade and Industry only funds a project that has all the documentations from all the ministries, accompanied by a feasibility study, which could cost well over 30 000 USD. The provincial rural department would also require prior consultation if tribal land is to be utilised, whereby the local chief would need to approve and provide a go- ahead, which incurs extra cost as well. With all these impediments, aquaculture farming for unfunded emerging entrepreneurs is unattainable. In whatever ministry aquaculture finds itself, the current South African institutional structure remains fraught with long, tedious chains of bureaucracy linking policy makers to potential fish farmers. This long chain of inter-governmental policy and time-consuming interventions often result in the loss of non-optimized financial resources and transfer of important technical information, which creates obstacles between taxpayer funding and the prospective fish farmer. A centralised office (one stop shop) where all these documentations could be acquired need to be put in place to allow the aquaculture sector to develop like it has done in China, Egypt, Norway and many other countries.

The Food and Agriculture Organisation of the United Nations [25] concluded that capacity building should be the first priority of many African governments. With a centralised and well-coordinated office, gaps within the capacity building strategy to map first priorities in terms of aquaculture development can be easily identified. The first gap to be filled would be Research and Development that would focus on species that fit the country's main objective of poverty alleviation, food security, skills development and job creation.

The current situation in South Africa is that abalone culture is currently leading the aquaculture marine subsector and is only meant for overseas markets [26]; there, it falls short of covering the basics of food security. A centralised office would be able to find means to generate funding and funding models from which entrepreneurs could benefit. Brummett *et al*. [27] acknowledged that there are many pressing issues within the African continent, with many governments prioritising healthcare, education and other critical social services over aquaculture, although most governments can afford to spare some resources in promoting aquaculture. The authors further highlighted that a comprehensive approach to government leadership is probably not feasible now and most governments have to limit themselves to the general policies such as "creating a conducive environment for aquaculture as a means of poverty alleviation and food security". This policy has the potential to be flexible, thereby creating an environment where foreign donors and international development agencies can come in on behalf of government. Most of these foreign interventions may have meaningful and sustainable contributions to the African continent. Lazard *et al*. [28] has long suggested that Africa's development models that allocate resources to government as a prime facilitator and transfer the role of motivator to the private sector would produce better results in securing a bigger space for aquaculture on the continent.

As highlighted above, shortage of realistic government legislation that governs aquaculture limits the growth of this promising farming sector in South Africa and as such, increases uncertainty for entrepreneurs. Large and well established investors can negotiate with the national government over aquaculture permits and access to water and land resources, while small-scale entrepreneurs are obliged to foster a working relationship with traditional local authorities for land and water [28]. The practice by local chiefs to allow outsiders to commission projects is usually popular, as most of the traditional leaders would like to see development of unused resources. However, in many areas of South Africa, once an investment or development becomes profitable, conflicts emerge within the communities, as more residents feel entitled to a higher personal share of the profits and eventually it is the same project that ultimately suffers and collapses. This usually happens because of a lack of a policy (national or provincial) to regulate profit sharing/distribution in economically viable "community projects".

SHORTAGE OF TECHNICAL AND MANAGEMENT SKILLS IN AQUACULTURE

Unlike livestock farming, which has developed the best breeding techniques, feed formulations and have an abundance of trained veterinarians and animal health technicians, the South African aquaculture sector still lacks in these categories [29].

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Countries such as Norway have developed many Centres of Excellence that are fully funded by the Research Council of Norway to focus entirely on aquaculture, system designs, feed and disease research and vaccine developments [30]. These are guided by well-planned government interventions that focus on capacity building and sound legislation that has incorporated aquaculture as a national food production initiative [30]. Such initiatives make it easier for entrepreneurs to enter the aquaculture environment.

Over the past two decades, few South African universities, namely: University of Limpopo, Stellenbosch University and Rhodes University have introduced aquaculture into their syllabus. However, there is still no consensus between these institutions and government on the research priorities to develop aquaculture. This makes it difficult for investors and entrepreneurs to find a good blend of local experts to grow their enterprises. The Chinese government invested millions of Yuan in developing the best technology that saw cross- breeding of Nile tilapia (*Oreochromis niloticus*) females with Blue tilapia (*O. aureus*) males to produce genetically improved tilapia strain, now famously known as GIFT tilapia [31]. Annually, Chinese farmers record almost 2 million tons of GIFT tilapia harvest [32]. However, many fish grown in rural South Africa are of poor genotypic and/or phenotypic quality. This stems from lack of hatchery skills to produce the best seed that may grow within a reasonable time for the entrepreneur to realise his or her investment returns. Uncontrolled hatcheries, which are widely common around the country, have the potential to result in fish that performs 40% less in growth than their wild counterparts [33].

For the South African fish farmers to be profitable and competitive on the African market, they must produce fast growing and high quality fingerlings. However, some of the legislations prohibit the importation of some species, especially some tilapia species due to biodiversity concerns [29]. The introduction of the potentially invasive Nile tilapia into South African river systems, via escapees from aquaculture facilities, is a cause for concern for the conservation of indigenous tilapia, such as Mozambique tilapia whose monotype existence is at risk through hybridisation and competition for food resources [34].

One of the most important commodities in aquaculture is feed. Studies have shown that feed cost accounts for between 50 and 70% of the total costs of production, making it the most expensive part of running a successful aquaculture enterprise [35]. Since early 2000s, suitable raw material for fish feed production is available nationwide, but designated feed pelleting mills are limited and, in most cases, inaccessible by farmers. The high cost of formulated extruded feed - as measured against selling price of aquaculture products (inclusive of logistics costs) - is limiting the use of industrial extrusion technologies for upmarket products such as trout [36]. As of 2019, there are less than six finfish feed producers in South Africa and the quality of the feed is not up to standard, thereby forcing local finfish farmers to import feed from Europe. Most of the emerging entrepreneurs in South Africa have limited training on fish nutrition and feeding, and with poor financial resources, they resort to the use of low-quality feeds. Finfish feed producers still need training and funding to produce high quality feed. Unavailability of financial resources has forced most of rural youth aquaculture entrepreneurs to make their on-farm feed [37], which often does not meet the standard of

conventional feeds and, as a result, cannot guarantee fish and consumer health safety. With proper training, young entrepreneurs can develop their own on-farm feed that incorporates the basic ingredients that are rich in proteins necessary for adequate fish growth.

With aquaculture being a relatively new form of farming to most South Africans, the industry still has a shortage of experienced aquaculture managers. An aquaculture farm manager must ensure that four most important components of the farm are always available [38]. These components are raw feed ingredients, machinery, human resource and funds and may include seed (high quality of fry/fingerlings), pond fertilizers and feed that is needed for the growth and survival of the fish. The manager must be able to ascertain that farm machinery such as pumps, air blowers, power generators and on-farm laboratory equipment are functional and are in good condition. The machines must at all times follow appropriate specifications that will suit the requirements in rearing the fish from fry to marketable size. Human resource includes both the day to day operations of the farm and managerial staff that will operate and manage each section of the farm, from hatchery, laboratory, storage facility to rearing facilities. In an ideal operating farm (up-scaled), there must be head technician, hatchery general workers and a lead scientist [38]. The production staff is accountable to the Production Manager who ensures that production runs are scheduled in order to monitor the flow of the operations. The Production Manager, in turn is accountable to the General Manager who oversees the entire business operation from administrative to marketing functions. The General Manager is ultimately accountable to the owners of the enterprise through the Board of Directors, in an ideal corporate set-up. The Board of Directors should always make sure that the fourth farm component (funds) is always available when needed for farm operations. Aquaculture farm management is still a scarce skill in South Africa and young entrepreneurs should have necessary basics on how to manage the enterprise, should one be afforded the opportunity. In small-scale farms, the manager is usually the owner, production manager and marketer. This all- in- one function makes the manager a key person. Training all-in-one managers requires a different skills set and training procedures than for managers alone. If well executed, small-scale farmers can be key players in the backbone of aquaculture growth in South Africa.

ON-FARM SECURITY CONCERNS

Besides fish, aquaculture farms boost a number of machineries such as air blowers, pumps and generators, compounded by the fact that most farms are based on the outskirts of town, thereby becoming a high target for thieves. For many decades in Africa, rural-based farms were not much concerned about crime as the impact was minimal. However, in the last few years, South Africa has seen an increase in crime against fish farms, and in some cases, fish farmers are murdered [39]. This alone has a potential to discourage entrepreneurs from engaging in fish farming or to make them discontinue their operations altogether. Stock and machinery theft (farming in general) in South Africa is a persistent problem and in terms of aquaculture, may pose a serious threat to its development and to some degree, local food security to those communities that depend on fish as a source of protein [40]. Bunei and Barasa [41] further highlighted that this problem, if not well managed, could be of great concern to the development of aquaculture in rural South

Africa, with serious threat to rural livelihoods and employment options if fish farms were to close due to crime.

ARE SOUTH AFRICANS FISH CONSUMERS?

Most South Africans are still not familiar with the concept of aquaculture and a large part of the citizenry does not have a tradition of consuming fresh fish. The coastal communities from Cape point on the Atlantic Ocean side to Richards Bay along the Indian Ocean are familiar with capture fisheries and consume substantial amount of hake and snoek fish. South Africans consume about 321 000 tons of fresh fish annually according to the South African Sustainable Seafood Initiative report of 2011 [42]. Seafood consumption is predominantly the domain of the middle and upper-income groups. The exception is canned sardines and South Africa is one of the largest sardine consuming nations in the world as canned sardines form the staple diet for a large portion of the South African population [43].

Assessing the markets as basics of entrepreneurship and scientific literature is informative in determining whether there is a high demand for fish worldwide, but the reality is that fish consumption is low in South Africa. The phenomenon has deterred many entrepreneurs who want to invest or already have invested in aquaculture. On the other hand, fellow African countries such as Nigeria have a high number of fresh fish consumers with a total yearly consumption of 1.2 million tons [44]. Nigeria's neighbouring country Ghana has an annual consumption of approximately 0.64 million tons of fish, which accounts for 40-60% of animal protein supply in their diets [45]. Despite being a landlocked country with more lakes than anywhere else in the world, harbouring fish like Nile perch, Nile tilapia and African catfish, Uganda's fishery industry remains the second largest foreign exchange earner for the country after coffee and contributes annually to the food security and livelihoods of approximately 1.5 million people, which is 4 percent of the country's population [46]

Even though most South Africans do not include fish in their daily diets, close to 200 million Africans eat fish regularly [47]. In as many as 20 African countries, fish accounts for more than 20% of their animal protein intake [48]. Since 2007, growth in fish consumption has been hovering from 25%-50% in most of the sub-Saharan countries [49]. This positive fish-eating habit within the African continent spells good news for South African aquaculture entrepreneurs that are finding it hard to access or establish a *niche* market in South Africa for their produce. South Africa already exports, on average, approximately 160 000 tonnes of fish (from capture fisheries) per year to neighbouring countries [50] and Africa would definitely welcome additional aquaculture products.

CONCLUSION

Despite facing multiple constraints as highlighted in this article, many emerging entrepreneurs are coming forward to establish cooperatives within their respective communities in rural South Africa. However, for their efforts to be achieved, they would need major assistance from both the government and private sector. Among a host of interventions, emerging entrepreneurs would like to see the following:

- An improved engagement between government and stakeholders to facilitate the development of a user- friendly legislation to govern aquaculture
- Reduced number of government departments responsible for aquaculture, whereby a centralised office dealing with all aquaculture related issues and permits is established
- Improved government aquaculture extension services
- Improved access to finance from both the government and the financial institutions
- Focussed Research and Development initiatives to develop aquaculture species that would be first priority for local market
- Establishment of prospective and current technical college curriculums that would focus on aquaculture teachings
- Development of aquaculture awareness programs by the government to facilitate interest in fish consumption in South Africa
- Government resourced marketing incentives for prioritized aquaculture products, including all media advertising
- Government assisted establishment of small-scale aquaculture venture exhibition (geographically accessible in the nine provinces) that will attract prospective investors and entrepreneurs
- Adequate training of production and general farm managers (part of college/university curriculum)
- Improved security around aquaculture farms

DECLARATION OF CONFLICTING INTERESTS

Authors declare no conflicts of interest with respect to the research, authorship and/or publication of this article.

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