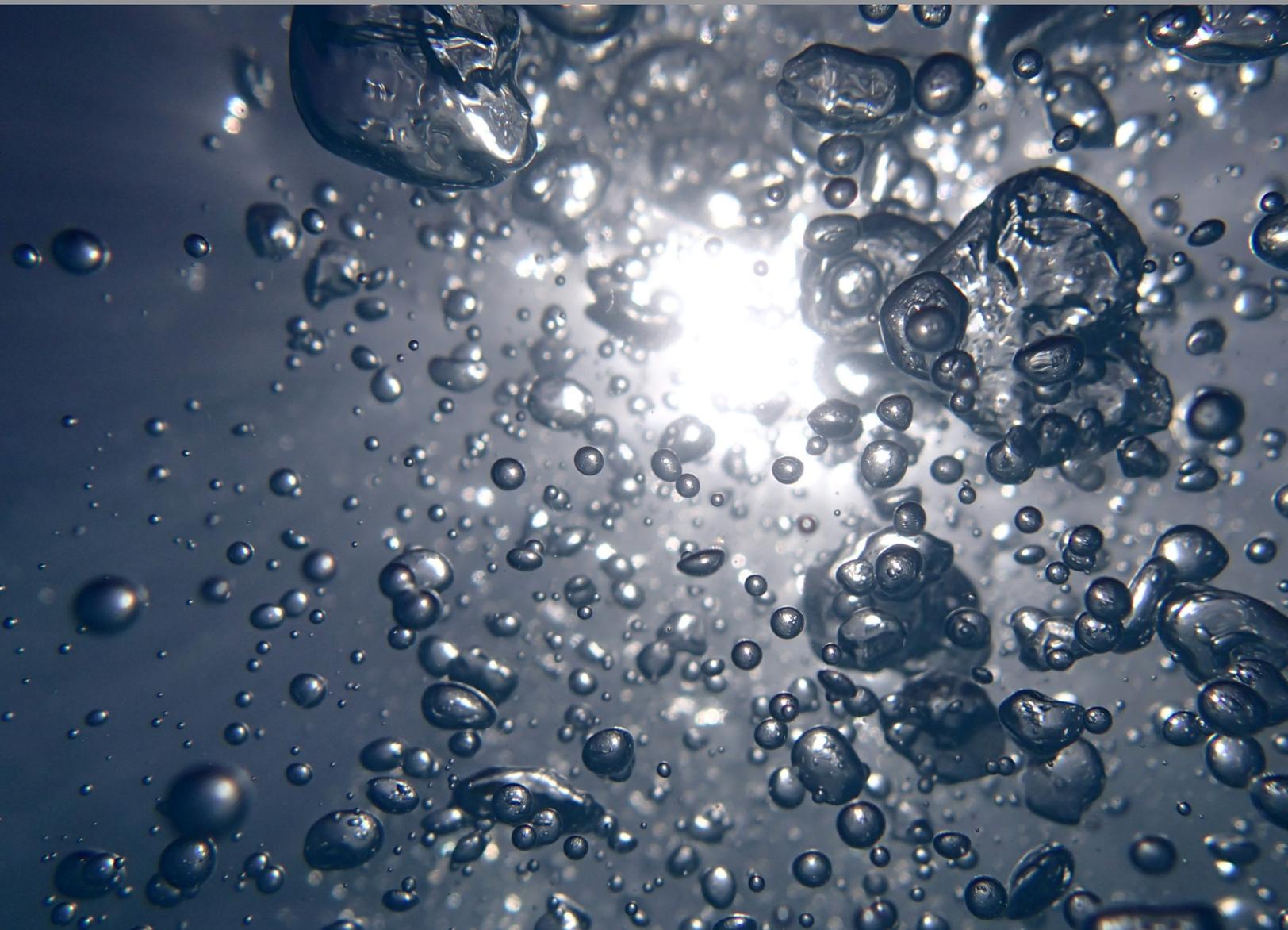


# AQUAPONICS BUSINESS PLAN USER GUIDE



# Aquaponics Business Plan User Guide

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# User Guide Introduction

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In 2011, the U.S. Environmental Protection Agency (EPA) released the [Urban Farm Business Plan Handbook](#) (Handbook) to provide guidance for developing a business plan for the startup and operation of an urban farm. While the Handbook acknowledged aquaponics as a method of producing food in an urban environment, the Handbook generally focused on food and non-food related cultivated agriculture. Since development of the Handbook, communities have expressed a growing interest in urban aquaponic farms as a sustainable method to provide a source of healthy, fresh, and cost effective protein and vegetables to the local community, while providing job and educational opportunities for citizens. Increased interest in urban aquaponic farms can be attributed, in part, to the ability to utilize brownfields and other underutilized properties and buildings in or near large population centers for aquaponics operations. This positioning is crucial to overcoming food insecurity and in providing new work opportunities for underserved populations, particularly among urban food insecure areas.

Because of the differences in production systems between cultivated agriculture and aquaponics, the ***Aquaponics Business Plan User Guide***<sup>1</sup> (User Guide) has been developed to provide guidance for developing an operating strategy specific to an aquaponic farm. This User Guide is modeled after the original Urban Farm Business Plan Handbook and provides an outline and guidance for the development of a business plan for an aquaponic farm. Some sections of the original Urban Farm Business Plan Handbook were modified to address aquaponic differences, while other sections keep the original text of the Handbook.

This User Guide emerged from a dynamic project partnership between EPA Region 3, Delaware State University, Kent Economic Partnership, Kent Community Gardens Collaborative and Delaware Division of Public Health.



Figure 1: Aquaponic operations in the District of Columbia  
Photo Source: East Capitol Urban Farm

As with a cultivated agriculture urban farm, an urban aquaponic farm can be established as non-profit, community or neighborhood-based urban farm or for profit urban farm business. In either case it is important for those establishing an urban aquaponic farm to develop a plan for the start-up and operation of the farm regardless of whether it is intended to be for-profit or non-profit.

*A business plan serves as an internal planning tool that maps out the strategies for the startup and operation of a business, tracks progress of the business against its goals, and provides information to external stakeholders important to the successful startup and operation of the business (e.g., investors and funding sources).*

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<sup>1</sup> This User Guide has been prepared for informational purposes only. EPA and the contractor team that prepared this report relied on outside sources for information and data. Although all best efforts were used to confirm the information and data used to complete this report, no representation or warranties are made as to the timeliness, accuracy or completeness of the information contained herein or that the actual results will conform to any projections or recommendations contained herein. All areas are approximate. Any reliance upon this material shall be without any liability or obligation on the part of EPA or its contractors, Vita Nuova LLC and SRA International, a CSRA company.

## How Should the User Guide and Worksheets Be Used?

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The ***Aquaponics Business Plan User Guide*** (this document) provides guidance for developing a business plan for the startup and operation of an urban aquaponic farm. The information provided is applicable regardless of whether the farm is to be operated as a non-profit or for-profit business. The following outline the five sections of the User Guide and which ones are updated for aquaponics:

- **Overview** – provides statements of the vision, mission and goals for the farm. The worksheets were updated for aquaponic farm planning.
- **Organization and Management** – describes the ownership structure of the business and how the business will be organized and managed. Worksheets and text are original to the Urban Farm Business Plan Handbook.
- **Marketing Strategy** – identifies the products to be produced, provides an analysis of the market for the products and the potential competition for the products, and describes the approach for packaging, distributing, and promoting the product. Worksheets and text are original to the Urban Farm Business Plan Handbook.
- **Operating Strategy** – describes the approach for product management, farm size and capacity, physical and human resources, regulatory requirements. The worksheets were updated to recognize the differences in production systems between cultivated agriculture and aquaponics.
- **Financial Strategy** – Provides estimates of income and expense, anticipated profit and loss, fixed asset requirements, potential sources of funds, and potential risks to the success of the business. Worksheets and text are original to the Urban Farm Business Plan Handbook.

This User Guide describes what information should be collected, evaluated, and presented in each section of the business plan. The User Guide is designed to be used side-by-side with the accompanying Aquaponic Business Plan Worksheets. As the User Guide describes each section of the business plan, there are references to worksheets that should be filled out in order to fully develop that section of the business plan. A list of all of the provided worksheets is listed at the end of the User Guide. The [Urban Farm Business Plan Handbook](#) and [Worksheets](#) Appendix B helps users understand how to fill in the worksheets and demonstrates hypothetical information to serve as a useful example of the level of detail and background research required to develop a business plan. The Aquaponics Business Plan Worksheets provide a framework in which to compile and organize the information needed to draft a business plan. There are two files that comprise the Worksheets:

1. ***Aquaponic Business Plan Worksheet.doc*** (Microsoft (MS) Word®). This file contains blank worksheets that when completed will provide the information needed to write a business plan. Worksheets 1-16, 18-22, and 28-29 are contained in this file. A list of all worksheets is provided in that file.
2. ***Aquaponic Business Plan Worksheet.xls*** (Microsoft (MS) Excel®). This file contains spreadsheets with formulas to help calculate expenditures and revenue. Worksheets 17 and 23-27 are contained in this file.

The information presented in the following sections of this User Guide is intended to be representative of the information needed for the development of a business plan; however, the specific goals and plans for any individual farm may require more or less information be provided for their particular plan.

# Before Beginning the Aquaponics Business Plan User Guide

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Before beginning the development of your business plan, think about the primary reasons for starting an urban farm. Documenting your reasons for starting the farm will help you focus the business plan and identify the issues, the resources and the expertise that will be needed to develop the business plan. Finally, think about the values that you bring to the business and the values that are important to the success of the business.

- Consider the following questions:
- Do you have crop growing or farm experience that will assist in your farm operations or will you need to secure that expertise elsewhere?
- Do you intend to produce food, animal husbandry, aquaculture, aquaponics, or non-food products or some combination of products?
- Do you have a property or are you in the process of selecting a location?
- Are you developing the farm as a community-based, non-profit business that will involve community members in the operation?
- Are you developing the farm as a for-profit business and income source?
- Are you developing the farm as a family-run business and source of income?
- Is there a particular expertise or product that you want to commercialize?
- Are you creating the farm to provide produce for another business, such as an institution or restaurant?
- Who will be part of your planning team?
- Do you have the expertise to develop marketing, operating, human resource, and financial strategies necessary for the business plan or to help in the start up of the business?
- Are you going to need expertise to address environmental and cleanup issues that may be associated with an urban property you intend to farm?
- Do you need to hire expertise to develop the strategies, conduct surveys, or plan the development?
- Do you need financial resources to obtain this expertise?
- Is there an economic motivation for this farm?
- Are you hoping to generate a profit, break-even, or will the farm require a source of charitable income?
- Is the farm to be community-focused?
- To what extent are environmental issues related to the operation of the farm a consideration, such as organic fertilizers and resource use?

Use **Worksheet # 1 (Before You Begin)** to document your reasons, expertise and resource needs.

## Overview

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The overview introduces the reader to the business plan, provides your vision and mission for the farm, and summarizes your goals for the farm. The overview is divided into four sections:

- Introduction
- Vision Statement
- Mission Statement
- Goals



Figure 2: Example Urban Farm  
Data source: Image via Flickr, courtesy of David Barrie

## Introduction

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The introduction describes the purpose of the business plan and the key issues addressed by the plan. It provides the reader with an understanding of what information is contained in the business plan and a general description of the plan development process.

Consider the following questions:

- Is the business plan an internal organizing tool, a tool for communicating outside the proposed business, or a combination of both?
- Is there information that is missing or unable to be identified at this stage of the planning process?
- Who are the members of your business planning team?
- Who was involved in the planning process?
- What is the planned size of the company and is future growth anticipated?
- What is the time frame considered in the business plan (at minimum the plan should consider a 5-year time frame)?
- Is it to be a for-profit or non-profit business?
- Are there potential risks for the start up of this business?

Use **Worksheet # 2 (Introduction)** to document the information to include in the introduction.

## Vision Statement

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The vision statement is an inspirational statement that describes your vision for the future of the farm and how your values will be incorporated into the farm. It focuses on the future and provides a direction for the farm and the community in which it operates. It provides clear decision-making criteria.

Consider the following questions:

- What economic, environmental, or community values are important to the success of the farm?
- In a general sense, what products or services do you expect to provide?
- How will the community benefit from these products or services?
- How will operating practices enhance the environment?

Use **Worksheet # 3 (Vision)** to document the information to include in the vision statement.

## Mission Statement

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The mission statement is a simple statement that communicates the fundamental purpose and expectations for the farm to its customers and others outside of the business. It is a set of guiding principles that describes the overall goals of the business and serves as a benchmark. It incorporates meaningful and measurable criteria addressing concepts such as values of the business, public image, the target market, products or services, the geographic extent of the business, and expectations of growth and profitability. It provides an understanding of what the business aspires to be and what the business will be known for in the future.

Use **Worksheet # 4 (Mission)** to document the information to include in the mission statement.

## Goals

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The goals describe what is to be achieved by the business in the future. Goals can be expressed in terms of time, such as short-term and long-term goals. For a start-up business, short-term goals may be focused on the startup of the business and achieving a certain level of production income. Long-term goals can reflect plans for growth. Goals address potential products, what the farm will look like, who will be involved in operations, and your expectations from the business. The goals reflect what you would like to achieve and when you would like to achieve them. They do not identify how this will be accomplished. Clearly identified goals can motivate, help to mitigate conflict, and direct limited resources.

Use **Worksheet # 5 (Goals)** to document the information to include in the goal discussion.

# Organization and Management

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*\*The Organization and Management is pulled directly from the [Urban Farm Business Plan Handbook](#) and [Worksheets](#) and was not specifically updated to target aquaponic farm development. However, all information and worksheets will be valuable to those seeking to develop an aquaponic farm.*

Describe the ownership structure of the business and how the business will be organized and managed. If you decide to create a corporation, a non-profit, a limited liability company, or a partnership, you will need to register your business with the state. Check with your state's requirements for organizing a business and registering your business name. In addition, you will need to register your business with the IRS and state and local revenue agencies and receive a tax identification number or permit.

Consider the following questions:

- What will be the legal structure of your organization (e.g., sole proprietorship, partnership, limited liability company, corporation, non-profit, cooperative)?
- How will the business management be organized?
- Will there be a single farm manager to oversee all business operations or multiple managers to oversee various business segments (e.g., marketing, operations, finance, human resources)? Where a multiple manager structure is anticipated, a simple organization chart may be useful to explain the organization.
- Who will be the principal or key managers who will run the business?
- What unique skills do they bring to the business and what will be their duties and responsibilities?
- Will there be an overseeing board or board of directors?
- What will be the composition of such a board and what, if any, role will members of the board take in the business?
- How will the principals, key managers, or board members be compensated?
- Are there any administrative expenses associated with the management or oversight of this business?

Use **Worksheet # 6 (Organization and Management)** to document information about the organization and management of your business.

# Marketing Strategy

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*\*The Marketing Strategy is pulled directly from the [Urban Farm Business Plan Handbook](#) and [Worksheets](#) and was not specifically updated to target aquaponic farm development. However, all information and worksheets will be valuable to those seeking to develop an aquaponic farm.*

Defining a strategy for marketing and sales is the most important part of your business plan. If a market does not exist or if a workable approach for getting your product to the market has not been identified, you will not meet your goals or expectations. The development of your marketing strategy will require an understanding of the market, including the demand for your product, the potential customers, and the potential competitors. In developing a marketing strategy, you need to convince yourself, as well as the reader of the business plan, that there is a viable market for your product. The marketing strategy is divided into seven sections:



Figure 3: Example Urban Farm Marketing  
Data source: Image via Flickr, courtesy of David Boyle

- Introduction
- Market
- Product
- Distribution
- Competition
- Promotion

## Introduction

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The introduction to the marketing section summarizes for the reader:

- the potential customers for the farm (Market),
- the products that will be produced and sold (Products),
- where and how the products will be made available to the customers (Distribution),
- the competitors (Competition), and
- how the customers will be made aware of the farm and its products (Promotion).

It should also describe the approach that was taken in developing the marketing strategy.

## Market

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The market section provides an analysis of the market to identify your potential customers or target market. To identify your potential customers, you will first need to have a general understanding of the environment in which your business will operate. Describe the economic factors, such as inflation, unemployment, interest rates, and income that affect a potential customer's purchasing power and spending patterns. Income, for example, will affect a consumer's ability to purchase and the price you will be able to charge for your product. Discuss the demographic factors that describe your potential

customers. Demographics provide information on the size, location, age, income, and other statistics about potential consumers. Discuss the social and cultural factors that will influence or impact your business. Social and cultural factors refer to the basic values, perceptions, preferences, and behaviors of your potential customers. They could include preferences on the types of crops to be grown, the ease of purchase of the product, perceptions of organic versus chemical-based production, and impact on the immediate neighborhood. Finally, discuss any voids in the market that your farm will fill.

Consider the following questions:

- What are the significant regulatory requirements that need to be addressed or that will impact your business?
- Who are your potential customers (e.g., households, commercial businesses)?
- Where are your customers located (i.e., within easy transportation or long distances)?
- How likely are they to buy your product (is the project unique or of superior quality)?
- Is there a particular crop that you will grow that is not easily accessible to the consumer?
- Is fresh, organically grown produce easily accessible to the consumer?

Use **Worksheet # 7 (Market Analysis)** to document information to include in the market section.

## Customers

Considering the market analysis, describe the customers that your farm will target and how your offerings will meet their needs. Where appropriate, divide the larger target market into submarkets (market segments), such as direct marketing to individual households or business-to-business marketing. Identify the market segments to be targeted. Describe the size and geographic location of each market segment. For example, distance from the business, number of households, commercial establishments or institutional establishments, and likely purchase volume. Discuss the specific characteristics or demographics that define the target customers in each segment, such as age, gender, and income. Discuss the attributes of the market segment related to personality, values, attitudes, interests, or lifestyles. Describe the specific needs and preferences of the market segment that the farm will target.

Consider the following questions:

- Are there trends and/or market conditions that were considered for each market segment?
- Is there a specific product that will appeal to the market segment?
- What motivates buying decisions in each market segment?
- What evidence is there that potential customers in each market segment want the product?

Use **Worksheet # 8 (Market Segments)** to document information about the customers and market segments. Complete a worksheet for each market segment.

## Product

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Using information developed in the market analysis about the customer values, needs, and preferences, describe the products to be offered and how they will compete in the target market. This could be a list of specific products (collard greens) or a list of general classes of products (greens). Product offerings should also include the seasonal availability of the products. Describe the specific characteristics of the product that meet the needs of the target market. For example, the market segment desires fresh,

organically grown produce from local suppliers or the specific product is not available in the current market. Discuss why the products offered to each market segment are unique. Attributes such as locally grown, organically produced, and price serve to differentiate a product and make it unique. Finally, describe why the business is different from its competitors. Attributes such as being a local employer, accessibility to customers, and partnerships with local businesses help to describe the uniqueness of your business.

Consider the following questions:

- What products will be offered?
- What is the product availability (seasonal offerings)?
- Why would a customer prefer your product to a competitor's?
- What differentiates your product in the target market?
- How does your product differ from that of your competitor's?
- What are the strengths and weaknesses of the product?

Use **Worksheet # 9 (Product)** to document information about your product. Complete a worksheet for each market segment.

## Distribution

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Getting your product to the market will be a critical component of your marketing strategy. Perishable products will need to be delivered or sold to customers within a short period of time after harvest or stored. The quality of crops and customer perception will depend on the quality and freshness of your product. Describe how your product will get to each market segment. Discuss the handling of the product from harvest to sale to the customers in each market segment including any options for storage of the product prior to sale.

Consider the following questions:

- Are products to be packaged for distribution (salad mixes), secondary products (salsa or preserves), or distributed in bulk crates or bushels?
- Are products going to be stored for later distribution?
- Will product be distributed direct from the harvest to the customer?
- How will your product be sold?
- Will the distribution be through direct marketing, such as community supported agriculture, farmers' markets, home delivery services, Internet sales, pick-your-own, or will the products be marketed through an intermediary distributor (e.g., retailers, wholesalers, brokers, or cooperatives)?
- How will product quality be maintained during storage and distribution?
- Why was a particular method of distribution selected for a market segment?
- Are there seasonal issues that will affect the supply of product to a market segment or the distribution of the product to a market segment?
- What will you do with product that is not sold or delivered?

Use **Worksheet # 10 (Distribution)** to document information about your approach to storage and distribution. Complete a worksheet for each market segment.

## Sales

Using information developed in the market analysis about the average product consumption, geographic location, and customer attributes, needs, and preferences, develop simple sales projections for each market segment. Since various crops may be seasonal, describe when and how long product will be available for each market segment. For example, products may be available for a market segment all year or only on a seasonal basis.

## Pricing

To develop you sales projections, consider the prevailing prices for the products to be sold and your strategy for pricing these products. Describe the pricing strategy for each market segment and how your strategy compares with the competition. Finally, discuss why the selected pricing strategy will be effective in the market segment.

Consider the following questions:

- What are the prevailing market prices for similar products?
- What is the sensitivity of demand to price?
- Will customers be willing to pay higher prices for your offering?
- How will the product be priced for each market segment? Will pricing be based on what your competitors are charging, on the cost of producing the crop plus a percentage for profit, on a price determined by a market study, or some other form of pricing strategy?
- Is there evidence that the target market segment will accept the price?

Use **Worksheet # 11 (Pricing)** to document information about your approach to pricing. Complete a worksheet for each market segment.

## Sales Volume

Estimate the potential volume of sales for each market segment. This discussion will require an estimate for each market segment of the number of potential customers in your planned market area and the number (or percentage) of these potential customers that will be needed to sustain the anticipated volume of product. The potential sales volume will be the product of the potential number of customers times the potential volume for each customer. Describe any assumptions that were made about the market segment and volume estimates. Identify any research that was conducted or used to develop information about each market segment.

Use **Worksheet # 12 (Sales Volume)** to document information about potential sales volumes. Complete a worksheet for each market segment.



Figure 4: marketing for Aquaponic Farm in the District of Columbia  
Photo Source: East Capitol Urban Farm

## Competition

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Describe the competition for each market segment and how the business will be positioned to compete in each market segment. Summarize the products they provide, the characteristics of their products, and pricing for their products. Discuss the advantages your business will have over your competitors in each market segment. Discuss the disadvantages your business will have to the competitors in each market segment. Discuss how your business will distinguish itself from competitors. Finally, discuss whether competitors are expected to respond to your entry into the market and how quickly and effectively the competitors may be able to respond.

Consider the following questions:

- Who are the competitors for each product segment?
- Is your product of a higher quality, better meeting the needs of the consumer, more accessible?
- Are your competitors established in the market?
- Do they offer a greater variety of products?
- Will your pricing be competitive with your competitors?
- Will product distribution be an issue?
- Why will customers switch to or select this business over a competitor?
- Will your business provide higher quality product, greater variety, better service, lower prices?

Use **Worksheet # 13 (Competition)** to document information about competitors. Complete a worksheet for each market segment.

## Promotion

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Discuss how you will gain access to the market segments and distribution channels. Describe how you will communicate your message about the product or business. Discuss what you want to communicate to your customers. Discuss how much you expect to spend on advertising and communication.

Consider the following questions:

- How will potential customers find out about your product?
- What approaches will be used to promote your farm and its products?
- Will you advertise the product, the business or company image, or both?
- Will you contact potential customers directly or use display ads in magazines or newspapers, mailings, flyers, catalogues, Internet, social media, programs promoting locally grown products, or some combination?
- Do you want to communicate your business values, the product you are supplying, product quality, production practices (organic, local), price, availability, or some combination?
- How often will customers be contacted through advertising and communications?
- Why do you believe that the selected approach will be effective in reaching the target customer?

Use **Worksheet # 14 (Promotion)** to document information about your approach to promotion. Complete a worksheet for each market segment.

## Operating Strategy

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*\*The Operating Strategy is updated to address aquaponic operations and information. This section is customized for the Aquaponics Business Plan User Guide and developed in July 2016.*

The operating strategy is divided into five sections:

- Introduction
- Fish and Plant Crop Management
- Size and Capacity
- Physical Resource Needs
- Human Resource Needs
- Regulation and Policy



Figure 5: Aquaponic operations in the District of Columbia  
Photo Source: East Capitol Urban Farm

## Introduction

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Aquaponics is a system of farming that combines hydroponics (growing plants without soil using nutrients in water) with aquaculture (growing and harvesting fish and aquatic plants). A simple aquaponic system circulates nutrient-rich water from the fish tank through settling basins and filters to remove solids and convert fish by-products in the water to nutrients for the plants, then into the plant production system where the nutrients in the water are consumed by the plants before the water is returned to the fish tank. A successful aquaponics system requires the management of the plants, fish, and nutrients to provide a balanced and interdependent relationship.

Prior to developing the operating strategy, it is important to have completed the market analysis and have identified the type and volume of plant crops and fish to be raised.

The Operating Strategy summarizes for the reader the:

- approach for cultivating and harvesting the plant crops and fish (Crop Management)
- estimated production capacity of the farm (Size and Capacity),
- physical resources needed to operate the farm (Physical Resources),
- human resources needed to operate the farm (Human Resources), and
- regulatory issues and requirements that need to be addressed in order to start-up and operate the farm (Regulatory and Policy Issues).

It also should describe the approach that was taken in developing the operating strategy.

## Fish and Plant Crop Management

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Fish and plant crop management involves managing the relationship between the volume of fish and plant crops needed to meet the objectives of the marketing strategy, in terms of the type, amount, and quality of crops and fish that are needed to meet market demands. This involves an understanding of both the approach that will be used to raise the fish and produce the crops and the schedule for planting and harvesting the plant crops and stocking and harvesting the fish.

Discuss your approach to plant crop and fish production including the specific method to be used such as raft based, media based, hybrid, or other systems of hydroponic growing systems.

Consider the following questions:

- What type of hydroponic system will be used for the plant crops?
- What is the primary product? Since there is an interdependent relationship between the fish and the plant crops, will the volume of plant crops required to meet anticipated market demand drive the volume of fish needed to provide appropriate nutrients to the plants or will the volume of fish needed to meet market demand drive the volume of plants needed to remove the by-products from the water to support the fish population?
- Will fish be raised to be marketed as a product of the farm or managed solely to support the plant crop production?
- Do you intend to be certified as an organic producer?
- Will plant crops be started from seeds on the farm or seedlings purchased from an outside supplier?
- Will fish be bred on the farm or purchased from an outside supplier?
- How will water conditions such as pH, temperature, ammonia, nitrates, nitrites, oxygen, total dissolved solids, and hardness, electrical conductivity (EC) be managed?
- What production management alternatives are going to be implemented for issues such as pest, and disease control, water supply, seed and plant selection, waste handling and disposal, and crop quality control?
- How will plantings be made to achieve the required crop harvest to meet the marketing strategy (e.g., overplanting)?
- Will you be planting and harvesting year round?
- How will your planting and harvesting schedules change over the first five years of production?

### Types of Hydroponic Growing Systems

- Raft-based consisting of Styrofoam rafts floating in a relatively deep aquaculture basin in troughs.
- Media based recirculating aquaponics: solid media such as gravel or clay beads, held in a container that is flooded with water from the aquaculture. This type of aquaponics is also known as closed-loop aquaponics.
- Media based reciprocating aquaponics: solid media in a container that is alternately flooded and drained utilizing different types of siphon drains. This type of aquaponics is also known as flood-and-drain aquaponics or ebb-and-flow aquaponics.
- Hybrid - Combination of raft-based and media-based where media-based acts as filter prior to raft-based
- Other systems include towers that are trickle-fed from the top, nutrient film technique channels, horizontal PVC pipes with holes for the pots, plastic barrels cut in half with gravel or rafts in them. Each approach has its own benefits.

Issues to consider when developing a crop management plan include:

- Seedlings can be started from seed on the farm or purchased from a third party. Seedlings started on the farm are generally started outside the hydroponic tank then transplanted into the tank after two or three inches of growth. This process typically needs to be done in a relatively controlled area.
- It is more common to bring fish in from a third party rather than setting up a full scale hatchery on the farm.
- Might want to consider relocating fish ready for sale to a separate fresh water tank with separate filter to clean the fish prior to sale.
- Usage of more than one species of fish is typically not recommended in an aquaponics operation since it complicates the management of the fish to plant ratio as well as the fish management.
- Water supplied from a domestic water supply such as a municipal water system may need to be treated prior to use in the fish or hydroponic tanks. This would include the initial water supply and make-up water.
- The relationship between plant crops and fish is a critical criterion. This relationship requires an understanding of the appropriate volume of water per pound of fish, fish feeding ratio per square foot of growing area, and volume of fish per square foot of growing area. The actual ratio will be dependent on the growing system used, the type of plants grown and the type of fish raised. For example, some literature suggests that for a media growing system, a ratio of 1.5 to 2 pounds of fish in 6 gallons of water per 1 square foot of grow bed surface for 12-inch-deep beds.
- Nutrient requirements for plants are dependent upon the type of plants grown and governed by the maturity and density of the fish. For example, cabbage, lettuce, basil, spinach, chives, and herbs typically require a low to medium level of nutrients, whereas tomatoes, cucumbers and peppers typically demand a higher nutrient requirement.
- Plant crops will typically reach harvestable size sooner than fish, allowing for multiple plantings in the same year.
- The most commonly raised fish by percent include tilapia (69%), ornamental fish (43%), catfish (25%), other fish (18%), perch (16%), bluegill (15%), trout (10%), and bass (7%) respectively (Love et al., 2015).
- Water temperature control will be an important consideration based on the type of fish raised. For example, fish such as tilapia, perch, and cod can thrive in changing water conditions while, bluegill, catfish, and trout typically require limited variation in water temperature.
- In determining the size of the fish tank for your aquaculture component, it's important to consider the fish to plant ratio and the constraints of your space. The size of the tank is a function of the type of fish and desired yield. The fish tank may be integrated with the hydroponics tank or a separate tank. Determination of the size of the tank will include both depth as well as surface area.

Use **Worksheet # 15 (Crop Management)** to document information about your approach to production management. Use **Worksheet # 16 (Planting and Harvesting Schedules)** to evaluate your approach to planting and harvesting. **Worksheet #17 (Farm Planning)** is not included for the aquaponics farm due to the variability in design related to the fish/crop interdependence. It is recommended that an individual experienced in the design of aquaponics system be engaged to develop the design criteria for the equipment based on the initial and five-year market assumptions.

## Yield

Discuss the estimate for the amount of plant crops and fish that can be repeatedly produced (e.g., pounds of produce or fish per month for each market segment and crop or fish type) given the crop management approach, operating area size, and available resources. The output should be estimated for the first five years of operation. You may also want to estimate a high and low case output for purposes of evaluating the range of potential output against the objectives of the marketing strategy. These output projections should be consistent with your plans for the growth of the business. Describe your growth plans.

Use **Worksheet # 18 (Yield)** to document information about the farm capacity and size. **Worksheet #17 (Farm Planning)** is not included for the aquaponics farm due to the variability in design related to the fish/crop interdependence. It is recommended that an individual experienced in the design of aquaponics system be engaged to develop the design criteria for the equipment based on the initial and five-year market assumptions.

## Physical Resource Needs

Physical resources include land, buildings, and equipment necessary to produce and market your plant crops or fish to meet the objectives of your marketing strategy. Discuss your physical resource needs and how they will be acquired. Describe the environmental factors related to the resources that will be needed to run the farm, such as water, electricity, and the impacts the farm may have on the environment (e.g., waste generation and disposal).

Consider the following questions:

- Will all or part of the aquaponics farm be located within a building?
- What types of buildings and other structures are required initially and within five years?
- How much building area and/or land area is required initially? Within five years?
- Will you acquire the building/land or lease?
- Are there known or potential environmental issues on the property that will require assessment or cleanup on the property or require specific actions to address prior to setting up the farm operation?
- Has an environmental assessment and/or remedial action been conducted on the property?

*Some of the most frequently raised fish and plants crops among commercial producers include (Love et al., 2014):*

Plant Crops	Percentage
Basil	81%
Salad greens	76%
Non-basil herbs	73%
Tomatoes	68%
Head Lettuce	68%
Kale	56%
Chard	55%
Bok Choi	51%
Peppers	48%
Cucumbers	45%
Fish	Percentage
tilapia	69%
Ornamental fish	43%
Catfish	25%
Other aquatic animals	19%
Perch	16%
Bluegill	15%
Trout	10%
Bass	7%

- Are there physical conditions that present challenges to the use of the property (e.g., concrete foundations or floor slabs remaining, environmental restraints (e.g., land use restrictions)?
- What resources will be needed for the farm, such as water, electricity, and waste disposal.
- What equipment, such as vehicles, refrigerators, monitoring equipment, lighting, tanks, are needed initially and within five years?
- What tools are needed initially and within five years?
- What supplies, such as feed for fish, water additives (e.g., nutrients), seeds, crates, or labels, are needed?
- How will resources be acquired?

*An aquaponics system will typically include a fish tank, a settling basin to remove solids, a bio-filter to breakdown fish byproducts, a hydroponics growing system which may include a tank or other water contact system, and a recirculating system.*

Issues to consider when identifying physical resource needs include:

- When determining spatial needs for the development of an aquaponics operation, consider that commercial aquaponics operations today typically exist in controlled environments, such as greenhouses, buildings, or outdoor locations with agreeable climates, using methods and equipment that pull from both the hydroponics and aquaculture industries (Love et al., 2015).
- Determining the square footage needs should consider not only the area needed for the fish and hydroponics tanks, but should include sufficient space to access and work around the fish and hydroponic tanks, space for offices, packaging and shipping, growing seedlings, cold storage, equipment and material storage, as well as for future growth.
- Proper cold storage will be important to the success of any aquaponics operation, as cooling produce is important for crop preservation to reduce spoilage and reduce/prevent wilting (Love et al., 2015). Consider having sufficient storage available for 24-48 hours.
- The need for systems to monitor pump operation, water temperature, air temperature, humidity, light levels, power, and other parameters critical to the success of the plant and fish. Consideration should also be given to remote monitoring systems or systems with capabilities to notify an operator of a system failure.
- Light requirements for plants as well as workers.
- Heating requirements for air and water temperature.
- Communication requirements for telephone, internet, remote monitoring.
- Availability and capacity of utilities: Electric, natural gas, sanitary sewer, storm sewer, telephone, internet
- The need for backup power (e.g., generator) if there is an extended power outage.

Use **Worksheet # 19 (Physical Resources)** to document information about your physical resource needs.

## Human Resource Needs

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Describe the manpower needed to operate the farm. This should include management as well as farm labor. Estimates of the number and types of workers needed can be made by identifying the specific tasks that will be required on a daily basis at the farm, including administrative and management responsibilities, and estimating the number of hours per month for each task. These tasks can be grouped by skill or experience and the total number of hours for each group estimated. As an example, tasks can be grouped into marketing, operating, administrative, and finance.

Consider the following questions:

- What are the workforce needs for the first three to five years?
- What types of positions will be created for the farm?
- How many workers will be required for each position?
- What skills or experience will be required for each position?
- Will training be required or provided?
- Considering the number and types of workers needed, will the workforce consist of volunteers, part-time workers, full-time workers, third party services, or some combination?
- How will workers be compensated?
- What are the typical ranges for salaries for each position (e.g., \$/hour, \$/year)?
- Will benefits, such as vacation or medical coverage, be provided?

Issues to consider when identifying human resource needs include:

- Findings from an international survey of commercial aquaponics production and profitability indicate that the average aquaponics facility employs one or two full-time workers and one part-time worker. The study also noted that the average commercial production site in the US was 0.03 acres in size and 2700 US gallons in volume (Love et al., 2015)<sup>2</sup>.
- Depending on the scale of the operation, there is typically no need for 24 hours per day coverage.
- There are tasks that need to be completed every day, such as water checks which require someone to be present daily at the farm.
- During harvest days there may be a need for additional manpower.
- Monitoring systems with remote notification capabilities are ideal to reduce labor and provide notification of systems problems when the aquaponics operation is unattended. These systems can monitor equipment function and other parameters such as water temperature, pH, dissolved oxygen, humidity, air temperatures, water flow (pump function), and power.

Use Worksheet # 20 (Manpower Needs) and Worksheet # 21 (Workforce Needs) to document information about workforce needs.

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<sup>2</sup> Love, David C., Fry, Jillian P., Li, Ximin, Hill, Elizabeth S., Genello, Laura, Semmens, Ken, and Thompson, Richard E. *Commercial aquaponics production and profitability: Findings from an international survey*. *Aquaculture* 435 (2015) 67–74.

## Regulation and Policy

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Operating a farm business will require a number of state or local zoning, permitting, licensing, and other regulatory issues be addressed. These regulatory requirements could have a significant impact on your production and operating plans, as well as on start-up costs. To minimize the impacts and properly plan production activities, identify the types of permits, licenses, or regulations and associated fees required to start up and conduct the business. Describe the political or legal factors that will influence or limit your activities. Your business must operate within governmental and regulatory requirements, such as zoning, planning and building requirements, waste management requirements, and sales and other tax requirements.

Consider the following questions:

- Are there political or legal factors that will influence or limit your activities?
- What regulatory requirements exist, such as conditional use permits, waste handling and disposal requirements or permits, health and safety plans and permits, building permits and inspection requirements, environmental permits, business licenses, and food handlers' licenses?
- Are there regulatory requirements or industry standards for handling, storing, packaging, and distributing the products?
- What conditions or issues are associated with each regulatory requirement?
- Can you meet each regulatory requirement?
- What fees are associated with the identified permits, licenses, or regulations?

Use **Worksheet # 22 (Regulation and Policy)** to document information about your approach to regulations and policies.

## Financial Strategy

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*\*The Financial Strategy is pulled directly from the [Urban Farm Business Plan Handbook](#) and [Worksheets](#) and was not specifically updated to target aquaponic farm development. However, all information and worksheets will be valuable to those seeking to develop an aquaponic farm.*

The financial strategy is divided into seven sections:

- Introduction
- Expenses
- Income
- Profit and Loss
- Fixed Assets
- Funding Requirements
- Risk Management



Figure 6: Urban Farm Employee  
Data source: Image via Flickr, courtesy of Michigan Municipal League (MML)

## Introduction

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The introduction to the Financial Strategy summarizes for the reader the:

- estimated expenses for start-up and operation of the farm (Expenses),
- projected income for the farm (Income),
- projected profitability of the farm (Profitability),
- anticipated fixed assets (Fixed Assets),
- potential source of funding (Funding), and
- potential risks to the successful operation of the farm (Risk Management).

It should also describe the approach that was taken in developing the financial strategy.

## Expenses

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Develop a five-year projection for the annual expenses for the farm including adjustments for inflation using information such as the consumer price index (<http://www.bls.gov/cpi/>). The expenses should include the marketing expenses, operating expenses, and human resource expenses discussed in the marketing, operating, and human resource strategy sections of this business plan handbook. Expenses should also include administrative expenses related to the administration and management of the farm and one-time or initial start-up expenses, such as initial operating expenses, site preparation, environmental investigations, and remedial actions not treated or included as part of fixed asset costs. Discuss any assumptions used to develop the estimated expenses.

Use **Worksheet # 23 (Expenses)** to calculate and document the annual expenses.

## Income

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Develop a five-year projection for the annual income for the farm. The income should include receipts from the sales of produce and other products from the farm, less any loss associated with spoilage or product which cannot be sold. It should also include income from grants, donations, rent, or other sources which are anticipated on an annual basis to cover operating expenses. It is helpful to break down projected sales income by market segment to identify the contribution to income and evaluate the performance of each market segment. Identify any assumptions that were used to estimate the income.

Consider the following questions:

- For sources of income other than sales receipts, what are the sources of funding?
- What is the anticipated amount of funding that will be obtained from each source?
- What, if any, are the limitations on the use of the funding?

Use **Worksheet # 24 (Income)** to calculate and document the annual income.

## Profit and Loss

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Develop a five-year projection for the annual profit or loss for the farm. The annual profit or loss is the difference between the estimated annual expense and the estimated annual income.

Use **Worksheet # 25 (Profit and Loss)** to calculate and document the annual profit or loss.

## Fixed Assets

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Develop a five-year projection for the fixed assets that will require initial purchase or construction costs. Fixed assets normally include items such as land and buildings, motor vehicles, furniture, office equipment, computers, fixtures and fittings, and plant and machinery. These are items that are normally depreciated over time for tax purposes. Discuss any assumptions that were used to estimate the fixed asset costs.

Use **Worksheet # 26 (Fixed Assets)** to calculate and document the fixed assets and estimated costs to purchase and install.

## Funding Requirements

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Describe the sources and amount of funding (capital) required to purchase and install the fixed assets needed to start up the farm and achieve the five-year goals of the business plan. Discuss the plans for obtaining the needed funding for the farm. Donations of equipment, such as vertical gardens or hoop houses, should be discussed along with the value associated with the donation. Any associated expenses should be included in the projected expenses for the farm (See Worksheet # 23).

Consider the following questions:

- What are the sources or potential sources of the funding?
- How much is needed?
- Will some or all of the capital requirements be financed?
- Are there specific limitations on the funding?
- What are the critical assumptions concerning the funding?

- What is the timing of the funding and how will it impact the achievement of the business plan?
- Are there any expenses associated with obtaining financing or funding, such as consulting expenses, filing fees, insurance?
- Is some of the funding going to be achieved through donations of equipment, buildings, or other fixed assets?

Use **Worksheet # 27 (Funding)** to calculate and document the sources of funding, the anticipated amount of funding that will be obtained from each source, and what, if any, are the limitations on the use of the funding. Use **Worksheet # 28 (Funding Information)** to document information concerning the funding needs and sources.

## Risk Management

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Identify and evaluate potential risks that can impact the financial strategy and the success of the business plan.

Consider the following questions:

- What are the potential risks that may need to be managed, such as production risks related to failure of a crop or unexpected low yield or environmental risks such as restrictions on land use?
- What are the marketing risks related to unexpected competitive actions, such as lower than expected competitor pricing?
- What are the financial risks related to loss of funding sources or low sales volume, or labor issues related to labor injuries or loss of the farm manager?
- How likely are the risks to occur?
- What can be done or what is planned to minimize these potential risks if they occur?
- What are the potential impacts on the financial strategy if there were changes in the assumptions for sales or production?

Use **Worksheet # 29 (Risk Management)** to document information on the potential risks that can impact the financial strategy.

## List of Provided Worksheets

Worksheet		Purpose
1	Before You Begin	Document your reasons, expertise and resource needs
2	Introduction	Document the information to include in the Business Plan introduction
3	Vision	Document the information to include in the Business Plan vision statement
4	Mission	Document the information to include in the Business Plan mission statement
5	Goals	Document the information to include in the Business Plan goal discussion
6	Organization & Management	Document the information about the organization & management of your business
7	Market Analysis	Document the information to include in the market section
8	Market Segments	Document the information about customers and market segments (complete one worksheet for each market segment)
9	Product	Document the information about your product (complete one worksheet for each market segment)
10	Distribution	Document the information about your approach to storage and distribution (complete one worksheet for each market segment)
11	Pricing	Document the information about your approach to pricing (complete one worksheet for each market segment)
12	Sales Volume	Document the information about potential sales volumes
13	Competition	Document the information about competitors (complete one worksheet for each market segment)
14	Promotion	Document the information about your approach to promotion (complete one worksheet for each market segment)
15	Fish & Crop Management	Document the information about your approach to production management
16	Aquaponics Harvesting Schedules	Evaluate approach to planting and harvesting
17	Aquaponics Operations Planning (N/A)	Assist in estimating the operating expense for the farm and size and capacity of the farm

Worksheet		Purpose
18	Yield	Document the information about farm capacity and size
19	Physical Resources	Document the information about the physical resource needs
20	Manpower Needs	Document the information about workforce needs
21	Workforce Needs	Document the information about workforce needs
22	Regulation & Policy	Document the information about your approach to regulations and policies
23	Expenses (MS Excel)	Calculate and document annual expenses
24	Income (MS Excel)	Calculate and document the annual income
25	Profit & Loss (MS Excel)	Calculate and document the annual profit or loss
26	Fixed Assets (MS Excel)	Calculate and document the fixed assets and estimated costs to purchase and install
27	Funding (MS Excel)	Calculate and document the sources of funding, the anticipated amount of funding that will be obtained from each source, and what, if any, are the limitations on the use of the funding
28	Funding Information	Document the information concerning the funding needs and sources
29	Risk Management	Document the information about the potential risks that can impact the financial strategy