Viffa Consult

HYDROPONIC FARMING

IN KENYA

SME Market Opportunity Outlook

Contents

Acronyms

CAGR - Compounded Annual Growth Rate

FAO - Food and Agriculture Organization

KNBS - Kenya National Bureau of Statics

Introduction

The going concern of SMEs in Kenya is at a risk majorly attributed to the negative effects of Covid-19 which has accelerated their mortality rate from 75 percent within 3 years of inception to theoretically over 90 percent within one year in 2020.

We hypothesize that the high mortality rate of SMEs especially during the covid-19 pandemic may be due to ; SME sector distribution that is skewed towards wholesale-retail, motor vehicle-cycle report, food and accommodation (KNBS 2016), a situation in which supply chain disruption caused havoc for businesses, weak business models with little to no value addition in most value chains for example leather where less than 2 percent is processed to finished goods and Africa accounting for less than 4 percent of global leather products despite Africa owning a fifth of global livestock (Ministry of Industrialization Trade and enterprise development).

With the economic growth estimated to grow at less than 3 percent; efforts must be made to catalyze and support traditional as well as non-traditional economic sectors that contribute highly to economic development. Traditional sectors include; tourism, manufacturing, horticulture among others while nontraditional sectors include startups and agritech among others.

The study focuses on hydroponic under the agricultural sector as an economic development opportunity worthy of support as well as a business opportunity for SMEs to explore.

The study further looks at the benefits and the practice of aquaponics agriculture globally as well as possible application in the Kenyan context.

Overview

The global population is Estimated to be 10 billion in 2050 (FAO 2017) boosting demand for agricultural products by 60 percent (PWC 2016)

High agricultural yield to meet the growing demand faces a barrage of challenges such as; wastage, losses, environmental, pest and diseases, high production cost, climate change among others.

Farmers of the future must build technological capabilities in order to manage the challenges mentioned hence meet the growing demand.

Hydroponics is the cultivation of plants in water without soil. It is a type of horticulture where mineral solutions in a water solvent feed the plants with nutrients. Only the roots are exposed to the solvent with the rest of the plant suspended by an inert media such as gravel, pumice, sand, wood fibre or any other substrate.

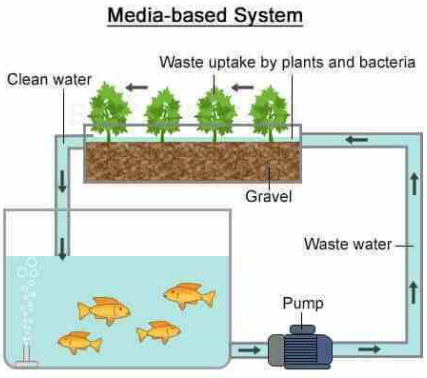
Hydroponic farming is suitable for urban setting with little space utilization, significant low input cost (Table 1) as well as short access to market.

Table 1: Analysis of Traditional vs Hydroponic farming

Aquaponics

Aquaponics (Illustration 1) a sub-set of hydroponics is a closed loop system whereby plants are grown in water which the roots filter down to a pool of fish, whose waste water is then pumped up to the plants as a source of nutrients. Production from aquaponics can be applied at both domestic level to supplement income or domestic consumption as well as commercially as a business.

Illustration 1: Aquaponic system



There are many advantages of aquaponics over traditional farming methods, including the efficient use of resources – namely water, fertilizer, infrastructure and land but the main difference is the source of nutrients for the plants (Table 2). In Aquaponics, plants get nutrients from the waste of aquatic animals such as fish and prawns, which would otherwise be toxic if it accumulates.

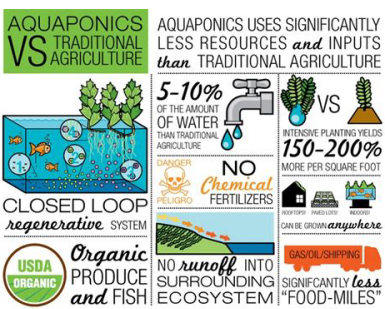
Table 2: Difference between hydroponic and aquaponics

Hydroponic	Aquaponic
Difficult to maintain and costly	Cost effective
Less productivity	High productivity
Bacteria growth inhibited	Bacterial growth used in nutrient production
Chemical used	Fish waste (Nutrient)

Analysis: Viffa Consult
Source: Pediaa

Organic produce from aquaponics is free from pesticides or fertilizers and produces eight times more food per acre in 1/6th of the space (Illustration2) required by traditional agriculture and use 90 percent less water (Industry Arc). Commercial aquaponics are increasingly becoming common underpinned on increased demand for organic food market and cost-efficient factors of running an aquaponic farm.

Illustration 2: Aquaponic Advantage

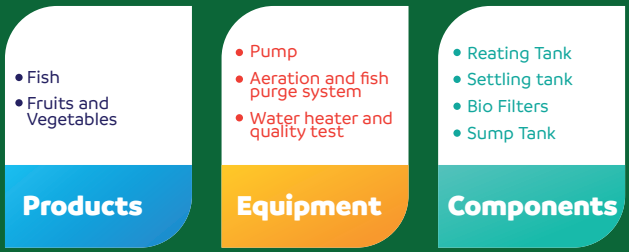


Global Market Size

The global Aquaponics market is expected to register a CAGR of 13.4 percent from 2019 to 2024 to reach $1.34 billion (Market Research Future).

The growth is being driven by the demand for the organic dual-produce of aqua animals and plants, and the low cost of production associated with aquaponics. The global market is categorized into several key components (Illustration 3) with players operating in one and all components.

Illustration 3: Global Aquaponic market components



Source: Market Research Future
Analysis: Viffa Consult

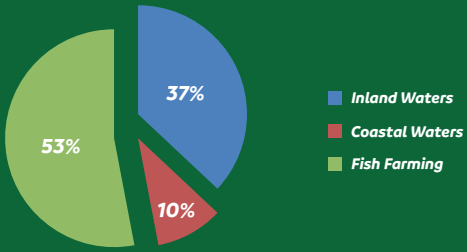
Africa Market

Aquaponics is emerging as one of the innovative sources of providing fresh, nutrient rich food to urban cities and towns in a continent that is grappling with a $35b structural food deficit (PwC). Uganda, Botswana, Namibia, Kenya, Malawi, Zimbabwe and South Africa were among the first countries to set-up pilot and commercial aquaponic farms in Africa. In Botswana, Portable Farms Ltd build a 10,000 sq ft in 2012 with a capacity of producing 60,000 vegetables and 9,000 kgs of tilapia fish per year.

Kenya

Kenya's fisheries and aquaculture sector GDP contribution stood at 0.54 percent in 2013 (FAO) and employed 129,300 people (Chart 1).

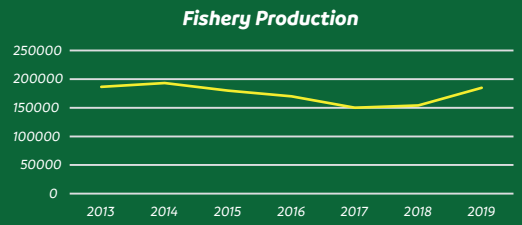
Chart 1: Kenya Fisheries employment distribution



Source: FAO
Analysis: Viffa Consult

Total fish production in 2013 amounted to 186,700 tonnes, with 83 percent coming from inland capture fisheries with Lake Victoria contributing 90 percent. Production in 2019 stood at 185,000 tonnes (Table 3) though lower that the 2014 period represented a 20.9 percent increase compared to 2018. Further the value of fish exports was about USD 62.9 million in 2012 and USD 45 million in 2013.

Table 3: Kenya Fish Production trend



Source: FOA
Analysis: Viffa Consult

Aquaponic Products

Fish species

- Perch
- Goldfish
- Marron
- Tilapia (Popular because they are hardy to raise)
- Catfish (Also preferred because of the preference to warm weather)
- Perch
- Goldfish
- Marron
- Trout
- Koi
- Freshwater mussels
- Freshwater prawns
- Barramudi

Plant species

Aquaponics can be used to grow almost all kinds of plants although vegetables yields like kales and spinach do better than other plant products.

- Peas
- Cucumber
- Egg plant
- Cabbage
- Broccolli
- Celery
- Onion
- Basil
- Mint
- Tomatoes
- Lettuce
- Spinach
- Strawberries
- Peppers
- Chillis
- Squash
- Melons
- Carrots
- Beetroot
- Garlic
- Coriander

Players

Hydroponics Kenya – Started in 2012. Has installed over 700 hydroponic and aquaponic systems in Kenya, Uganda, Rwanda and Tanzania and trained over 2,200 people

Kikaponi Commercial Aquaponics Farm – Started with a 1500 m^2 farm in Kiserian, Kajiado County. Now producing vegetables for commercial

Amsha Africa Foundation – Piloted one of the first aquaponic farm in Kenya in 2007and has expanded into five more countries and positively impacted thousands of livelihoods. Projects targets sustenance farmers who do not have an adequate supply of food and water.

Case Study

A farmer in Gitaru, Kiambu has deployed an overhead Agroponic system on a 30 meter by 10 meter greenhouse space to produce high quality, organic strawberries that would require an acre of land to produce the same yield in traditional farming.

Opportunities

An earth pond measuring 18 by 20 meters stocked with about 4,000 catfish fingerlings and the aquaponic system can cost up to Sh1.5 million. But simpler commercial systems that use locally available materials such as dam liner, timber, water pipes, seedlings, bell siphon, fish ponds, pumps and other materials could cost between Sh300,000 to Sh500,000 depending on the size.

Aquaponic setups are highly scalable; from affordable balcony systems for domestic consumption to large-scale commercial setups. For SMEs, an 8 meter by 15 meter grow bed space with a 14,000 liter tank can house approximately 3,600 fish.

Challenges

Set up Cost

Reliable energy source

Tecnhical Training to manage and repair

Observations

A study by Gorcum, Goddek and Keesman on Gaining market insights for aquaponically produced vegetables in Kenya concluded that;

1. Restaurants, hotels and retailers in Nairobi do not pay clearly higher prices for products that claimed to be produced organically in comparison to conventional produced vegetables

2. Interviewees generally agree that production in aquaponics is natural, fresh, healthy and free of pesticides

3. The market potential for aquaponics products exists according to the increased consumer's willingness to pay for it

4. Aquaponics could provide a solution to bypass seasonal production issues due to climatic conditions in Kenya

Recommendations

The Food and Agriculture Organization (FAO) recommends best practice rules to achieve maximum results for aquaponic agriculture, whether for domestic, SME or large-scale commercial units;

1. Choose the tank carefully: Round hardy tanks with flat or conical bottoms are recommended because they are easier to clean.

2. Ensure adequate aeration and water circulation: Water and air pumps ensure that the water has high levels of oxygen, critical for the survival of the animals, plants and the bacteria.

3. Good water quality: Simple test kits will ensure that oxygen levels, pH, temperature, nitrogen and water alkalinity are kept at optimum levels at all times.

4. Avoid overfeeding: Leftover rotting food can cause disease and can use up all the dissolved oxygen.

5. Do not overcrowd the tanks: The recommended stocking density is 20 Kg/1,000 litres which will allow for substantial plant growing area.

6. Choose the plants wisely: Plant vegetables with short grow-out periods (salad greens) between plants with longer-term crops (eggplant). Leafy green plants do extremely well in aquaponics as well as fruiting vegetables, tomatoes, cucumbers and peppers.

7. Balance between plants and animals: Using a batch cropping system can help keep a steady harvest of both aquatic animals and vegetables to keep a consistent production level and maintain a constant balance between fish and plants

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