Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research
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Thesis submitted in partial fulfillment of the requirements for the Master's degree in Management Sciences

Field of study: Entrepreneurship

Startup Creation Project: Agritech Solution "AMAN" for Smart Vertical Farming

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Academic year: 2024/2025

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General Introduction

In the current era of global transformation, agriculture is undergoing a profound shift driven by technological innovation and growing environmental challenges. Climate change, urbanization, limited natural resources, and increased demand for sustainable food production have placed unprecedented pressure on traditional agricultural systems. As a result, the sector is increasingly compelled to adopt new approaches that promote efficiency, resilience, and sustainability.

Despite the global trend toward modernization, agriculture in many developing countries, including those in North Africa, Algeria being one of them, continues to face structural and operational constraints. The reliance on outdated techniques, combined with poor access to tailored technological solutions, limits the sector's capacity to meet growing demands. Water scarcity, inefficient land use, and the absence of data-driven decision-making tools represent persistent obstacles to progress.

Moreover, the lack of adequate support systems—ranging from technical training to affordable infrastructure—has hindered the adoption of modern agricultural methods. Many smallholder farmers and agribusinesses are unaware of, or unable to access, innovations that could enhance their productivity and sustainability. In this context, there is a pressing need for solutions that are not only technologically advanced but also locally adapted, accessible, and easy to use.

Technological progress—particularly in the fields of automation, data analysis, and smart systems—has opened the door to modern agricultural methods that optimize production while minimizing resource consumption. Vertical farming, hydroponics, and precision agriculture have emerged as promising alternatives to conventional practices, offering greater yields per unit area and significantly lower water usage. These innovations are becoming essential in responding to the global need for food security and environmental conservation.

The digitalization of agriculture, through the integration of smart technologies and connected systems, presents a unique opportunity to address these challenges. By improving the monitoring and management of agricultural resources, digital tools can reduce human error, increase crop quality, and contribute to more sustainable practices. Furthermore, they facilitate informed decision-making, enabling farmers to adapt more effectively to environmental and market conditions.

This project seeks to explore the intersection of innovation and agriculture, examining how emerging technologies can contribute to solving critical issues such as water management, space limitations, and inefficiencies in traditional farming

practices. Through a structured research approach, it aims to identify the underlying problems in the current agricultural landscape and propose pathways for the development and implementation of efficient, modern, and sustainable solutions.

1. Hypotheses

Based on the initial version of the Business Model Canvas (BMC0), a set of hypotheses was formulated to guide the development of the project. These hypotheses will be validated through exploratory research, with the results to be presented in BMC1 and 2

1.1 For Farmers and Agricultural Cooperatives

- Farmers and agricultural cooperatives perceive traditional farming methods, which rely heavily on manual labor and outdated irrigation systems, as inefficient and unsustainable in the long term.
- A locally adapted solution that optimizes water use, increases productivity, and minimizes land occupation would be preferred over generic imported systems.
- A smart vertical farming solution integrating automated irrigation and environmental monitoring is seen as a valuable innovation that could reduce labor, improve crop quality, and save time.
- A subscription-based model with scalable packages tailored to different types of users (smallholder farmers, cooperatives, and large-scale operators) is perceived as economically viable and flexible.

1.2 For Institutions, Agri-Enterprises, and Urban Stakeholders

- Agricultural enterprises, local institutions, and urban users (e.g., schools, municipalities, eco-conscious businesses) are increasingly seeking sustainable, space-saving farming solutions that are easy to deploy and manage.
- A compact and tech-enabled farming system that requires minimal agricultural expertise is likely to appeal to non-traditional growers and urban clients.
- The adoption of smart farming technologies will be favored if there is a clear return on investment (such as reduced water consumption, higher crop yields, or improved operational control).
- Institutions and businesses are willing to invest in solutions aligned with environmental regulations and sustainable development goals, particularly if they enhance food security and reduce ecological impact.

2. Objectives

This project aims to address key challenges related to sustainable agriculture, including water scarcity, limited space for cultivation, and inefficient farming practices, by developing an agritech slotution dedicated to the Algerian market.

The specific objectives are:

- To identify the main problems faced by Algerian farmers and urban growers through in-depth market research and stakeholder interviews.
- To design a sustainable and scalable farming solution that maximizes efficiency, minimizes water usage, and enhances crop quality.
- To develop and validate a comprehensive business model ensuring alignment with user needs and market conditions.
- To test and refine a prototype through cycles of feedback and experimentation, with a focus on both agricultural and technological performance.

3. Methodology

To achieve these objectives, a methodological study based on Design Thinking and the Lean Startup framework has been adopted:

Design Thinking: This is a problem-solving methodology focused on delivering innovative solutions by deeply understanding user needs, clearly identifying the problem, generating creative ideas, and continuously improving the proposed solutions through iteration.

Lean Startup: This widely used approach is designed for developing and launching new products or ventures. It emphasizes a systematic and iterative process aimed at minimizing waste, validating business hypotheses, and efficiently delivering the product or service that meets customer demands.

4. Structure of the Thesis

This thesis is divided into three main chapters:

Chapter 1: Problem Identification

This chapter focuses on analyzing the needs of urban farmers, households, and agricultural stakeholders, and identifying the current limitations of conventional farming methods in Algeria. It draws on an exploratory methodology to highlight key challenges related to water scarcity, limited space, and inefficient agricultural practices.

Chapter 2: Solution Proposal and Validation

This chapter presents the proposed agritech solution, including its conceptual framework, Business Model, and iterations developed through feedback and field research. It also details the prototype and its core features.

Chapter 3: Market Strategy Implementation

This final chapter explores the project's alignment with the United Nations Sustainable Development Goals (SDGs), its growth hacking and go-to-market strategies, the marketing analysis used to position the product, and the long-term objectives set for scalability and impact. It provides a comprehensive outlook on the roadmap for sustainable implementation and expansion.

Chapter 01:
Problem Identification

Chapter 01: Problem Identification

This chapter focuses on analyzing the needs and identifying gaps in the current market, as well as the real challenges faced by urban farmers, households, and businesses in Algeria regarding sustainable food production and space optimization. It employs an exploratory methodology based on uncovering various situations and constraints (Discover) to precisely define the specific problem to be addressed (Define).

General Problem Statement

Utilizing a Design Thinking approach, this study aims to identify and analyze the challenges associated with urban agriculture in Algeria. As urbanization accelerates and arable land becomes increasingly scarce, individuals and businesses struggle to optimize food production within confined spaces. Traditional farming methods often prove inefficient in urban settings, exacerbated by issues such as water scarcity and limited access to innovative agricultural solutions. While vertical gardens present a viable alternative, their adoption remains low due to insufficient awareness, technical barriers, and accessibility constraints. A comprehensive analysis of these obstacles is essential to understanding the factors limiting the widespread implementation of vertical gardening systems.

Section 1: Business Model Canvas Version 0

The initial version of the BMC0 is based on preliminary assumptions. The Business Model Canvas (BMC) serves as a tool to clearly visualize a company's value creation logic, identify gaps and opportunities, and support strategic decision-making and innovation—key aspects of our project.

Chapter 01: Problem Identification

Figure N°01: Business Model Canvas BMC0

<table>
<tr>
<td rowspan="2">Key Partners
• Automaticians
• Agricultural suppliers
• Agricultural technicians</td>
<td>Key Activities
• Continuous design update
• Production of the units And their components</td>
<td rowspan="2">Value Proposition
• Reduce water consumption used for irrigation
• cultivation space optimization
• cost-effective
• Mechanical self-irrigation system
• Minimal care for plants</td>
<td>Customer Relationship
• After-Sales Service
• Personalized support</td>
<td rowspan="2">Customer Segments
• Agricultural entrepreneurs
• Home gardeners
• Farmers</td>
</tr>
<tr>
<td>Key Resources
• Assets (Equipment, Manufacturing materials…)
• Work team</td>
<td>Channels
• Website
• Specialized outlets</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Production cost: 60%
• Marketing cost: 30%
• Technologies and content: 10%</td>
<td colspan="2">Revenue streams
• Direct sells: 5000DA/Unitée
• Printer:
- Laine de roche 50 pièces pour 1000DA
- Engrais liquide 2000DA/1L</td>
</tr>
</table>

Source: Produced by the student

Chapter 01: Problem Identification

Customer Segments

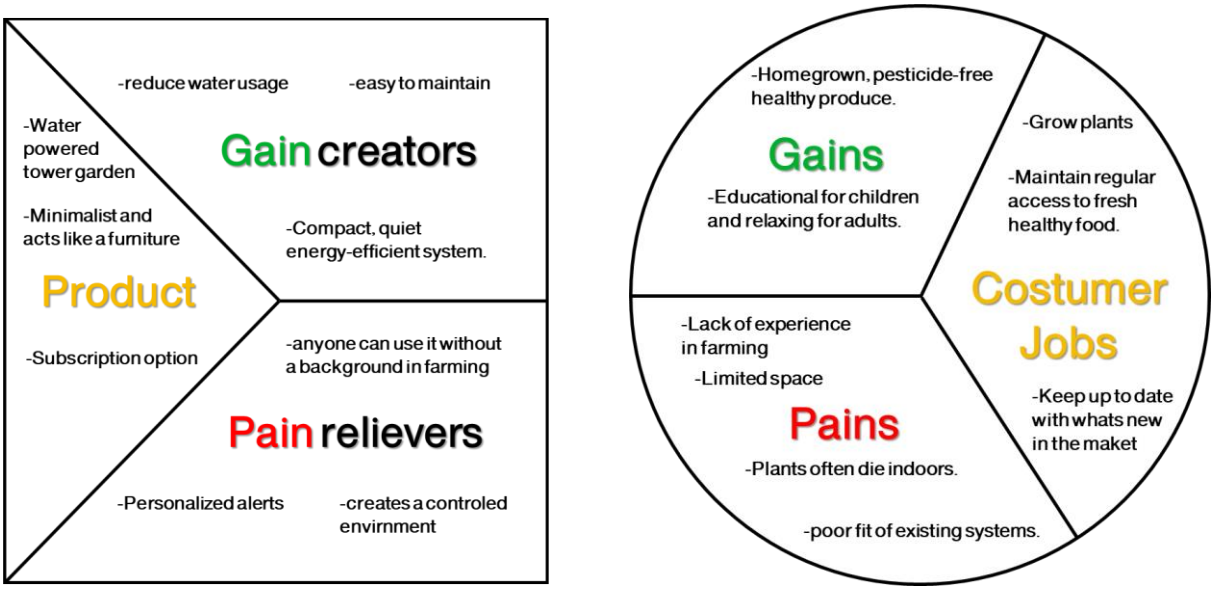
- **Agricultural entrepreneurs:** these are individuals or small business owners who are actively engaged in launching or running agricultural ventures. They are often innovative, open to adopting new technologies, and motivated by profitability and sustainability. Agricultural entrepreneurs may include people starting urban farming businesses, organic produce delivery services, or tech-driven agriculture solutions. Tower Gardens offer them a scalable, water-efficient, and space-saving method to cultivate high-value crops, enabling year-round production even in non-traditional farming locations such as rooftops, balconies, or unused indoor spaces.
- **Home gardeners:** particularly those interested in home gardening or providing fresh, organic food for their families, represent a key segment.
- **Farmers:** especially those looking for innovative and efficient agricultural techniques, can use vertical gardens to optimize land use, increase productivity, and reduce water consumption.

Value Proposition

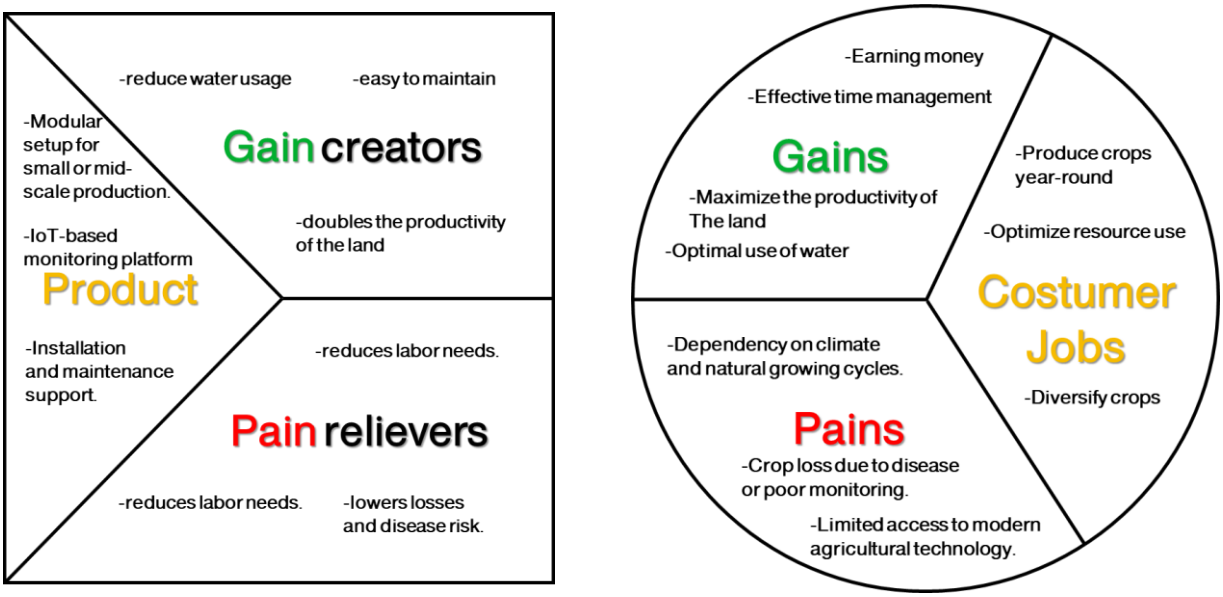
- **Reduced water consumption for irrigation:** the system uses hydroponic and aeroponic methods that save up to 90% of water.
- **Optimization of cultivation space:** Vertical design allows growing more plants in smaller areas.
- **Cost-effective solution:** Affordable unit pricing and minimal operating costs.
- **Mechanical self-irrigation system:** Operates without electricity, ensuring reliability and low energy dependence.
- **Minimal care required for plants:** Designed for simplicity, perfect for users with limited gardening experience.

Figure N°02: Value Proposition Canvas VPC0

- **Home gardener:** This Value Proposition Canvas explores the needs and constraints of home gardeners, particularly those living in urban or suburban areas. It identifies the functional, emotional, and social expectations of individuals seeking to grow food at home with minimal space, knowledge, or effort. The canvas highlights the key challenges they face and the types of value they seek in a practical, sustainable gardening solution.



- **Farmers:** This Value Proposition Canvas focuses on the realities of small-scale and independent farmers operating in environments affected by climate variability, limited water resources, and increasing operational costs. It outlines their functional needs, resource constraints, and strategic goals, providing insight into what kind of support and innovation they require to improve productivity, reduce losses, and ensure sustainability.



Source: Produced by the student

Chapter 01: Problem Identification

Channels

- **Website:** For information, orders, and direct interaction with the brand.
- **Specialized outlets:** Physical presence in agri-shops and eco-friendly stores to reach target customers.

Customer Relationship

- **After-sales service:** Quick assistance for maintenance, upgrades, or troubleshooting.
- **Personalized support:** Tailored advice for setup, crop choices, and optimal usage.

Revenue Streams

- **Direct sales:** 5000 DZD per unit
- **Additional products:**
  - **Rock wool:** 50 pieces for 1,000 DZD
  - **Liquid fertilizer:** 2,000 DZD per liter

Key Partners

- **Automations specialists:** For integrating smart features and mechanical improvements.
- **Agricultural suppliers:** To source nutrients, growing mediums, and tools.
- **Agricultural technicians:** For technical assistance in setup and customer support.

Key activities

- **Continuous design updates:** Based on user feedback and research.
- **Production of Vertical Gardens and their components:** Ensuring consistent quality and availability.

Key resources

- **Assets:** Software, premises, equipment, manufacturing materials
- **Work team:** CEO, engineers (mechanical, IT, AI), agronomist, multi-skilled technician

Cost structure

- **Production cost:** 60% Materials, manufacturing, and assembly.
- **Marketing cost:** 30% Promotion, packaging, and outreach campaigns.
- **Technologies and content:** 10% Encompasses software development, app maintenance, and educational or training content creation.

Chapter 01: Problem Identification

Section 2 : Problems Analysis

The primary users targeted by this solution include urban gardeners, home growers, and businesses or institutions seeking sustainable farming alternatives. Each of these user segments shares a desire to grow fresh produce locally but encounters distinct barriers tied to their environment and available resources.

- **Overcoming space limitations:** In urban and peri-urban areas, access to outdoor land is often scarce or non-existent. Home growers and city dwellers typically rely on balconies, rooftops, or indoor corners to cultivate plants. This spatial constraint limits the scale and variety of crops that can be grown using traditional horizontal methods, creating a need for vertical farming structures that can multiply usable surface area without requiring more floor space.
- **Managing plant growth and irrigation efficiently:** Many users—especially those without agricultural training—struggle to maintain consistent plant care routines. Manual watering can be time-consuming, imprecise, and wasteful, especially in climates with high evaporation or water scarcity. Inconsistent care can lead to overwatering, underwatering, or irregular plant development, affecting yield and overall plant health.
- **Ensuring proper nutrient distribution and environmental control:** Achieving healthy plant growth requires more than just light and water. Nutrients must be delivered in balanced quantities, and growing conditions—such as temperature, humidity, and pH—must be monitored and adjusted as needed. For non-professionals and small-scale users, this level of control is difficult to achieve without access to costly or complex agricultural systems. This challenge is especially acute for those seeking pesticide-free, high-quality food production at home or on-site.

These challenges underline the need for accessible, compact, and intelligently managed systems that allow users to grow plants efficiently, regardless of their technical knowledge or available space.

1- Personas

A well-defined customer persona provides valuable insights into the target market, enabling us to develop a product or service that effectively addresses their needs. In product development, the user persona represents a set of key characteristics that define the ideal customer, helping to shape a precise profile of the future user.

Figure N°03: Personas

Saci Mabrouk

Adresse: Annaba
Age: 61 ans
Marié
CEO of Agrvers

Behaviors & habits

- Tech-curious
- Visits farms and expos
- Delegates but stays involved

motivations

- Wants to increase crops yield while using less water
- Looks for tech to modernize his farm

Concerns & challenges

- Hesitant to invest in untested solutions
- Needs assurance that his staff can be trained easily on any new system

Goals & ambitions

- Reduce water and nutrient waste
- Export high-quality produce

Imad Fareh

Adresse: Guelma
Age: 49 ans
Marié
Director of a model farm

Behaviors & habits

- Very active in the local agricultural community
- Frequently colaborates with neary farmers
- Keeps a close eye on production quality and logistics
- Open to testing innovations if they prove practical

motivations

- Wants to imrpove seedlig quality And consistency
- Seeks tools to optimize water and space during
- Interested in tech that gives him a competitive edge

Concerns & challenges

- Needs assurance of high germination rates with new system
- Limited time and workforce during peak seasons
- Skeptical about integrating complexe tech

Goals & ambitions

- Improve efficiency of seedling production
- Introduce innovative methods that
- Local farmers can also adopt
- Become a regional reference point in sustanable agri-practices

Samira Boudjemaa

Adresse: Guelma
Age: 51 ans
Single
Administrative assistant

Behaviors & habits

- Balances work and home Responsibilities
- Loves social activities and follows Politics
- Loves social activities and follows politics
- Relies on instructions when using New products

motivations

- Wants to enjoy fresh ingredients at home
- Intrested in products that simplify her daily life
- Willing to invest if the product delivers real value

Concerns & challenges

- Often forgets about her plants
- Finds it difficult to learn complex technologies

Goals & ambitions

- Simplify daily routines
- Imrpove personal well-being
- Live a more heilthier and complicated lifestyle

Source: Produced by the student

2- Empathy map

Empathy maps are important tools for understanding user behavior at specific moments or over different periods of time. They can also be used to analyze past behaviors of the target audience and predict future actions.

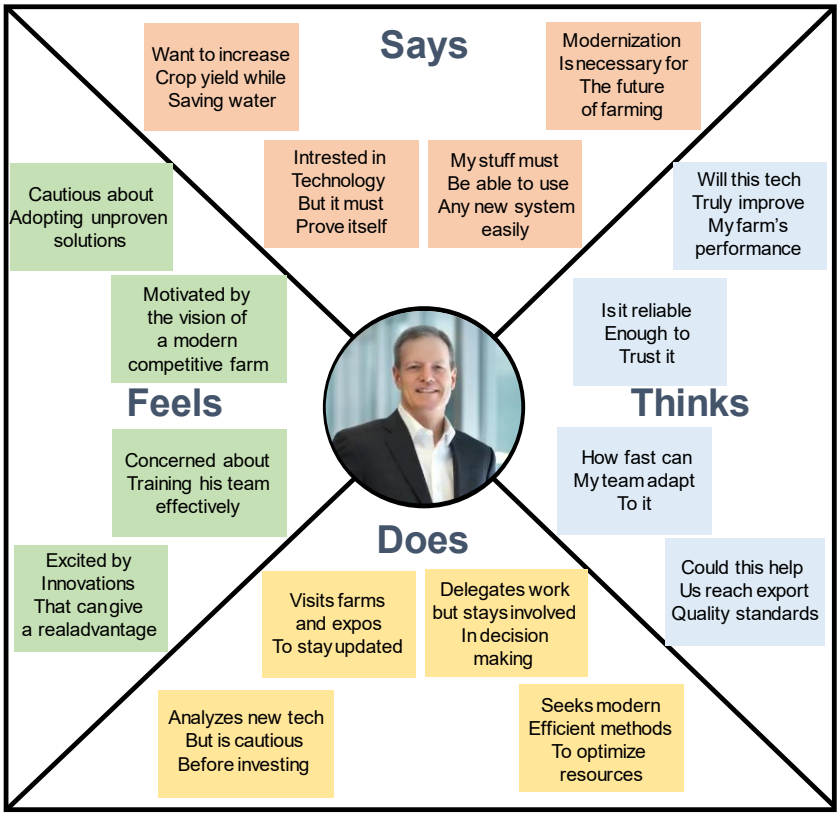
After conducting preliminary interviews to identify and explore key challenges — interviews carried out with several individuals over the past few months — three representative samples were selected, and empathy maps were created based on their profiles to better tailor the Tower Gardens solution to their real needs.

2-1- agricultural entrepreneurs

On April 24th, 2025, we conducted a series of interviews with farmers, agricultural experts, and home gardeners to identify the main challenges they face in crop cultivation and garden management.

The interviews revealed that the key issues include significant difficulties in optimizing limited space, managing irrigation efficiently, and maintaining consistent crop health. With the aim of improving the overall user experience, empathy maps help maintain a customer-centered mindset, identify bottlenecks or obstacles, and determine which issues need to be addressed as a priority.

Figure N°04: Empathy map (agricultural entrepreneurs)



Source: Produced by the student

2-2- Farmers

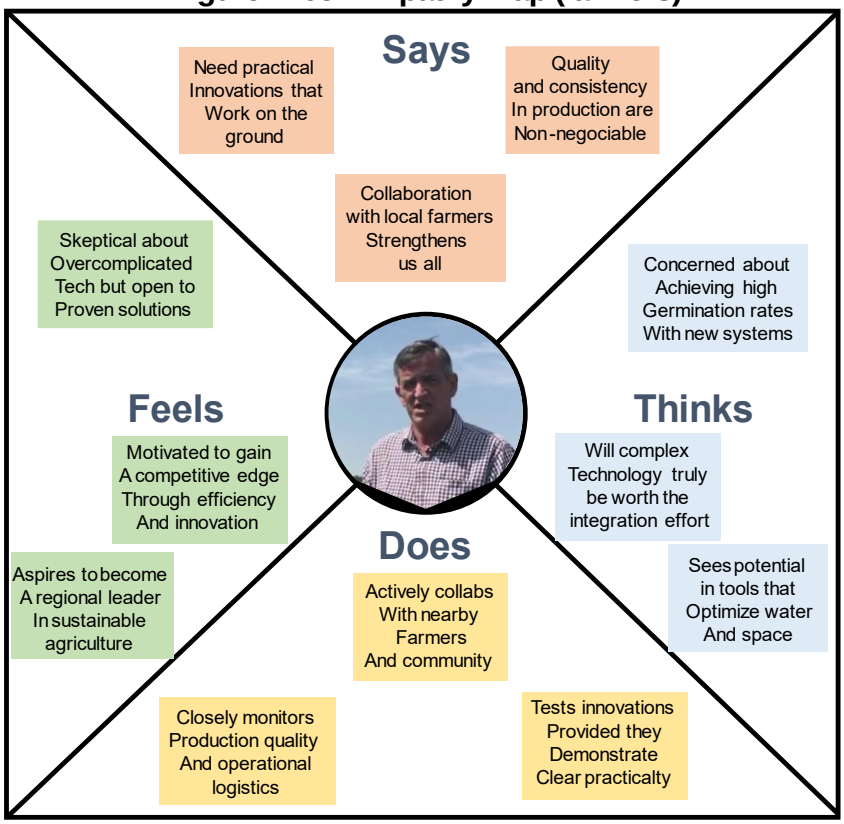
During an interview with Imad Fareh, director of a model farm in Guelma and an active member of the local agricultural community, we discussed the challenges he faces in adopting innovative agricultural systems. He emphasized the recurring difficulties associated with integrating new technologies, the lack of time and labor during peak seasons, and the need for practical and proven solutions that align with local realities.

Imad underscored the significance of developing tailored systems that can enhance seedling quality and optimize water usage while being easily implementable by farmers with limited resources. He highlighted the potential disruptions caused by delays in receiving support materials or untested innovations, particularly during critical periods.

Following this interview and additional discussions with two other agricultural professionals, we identified the primary obstacles in introducing new agri-tech systems in traditional farming environments. Their feedback revealed a strong desire for innovation, particularly systems that optimize water use and space—while also requiring simplicity, reliability, and tangible results to earn farmers' trust.

After gathering their insights and assessing their engagement with the issues raised, we conducted an in-depth analysis to pinpoint the main challenges. This informed the development of AMAN's solution: a smart vertical farming system that meets the expectations of farmers like Imad Fareh. It is designed to be compact, water-efficient, and equipped with user-friendly technology. Our objective is to offer a scalable model that supports local producers in enhancing seedling productivity and establishing themselves as references in sustainable agriculture.

Figure N°05: Empathy map (farmers)



Source: Produced by the student

2-3- Home gardeners

In our endeavor to design a solution that truly meets the aspirations of individuals seeking a healthier and more sustainable lifestyle, we engaged in a meaningful conversation with Samira Boudjemaa, a 51-year-old administrative assistant residing in Guelma. Samira manages a demanding schedule, balancing work and personal responsibilities, and values practical products that streamline her routine.

Samira expressed a clear desire for access to fresh ingredients at home, not only for convenience but also to enhance her overall well-being. However, she frequently neglects her plants due to her hectic schedule and finds managing complex technologies challenging. Although she lacks technical expertise, she is receptive to innovative solutions, particularly those that are intuitive, beneficial, and accompanied by clear instructions.

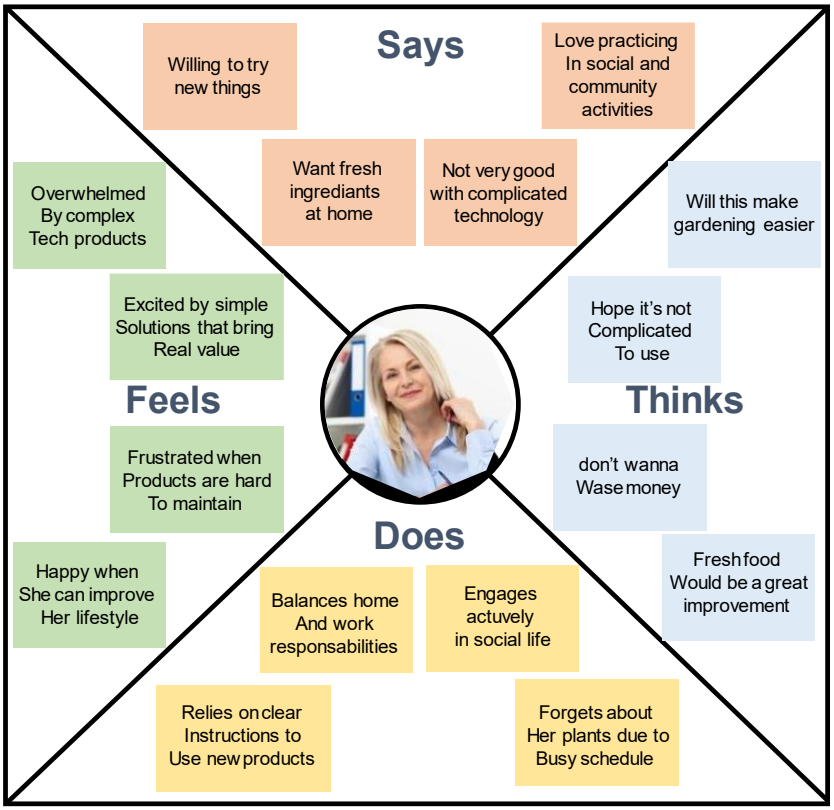
Samira's daily habits reflect a lifestyle characterized by limited time and the paramount importance of ease of use. She enjoys social activities and stays informed about current events, but when it comes to new products, she relies heavily on user guidance and step-by-step instructions. The concept of cultivating her own herbs or vegetables appeals to her, but the prospect of maintaining a traditional garden or employing unfamiliar systems can be discouraging.

That is where the AMAN vertical garden comes into play. Specifically designed with users like Samira in mind, it offers a sophisticated, space-saving unit equipped with sensors to monitor water, temperature, and nutrient levels. The system automates essential processes such as irrigation and provides reminders via a mobile application, alleviating the burden of remembering or constantly monitoring the plants.

Samira was particularly drawn to the simplicity of the system and its ability to maintain fresh produce without disrupting her routine. She expressed her willingness to invest in a product like AMAN if it could genuinely enhance her quality of life and provide enduring value.

Her input, along with insights gathered from other individuals, reinforced our unwavering commitment to crafting a gardening solution that supports healthier living while maintaining accessibility and ease of use. AMAN transcends mere product status; it serves as a lifestyle companion that empowers individuals like Samira to embrace sustainability, improve their well-being, and derive the benefits of fresh food at home without the stress or complexity associated with traditional gardening methods.

Figure N°06: Empathy map (Home gardeners)



Source: Produced by the student

Chapter 01: Problem Identification

3- User Journey Map

A journey map is a visual representation of a user's experience as they interact with a product, service, or company. It outlines the steps, touchpoints, emotions, and potential pain points they encounter while trying to achieve a specific goal.

3-1- Agricultural entrepreneurs / Farmers

This journey map outlines the key phases that agricultural entrepreneurs and farmers typically go through during a crop cycle, from preparation to harvest. It highlights the operational steps emotional states, and recurring challenges, providing a comprehensive understanding of their needs and pain points in the absence of smart agricultural solutions.

1. Preparation — Uncertainty

The entrepreneur begins by selecting crops and estimating water availability. This stage often involves relying on outdated government reports, historical weather patterns, or personal experience. Due to the absence of reliable forecasting tools, there’s a high level of uncertainty regarding water needs, crop performance, and resource allocation.

2. Planting — Optimism Mixed with Risk

The planting phase typically brings renewed energy and hope. However, the process remains largely manual and observational. Soil quality, seed placement, and spacing are supervised visually, increasing the risk of human error. The lack of real-time monitoring tools prevents early correction of issues that may arise during this critical phase.

3. Irrigation — Doubt and Inefficiency

Watering is often managed through fixed schedules and manual valve operation. Without precision control or live feedback, the entrepreneur cannot adapt irrigation to actual crop needs or environmental changes. This results in over- or under-watering, nutrient loss, and overall inefficiency in resource use.

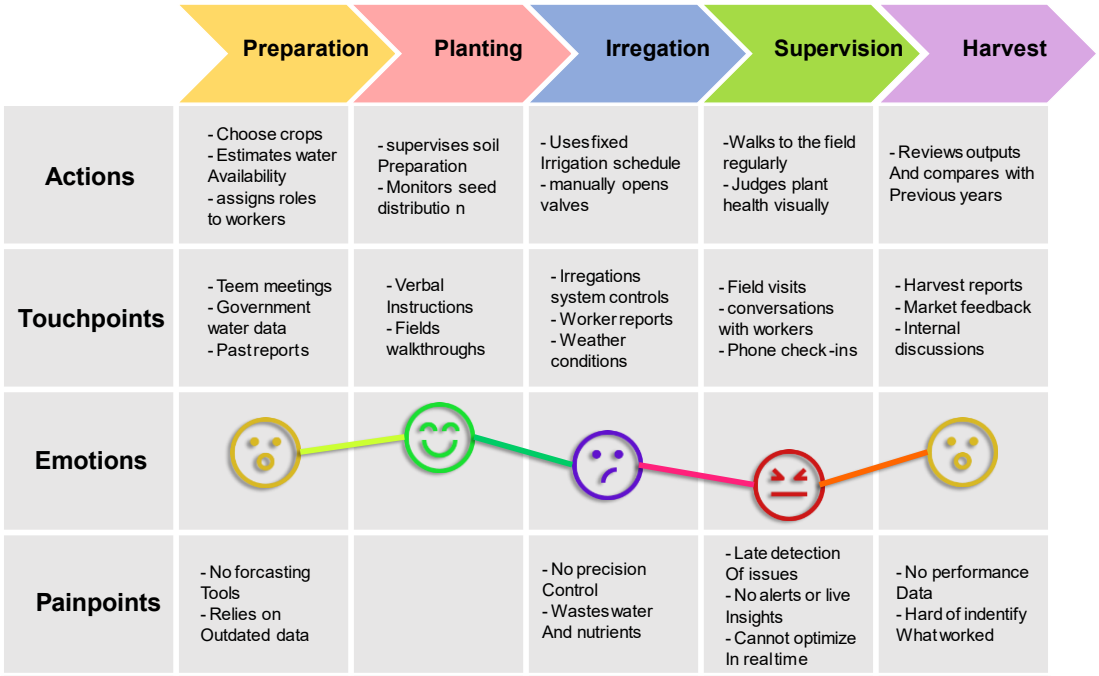
4. Supervision — Frustration

Crop health is assessed visually and through periodic field visits or worker feedback. Issues such as pests, disease, or nutrient deficiencies are often detected too late. The lack of digital insights, alerts, or centralized data makes it difficult to respond quickly or to make informed decisions in real time.

5. Harvest — Limited Insight and Learning

At the end of the season, the entrepreneur evaluates crop yield and quality. This assessment is typically based on harvest reports, market feedback, and internal discussions. However, due to a lack of performance data and traceability, it becomes difficult to identify what worked well and what needs improvement. As a result, lessons learned are limited, and opportunities for optimization in future cycles are missed.

Figure N°07: Journey map (Agricultural entrepreneurs and farmers)



Source: Produced by the student

3-2- Home gardeners

This journey map outlines the typical experience of home gardeners throughout their growing cycle—from the first moment of inspiration to harvesting and use. It highlights their actions, emotional states, and recurring pain points, providing a clear understanding of the limitations faced in the absence of smart gardening solutions.

1. Inspiration — Curiosity Meets Overwhelm

The journey begins when the home gardener is inspired by a recipe, social media post, or conversation to grow herbs or vegetables. Motivated by a desire for fresh produce or a new hobby, they begin searching for information. However, the sheer volume of choices and conflicting advice online quickly becomes overwhelming, making it difficult to know where to begin or which plants are most suitable.

2. Setup — Motivation with Uncertainty

In this phase, the individual purchases seeds, pots, soil, and other tools, attempting to recreate what they've seen or read. They set up a space near sunlight

and try to follow instructions found on packaging or online. Despite the initial motivation, a lack of clarity around basic setup steps and growing conditions leads to hesitation and second-guessing, making the process feel less accessible than expected.

3. Planting — Hope with Insecurity

The gardener plants their seeds and begins the growing process, often relying on vague memory or online videos for guidance. While this stage is filled with hope and anticipation, it is also marked by uncertainty. Doubts about watering frequency, spacing, and whether the plants are progressing as they should are common, as there is no feedback mechanism to confirm whether things are going right or wrong.

4. Care — Frustration and Inconsistency

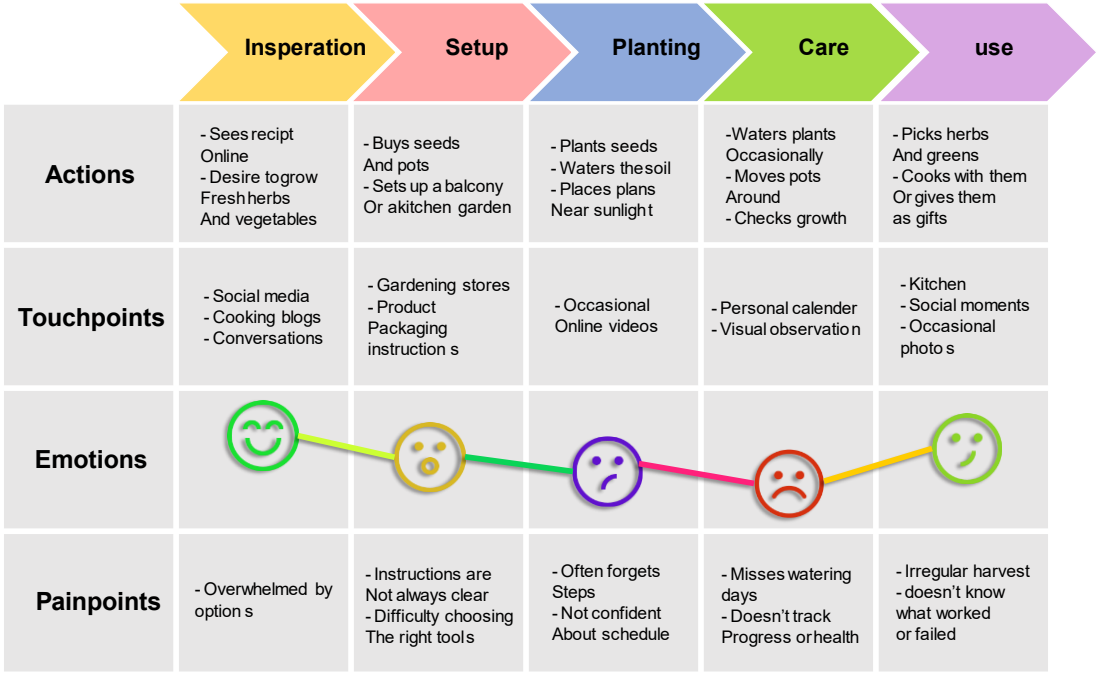
As time passes, the gardener's enthusiasm is tested by the demands of maintenance. Watering schedules are often inconsistent, sunlight conditions shift, and signs of poor health or pest damage may go unnoticed or misunderstood. Without smart alerts or tracking tools, identifying and correcting problems becomes guesswork, leading to stress and a drop in confidence.

5. Use — Satisfaction with Limited Insight

Eventually, some plants are harvested and used in cooking or shared with others. While this brings a sense of accomplishment, the results are often irregular. With no system in place to track what worked and what didn't, gardeners are left without clear lessons or the ability to replicate success. The experience ends with a mix of pride and confusion, and many miss out on the opportunity to grow more effectively in the future.

Chapter 01: Problem Identification

Figure N°08: Journey map (Home gardeners)



Source: Produced by the student

Section 3: Problem definition

Defining the problem is a crucial step in any problem-solving process, project management approach, or user-centered design methodology. For AMAN, this step is essential to clearly frame the challenges related to urban agriculture, water scarcity, and limited space. By precisely identifying these issues, we lay a strong foundation for developing innovative and sustainable solutions that meet the needs of eco-conscious consumers and urban communities.

1-Problem Classification

1-1-The LOTUS diagram

The Lotus Diagram was developed based on insights gathered from interviews with home gardeners and farmers, as well as the results of the User Journey Map focused on the gardening cycle from setup to harvest. It defines the central problem as: “Inefficiency in gardening and farming operations, and lack of consistency in plant care and monitoring”.

Chapter 01: Problem Identification

Table N°01: LOTUS Diagram

Over-consumption and major losses in water	Outdated farming methods	Lack of real-time monotoring of enviromental conditions
Difficulty in finding skilled workers and specialists	Inefficient and Unsustainable agriculture	Limited cultuvation space
The inability to monitor and control storage conditions	Inconsistant crop quality	Lack of access to quality agricultural inputs

Source: Produced by the student

1. Over-consumption and major losses in water

Traditional irrigation methods often lead to excessive water use and significant losses through evaporation, runoff, or inefficient distribution. In regions already facing water scarcity, this worsens the crisis and threatens long-term agricultural viability.

2. Outdated farming methods

Many farmers still rely on conventional techniques that haven't evolved with modern challenges. These methods are labor-intensive, less productive, and contribute to soil degradation, low yields, and vulnerability to climate change.

3. Lack of real-time monitoring of environmental conditions

Without sensors or automated systems, farmers struggle to track temperature, humidity, and soil conditions. This leads to poor decision-making, late reactions to crop stress, and inefficient use of inputs like water and fertilizers.

4. Difficulty in finding skilled workers and specialists

There's a shortage of trained agronomists, technicians, and system operators in many rural areas. This makes it hard to adopt new technologies or optimize farm performance, keeping farms stuck in outdated practices.

5. Limited cultivation space

Urban expansion and poor land planning have reduced the availability of fertile land. Small-scale farmers, especially in urban or peri-urban areas, can't scale up without innovative solutions.

6. The inability to monitor and control storage conditions

Post-harvest losses are high due to a lack of proper infrastructure to store and preserve crops. Without controlled temperature, humidity, or pest management in storage, significant portions of the harvest go to waste

7. Inconsistent crop quality

Variability in growing conditions, poor seed quality, and inadequate monitoring lead to uneven growth and poor product standards. This affects marketability, pricing, and consumer trust, reducing farmer income.

8. Lack of access to quality agricultural inputs

Farmers often face challenges obtaining reliable seeds, fertilizers, and tools, especially in remote areas. Limited availability or high costs prevent them from improving productivity and crop health.

The three issues highlighted in the diagram—Water Waste, Limited Cultivation Space, and Inconsistent Crop Quality—were selected because they directly address the most prevalent and critical challenges faced by home gardeners and small-scale growers. These challenges transcend technical limitations and directly impact individuals' motivation, efficiency, and success in cultivating their own food.

Water Waste:

In many regions, water scarcity is becoming increasingly prevalent. Traditional watering methods often result in unnecessary waste, particularly when performed manually or without adequate feedback on the plant's actual water requirements.

Table N°02: LOTUS Diagram (Problem of water waste and its causes)

Over-irrigation	Leaky or poorly maintained systems	Lack of soil moisture monitoring
Manual watering without timing	Over-consumption and major losses in water	Runoff from sloped or compacted soil
Mismatched irrigation systems	Neglecting weather conditions	Lack of user awareness

Source: Produced by the student

Limited Cultivation Space:

For individuals residing in urban areas or small dwellings and also farmers with small agricultural land, space is a significant constraint. Conventional gardening setups often fail to accommodate tight balconies or indoor environments.

Table N°03: LOTUS Diagram (Problem of limited cultivation space and its causes)

Urbanization and population density	Lack of private outdoor areas	Poor space optimization
High cost of land	Limited cultuvation space	Regulatory restrictions
Lack of modular or compact systems	Shared housing conditions	Low awareness of vertical farming solutions

Source: Produced by the student

Chapter 01: Problem Identification

Inconsistent Crop Quality:

Many gardeners encounter irregular results, with some plants thriving while others struggle. This inconsistency is often attributed to inadequate monitoring or environmental control.

Table N°04: LOTUS Diagram (Problem of inconsistent crop quality and its causes)

Unstable watering practices	Nutrient imbalances	Pest and disease pressure
Low-quality or old seeds	Inconsistent crop quality	Variable environmental conditions
Improper planting techniques	Lack of crop monitoring tools	Manual errors and inconsistency

Source: Produced by the student

2-Specific problem definition

The definition phase involves synthesizing the data collected during the discovery phase.

2-1- Home Gardeners

Urban growers and farmers in Algeria face three major challenges:

1. Water scarcity

• Limited water resources make traditional irrigation methods unsustainable.

• High water consumption in conventional agriculture contributes to environmental stress and increases costs.

2. Limited cultivation space

• Urbanization reduces the availability of land for farming.

• Households and institutions often lack the space to grow food efficiently in cities.

3. Inconsistent crop quality

• Uncontrolled growing environments result in variable yields and lower nutritional value.

• Exposure to pollutants and pests affects plant health and consumer safety.

-Point Of View (POV)

The Point of View (POV) framework helps develop concise and actionable problem statements that focus on specific users, their needs, and key insights uncovered during user research.

Table N°05: Point of View (POV) (Home Gardeners)

TARGET USERS (WHO)	NEEDS (WHAT)	INSIGHT (WHY)
Home gardeners in Algeria who want to grow their own food but struggle with space limitations, irregular plant growth, and lack of technical support.	They need a compact, automated, and water-efficient gardening system that allows them to grow healthy crops easily, even in small urban spaces.	Because they often deal with limited time, poor crop results, and no guidance, which makes home gardening frustrating instead of fulfilling. Without smart support tools, they lose motivation and efficiency.

Source: Produced by the student

Algerian home gardeners need a localized and automated solution to efficiently manage their cultivation, optimize water usage, and ensure consistent crop quality, because existing options are poorly adapted, time-consuming, and often too expensive or complex for personal use.

-HMW question (How Might We…?)

HMW questions help approach identified problems from a broad perspective, opening the door to diverse and creative solutions. Here are general HMW questions based on the challenges faced in urban agriculture:

- HMW optimize small spaces to maximize food production in urban environments?
- HMW design an easy-to-use and modular system tailored to the needs of Algerian households?
- HMW ensure consistent crop quality without relying on chemical inputs or large infrastructures?

Urban growers and communities need a solution to:

1. Optimize water usage

Current irrigation methods are inefficient and wasteful. There is a need for integrated systems that minimize water consumption while maintaining plant health.

2. Maximize productivity in compact spaces

Most available solutions do not effectively use vertical space or are not scalable for small urban environments like balconies, rooftops, or courtyards.

3. Ensure consistent and high-quality crop output

Growing systems must allow for controlled environments to produce healthy, pesticide-free crops all year round, regardless of external climate conditions.

2-2- Farmers

Farmers need a solution to:

1. Optimize water usage

Conventional irrigation practices are inefficient and lead to significant water loss. There is a strong need for smart, integrated systems that significantly reduce water usage while ensuring crop health.

2. Maximize productivity on limited land

Many existing solutions do not provide efficient use of space, particularly for smallholder farms. Scalable and vertical farming solutions are required to increase productivity in constrained areas.

3. Ensure consistent and high-quality crop output

Farmers need reliable, controlled-environment systems that can produce healthy, pesticide-free crops throughout the year, regardless of external weather and climate variability.

Table N°06: Point Of View (POV) (Farmers)

TARGET USERS (WHO)	NEEDS (WHAT)	INSIGHT (WHY)
Small-scale and medium-sized farmers in Algeria facing water shortages, inconsistent crop yields, and pressure to adapt to modern farming techniques.	They need an innovative, tech-enabled farming solution that optimizes water use, improves crop quality, and reduces labor through automation and real-time monitoring.	Because they are under increasing pressure from climate change, rising costs, and market demands, yet many still rely on outdated, manual methods. This prevents them from scaling or improving productivity sustainably.

Source: Produced by the student

Farmers in Algeria need a simple, modern, and sustainable solution that facilitates irrigation management, improves crop monitoring, and reduces losses and inefficiencies caused by lack of data, outdated methods, and the impact of climate change.

Chapter 01: Problem Identification

-HMW question (How Might We…?)

Here are general HMW questions based on the challenges faced by farmers in managing cultivation, resource efficiency, and crop quality:

- HMW support farmers in managing limited water resources more efficiently to ensure sustainable production?
- HMW help farmers make better use of small or degraded land to increase their agricultural yield?
- HMW provide accessible and easy-to-use agricultural technologies tailored to the realities of small-scale farming in Algeria?
- HMW improve crop consistency and quality despite changing climate conditions and limited access to advanced infrastructure?

Section 4: Market Analysis

A thorough understanding of the market environment is essential to evaluate the relevance and potential of the AMAN project. The analysis focuses on identifying current trends in urban agriculture, shifts in consumer behavior, and the growing demand for sustainable food production solutions. It also examines the characteristics of target segments, regional opportunities, and competitive dynamics that may influence the project's positioning and growth strategy. Through this approach, the market study aims to inform strategic decisions and ensure alignment between product development and real-world needs.

1- Global market for Vegetables and herbs agriculture:

The agriculture industry is one of the most critical sectors of the global economy, responsible for feeding billions of people every day. New technologies, environmental concerns, and government policies are driving transformative changes across the industry.

In our study we are going to focus on two of the most important crops in this industry which are vegetables and herbs:

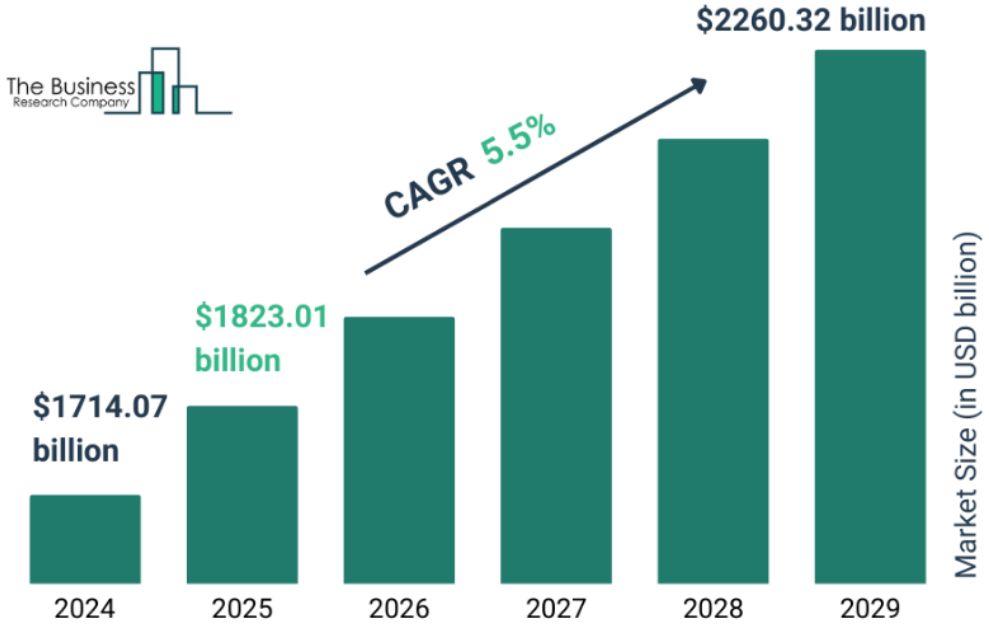
Vegetable and herb farming refers to the cultivation of vegetable crops intended for consumption, whether for individual use, regional markets, or large-scale sale. It includes soil preparation, planting, care, and harvesting of different vegetables like leafy greens, roots, and legumes, tailored to the specific climate, soil conditions, and consumer needs.

The main types of vegetable farming are growing vegetable crops and producing vegetable seeds. Growing vegetable crops refers to Plants that are grown

for human consumption. The various applications involved are household and commercial.

The vegetable farming market size has grown strongly in recent years. It will grow from $1714.07 billion in 2024 to $1823.01 billion in 2025 at a compound annual growth rate (CAGR) of 6.4%. The growth in the historic period can be attributed to population growth, health and wellness trends, urbanization, changing dietary patterns, government policies.

Figure N°09: Vegetable Farming Global Market report 2025

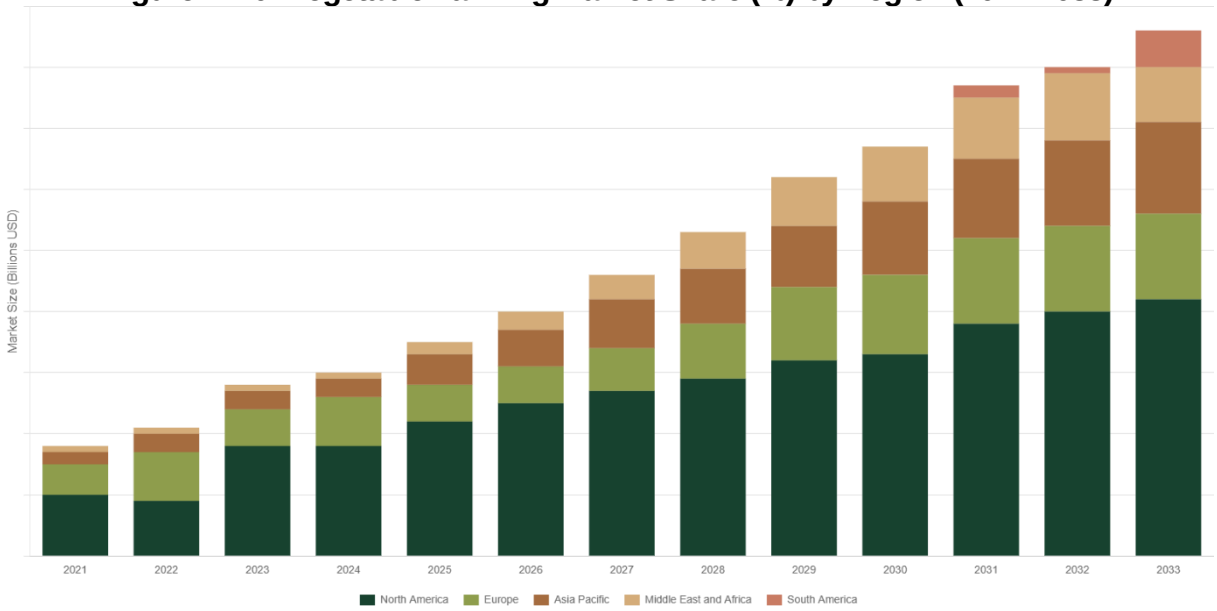


Source: https://www.thebusinessresearchcompany.com/report/vegetable-farming-global-market-report

The vegetable farming market size is expected to see strong growth in the next few years. It will grow to $2260.32 billion in 2029 at a compound annual growth rate (CAGR) of 5.5%. The growth in the forecast period can be attributed to climate change impact, global trade dynamics, consumer preferences, supply chain resilience, water scarcity concerns. Major trends in the forecast period include technology integration, technological advancements, sustainable practices, indoor farming, consumer preferences for exotic varieties.[1]

[1] Vegetable Farming Global Market Report 2025, The Business Research Company team, published on January 2025, https://www.thebusinessresearchcompany.com/report/vegetable-farming-global-market-report

Figure N°10: Vegetable Farming Market Share (%) by Region (2021-2033)



Source: Produced by the student

2- The latest technological applications and trends in global agriculture (Agritech)

The agriculture sector is changing, and the revolution is as a result of technological development. The concept of smart farming involving the use of advanced technologies such as AI, IoT, and big data analytics is defining the future of agricultural practices and is currently generating a tidal wave of opportunities for agritech startups. These startups are well placed to meet the growing demand for food around the world while at the same time offering efficient, sustainable farming solutions.[1]

These are some of the latest trends in global agritech adopted by startups in the field:

1. Tackling the Ultra-Processed Food (UPF) Challenge

As consumer demand for healthier, more natural options intensifies, food corporates face mounting pressure to reformulate products perceived as overly processed. This trend is particularly acute in the plant-based sector, where highly processed components, such as protein isolates, are increasingly being replaced by minimally refined alternatives like native pulse flours and protein concentrates. While

[1] Smart Farming: 6 Emerging Trends for Agritech Startups to Watch, Dr. Sat Kumar Tomer, Updated on March 07 2025, https://www.globalagtechinitiative.com/digital-farming/smart-farming-6-emerging-trends-f

these alternatives may offer slightly reduced functionality, they better align with consumer priorities for simplicity and transparency.

The shift is not merely about ingredient changes but about maintaining the delicate balance between functionality, cost, and consumer perception. Food companies are increasingly replacing ingredients like carrageenan and hydrocolloids with more natural or natural-looking alternatives, such as those developed through advanced plant protein categorization and modification to achieve gelling or structural properties. Ingredion has introduced NOVATION Indulge 2740, a clean-label starch designed to replace carrageenan in dairy-based desserts, offering similar texture and stability while allowing for simpler ingredient labeling. Similarly, the cultivated meat industry faces significant challenges related to ultra-processing, which remains integral to production. Alongside scaling and commercialization, companies will need to innovate on the positioning of end-products to gain consumer acceptance.[1]

2. AI-Driven Crop Management: Enhancing Productivity and Decision-Making

Artificial intelligence (AI) is rapidly transforming crop management, where it performs tasks which were previously handled manually and also carries out risk assessment. Automated crop management employs big data analytics by relying on machine learning (ML) algorithms to predict climate changes, disease risks, and the optimum time for harvesting. This makes it possible for the farmers to prevent anything that might hinder the growth of the crop and also improve the yield of the crop.

Agritech startups can leverage artificial intelligence to create apps that will assist farmers in managing the growth of crops, pinpointing the onset of diseases, and assisting in informed decision-making. Their products might also ensure optimal use of materials and manpower, reduce costs on labor, and boost the management of the supply chain.

3. IoT Integration: Connected Devices for Smarter Farms

The arrival of the Internet of Things (IoT) in the agtech space is making everything more connected by using devices such as smart devices, automatic irrigation machines, and drones. These IoT devices help farmers monitor and manage their farms even from far away by providing real-time information about the soil, weather, and the performance of the equipment on the farm.

[1] Key AgriFood Tech trends to watch in 2025, Bright Green Partners team, Published on December 16th 2024, https://brightgreenpartners.com/blog-insights/insights-agrifood-tech-trends-2025/

When it comes to agritech startups, IoT offers themselves a grand avenue to grow solutions that address the multiplicities of the farming value chain. Startups can develop software that optimizes irrigation based on forecasts or work on drones, which will help to control the state of huge fields and identify if crops are stressed.

4. Robotics and Automation: Redefining Labor and Productivity

Robotics and automation convergence in agriculture is mitigating the growing shortage of labor force and increasing efficiency. In terms of reliability, autonomous machines do relieve people of responsibilities in activities such as planting, weeding, and harvesting among other responsibilities.

From an innovation perspective, technologists in startups can identify the low-hanging fruit of using robots in the agricultural industry regarding repetitive duties that require human intervention in undertaking the task.

Automation technology offers scalability, enabling farmers to manage larger areas of land without compromising productivity. With advancements in AI and machine learning, these robots can adapt to different environments and crops, making them a versatile solution for diverse farming needs.

5. Blockchain for Traceability and Transparency

A trend that recent studies have identified is the application of that technology in the food supply chain which primarily guarantees the traceability of products. With the use of blockchain technology, all the information relating to farming, such as what seeds were planted, how the farm was cared for, and how the crops were transported, is stored in a secure, tamper-proof mode. This kind of transparency is not only appealing to the consumer who wishes to trace the sources of the delicacy but also helps the growers in defending their earnings and minimizing swindles.

Such agritech startups can easily leverage blockchain to create ecosystems that will guarantee proper quality assurance at every level of food production to combat and prevent any violations of the quality standards or environmental laws. It will increase the level of transparency, and assist in trusting farmers in terms of their ability to meet consumer needs and be competitive in the market.

6. Sustainability and Climate Resilience: Future-Ready Farming

However, because climate change is an ongoing process that impacts agriculture in a negative way, climate-friendly and sustainable farming practices are required more than ever before. There are increased uses of practices like

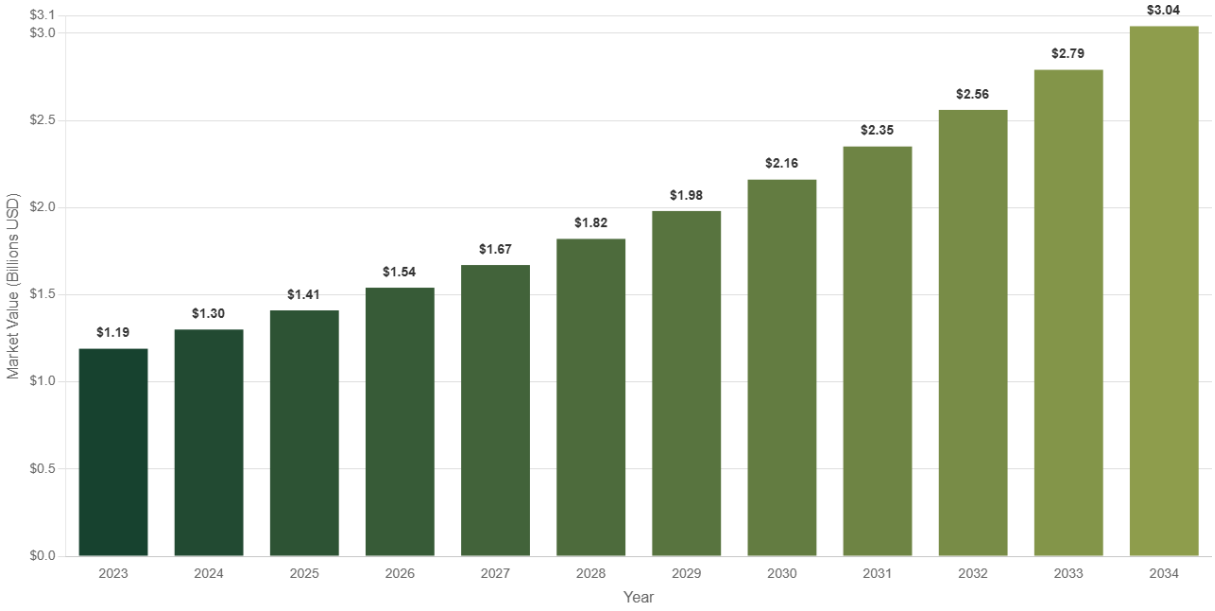
regenerative agriculture farming and efficient water use, while innovations such as artificial intelligence and the internet of things are making farming more efficient.

Early in the process, we explored key agritech trends and chose to focus on IoT integration for its practicality in monitoring essential farming conditions. This technology laid the groundwork for a solution designed to make fresh, healthy food more accessible using what's known as vertical gardens

3- Global market for vertical gardens

The global vertical garden construction market size is worth around USD 1.30 billion in 2024 and is anticipated to reach around USD 3.04 billion by 2034, growing at a CAGR of 8.90% over the forecast period 2024 to 2034. The vertical garden construction market growth is attributed to the growing demand for advanced garden solutions in urban areas.[1]

Figure N°11: Vertical Garden construction market size 2023 to 2034 (USD Billion)



Source: Produced by the student

1. Vertical Garden Construction Market Key Takeaways

- Asia Pacific dominated the global vertical garden construction market in 2023. [2]
- By type, the outdoor vertical garden wall segment accounted for a considerable share of the market in 2023.

[1] Smart Farming: 6 Emerging Trends for Agritech Startups to Watch, Dr. Sat Kumar Tomer, Previeously mentioned reference

[2] Vertical Garden Construction Market Size; Share and Trends 2024 to 2034, Precedence agricultural experts, reviewed by Aditi Shivarkar, Last Updated on 25 Sep 2024, https://www.precedenceresearch.com/vertical-garden-construction-market

- By type, the indoor vertical garden wall segment is anticipated to grow with the highest CAGR in the market during the studied years.
- By garden type, in 2023, the green wall vertical garden segment led the global market.
- By garden type, the green facades vertical garden segment is projected to expand rapidly in the market in the coming years.
- By application, the commercial segment held a dominant presence in the market in 2023.
- By application, the residential segment is expected to grow at the fastest rate in the market during the forecast period of 2024 to 2034

The market is experiencing significant growth due to the increasing adoption of green building construction and the promotion of indoor agriculture. Vertical gardens offer numerous benefits, including energy efficiency, improved air quality, and the ability to grow food in urban areas. However, the high initial investment required for vertical garden construction remains a significant challenge for market expansion. Key drivers of the market include the growing awareness of sustainability and the need to reduce carbon footprints. Additionally, nowadays, one of the primary reasons is the growing demand for wireless connectivity and IoT-enabled technologies in home gardening. This includes the use of artificial intelligence and machine learning for optimizing lighting, nutrition, and insecticides for indoor plants.

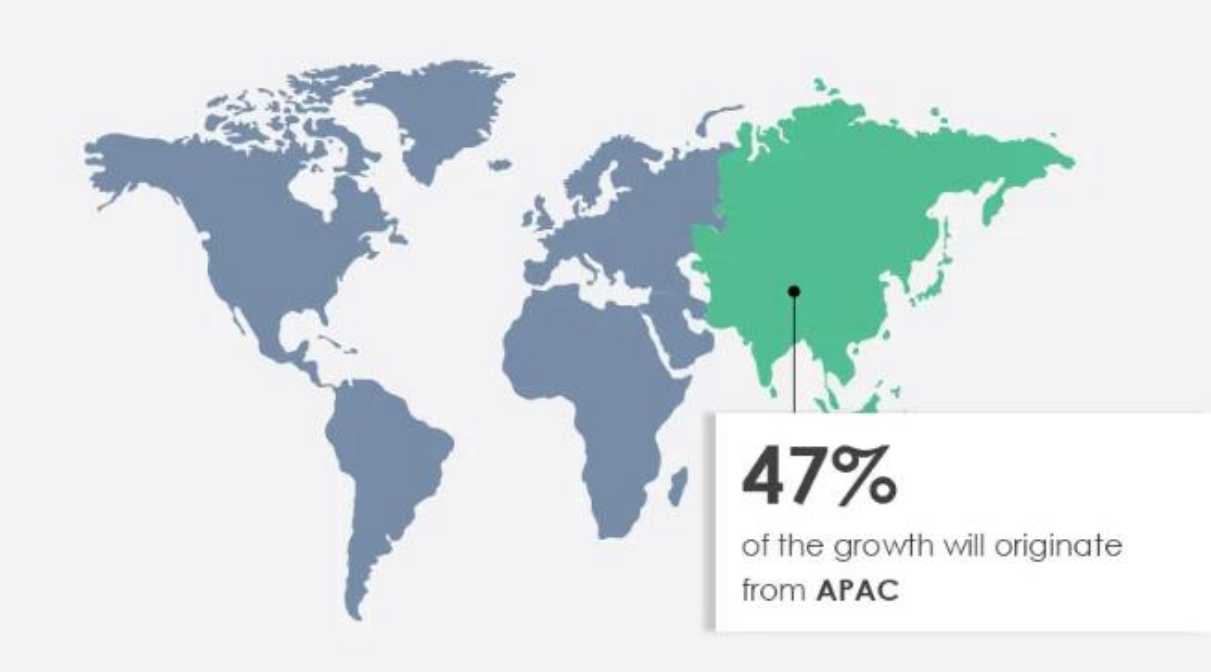
Moreover, the trend toward urbanization and the limited availability of horizontal space for gardening are creating a demand for vertical garden solutions. Despite these opportunities, the high upfront costs associated with vertical garden construction can be a barrier to entry for some businesses and individuals. Companies seeking to capitalize on this market should focus on innovative financing models and partnerships to help offset the initial investment. By navigating this challenge effectively, businesses can tap into the growing demand for sustainable and space-saving gardening solutions.

2. Regional Analysis

APAC is estimated to contribute 47% to the growth of the global market during the forecast period. Technavio's analysts have elaborately explained the regional trends and drivers that shape the market during the forecast period. [1]

The market in APAC is projected to experience significant growth, accounting for a substantial market share globally. With limited space in urban areas, vertical gardens offer an innovative solution for decorating walls and rooftops. China, India, Singapore, and Australia are key contributors to the market's expansion in APAC, driven by increasing government initiatives to promote green practices and a real estate boom due to urbanization and rising disposable income. The regional market is still in its developmental stage, requiring continued support from governments to encourage adoption and foster a sustainable future. Vertical gardens not only enhance the aesthetic appeal of buildings but also contribute to reducing carbon footprint, improving air quality, and mitigating urban heat island effects.

Figure N°12: Market Share of Vertical Garden Construction Held by the APAC Region



Source: https://www.technavio.com/report/vertical-garden-construction-market-industry-analysis

Incorporating hydroponic growing media and biophilic design elements in vertical gardens further enhances their sustainability and energy efficiency. The

[1] Vertical Garden Construction Market Analysis, Size, and Forecast 2025-2029:, Europe, North America, South America, and Middle East and Africa, Published on Mar 2025, https://www.technavio.com/report/vertical-garden-construction-market-industry-analysis

commercial building industry, particularly office buildings and green facades, is a significant end-user of vertical gardens. These structures absorb CO2 emissions, reduce electricity consumption, and minimize the impact of solar radiation. Additionally, they help mitigate airborne dust, noise pollution, and exhaust gas emissions, contributing to healthier living and working environments.

3. Growth Drivers of the Vertical Garden Construction Market

Several technical, economic, and regulatory factors impinging on its performance also exist within the VGC market. Stakeholders must understand such drivers as well as challenges to navigate the industry effectively and exploit emerging possibilities. About environmental policies, green technology innovations, and urbanization trends, there is a continuous change in this market but with challenges linked to cost maintenance and compliance costs.

The factors responsible for driving the vertical garden construction market include:[1]

a. Urbanization and Space Constraints: The demand for vertical gardens has been driven by urbanization leading to limited spaces in cities. Urban areas are increasingly seeking innovative solutions to integrate green spaces into densely populated environments. The need for vertical garden is increasing because it allows enhancing urban greenery without using up valuable ground space are becoming popular choices among cities facing land scarcity.

b. Environmental Sustainability Initiatives: Vertical Garden Construction is largely influenced by a global focus on environmental sustainability; which is why governments, corporations, or individuals adopt them as part of measures aimed at reducing carbon emissions from other sources that pollute air while heating cities. These goals can be achieved through vertical gardens that provide carbon dioxide sinks, filter out pollutants, and regulate temperature levels within any given environment's boundaries.

c. Technological Advancements: Growth in the market is being driven by technological innovations in vertical gardens like computerized irrigation systems, smart sensors and climate control technologies. These developments enable vertical gardens to be more productive, sustainable and maintainable which reduces adoption

[1] Vertical Garden Construction Market: Global Industry Analysis And Forecast (2024-2030), MAXIMIZE MARKET RESEARCH PVT. LTD, Published on June 2024, https://www.maximizemarketresearch.com/market-report/global-vertical-garden-construction-market/65039/

hurdles. Vertical garden technology is also expected to become more functional and scalable as technology advances further.

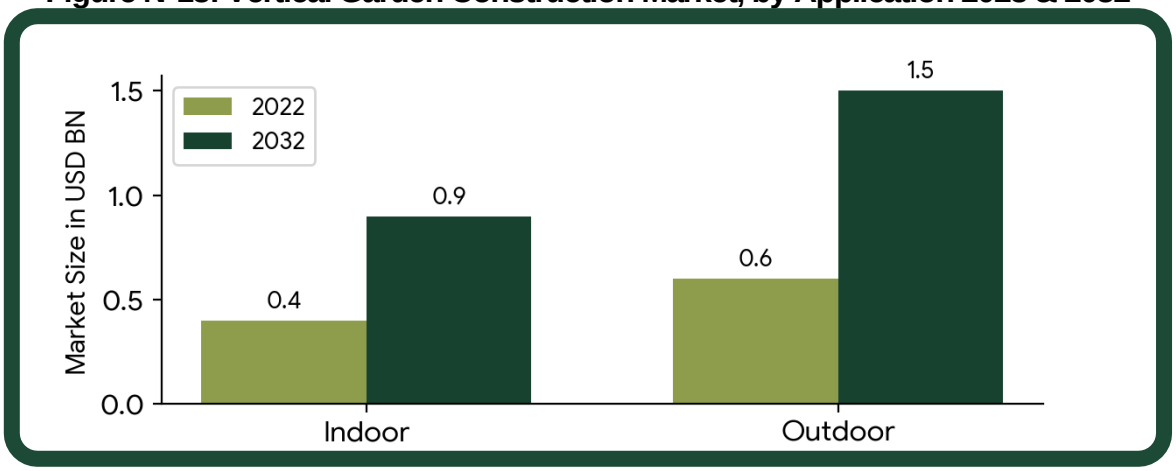
d. Health and Wellbeing Awareness: Growing awareness of green spaces' health benefits has led to a higher rate of adoption of vertical farming. Green spaces have been shown through research to reduce stress, improve mental health, and enhance air quality. Consequently, vertical gardens are increasingly being found in residential, commercial, and healthcare locations that promote health and well-being.

e. Government Policies and Incentives: There are many government policies as well as incentives that encourage people to embrace this form of gardening at home or on their business premises. Tax breaks, grants, and subsidies for green infrastructural projects are among these policies which make the construction of vertical gardens economically viable to developers and local authorities thereby expanding the market as well as creating urban green areas.

4. Vertical Garden Construction Application Insights

The Vertical Garden Construction market segmentation, based on Application, includes indoor and outdoor. Outdoor segment dominated the Vertical Garden Construction market in 2022. The scarcity of horizontal space has led to a high demand for skyscrapers. Due to the limited space in urban areas, the increasing number of skyscrapers being developed around the world has restricted horizontal building. Thus, vertical gardens have emerged as the most useful option for developers. Wall gardens could be added to existing buildings; thus, it's anticipated that developers everywhere will utilize comparable strategies. The addition of vertical gardening systems will also help to increase property value and generate a considerable amount of client demand.[1]

Figure N°13: Vertical Garden Construction Market, by Application 2023 & 2032



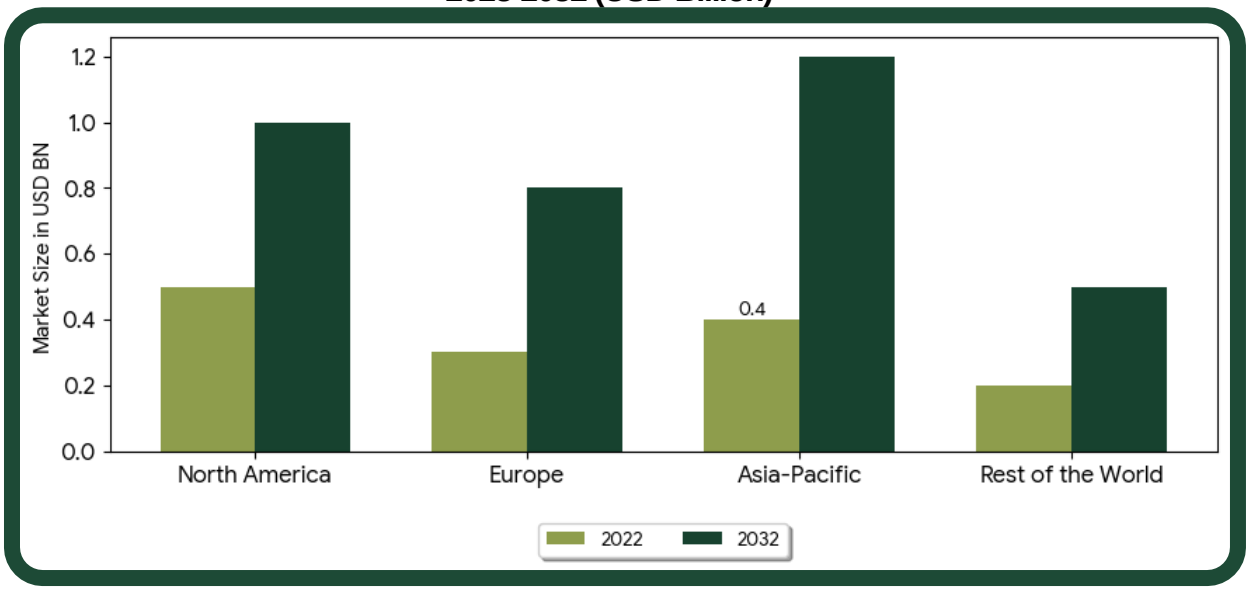
Source: Produced by the student

[1] Global Vertical Garden Construction Market Overview, Tejas Chaudhary, February 2020, Page 36

5. Vertical Garden Construction Regional Insights

By region, the study provides the market insights into North America, Europe, Asia-Pacific and Rest of the World. The Asia Pacific Vertical Garden Construction market dominated this market in 2022 (45.80%). Over the course of the projected period, the market in Japan is anticipated to expand at a significant CAGR of 6.6 percent. The growth of the region's vertical garden construction market is being attributed to several factors, including an increase in construction projects, India, China, and South Korea strengthening their infrastructure bases, a focus on the construction of vertical gardens that filter the air and reduce greenhouse gas emissions by converting carbon dioxide into oxygen, and the integration of modern construction innovations and green building practises. Moreover, China's Vertical Garden Construction market held the largest market share, and the Indian Vertical Garden Construction market was the fastest growing market in the Asia-Pacific region.Further, the major countries studied in the market report are The US, Canada, German, France, the UK, Italy, Spain, China, Japan, India, Australia, South Korea, and Brazil.

Figure N°14: Vertical Garden construction market share by region 2023-2032 (USD Billion)



Source: Produced by the student

6. Driver for choosing vertical gardens

Rising interest in indoor gardening

Rising interest in indoor gardening contributes to the growth of the vertical garden construction market as a practical solution for urban dwellers, thus driving the market. Consumers tend to design their homes with some form of green encompasses in their

interior living spaces, hence prompting the need to install vertical gardens on walls with limited floor space. These installations used to grow plants all year round, and the indoor air quality would be improved, and overall productivity would be enhanced.

The U.S. Environmental Protection Agency (EPA) noted that indoor plants are capable of removing up to 87% of indoor air pollutants within 24 hours, thus benefiting health-wise inclined consumers.

The increased trend of living in apartments in urban areas with every indication of living in even tinier units helps cement vertical gardens as a suitable fit for interiors. This growing trend goes hand in hand with the versatility of the concept of vertical gardening, which offers its services to a wide range of consumers willing to bring nature indoors.

In a survey conducted by the National Gardening Association, the percentage of U.S. households that involved themselves in indoor gardening rose to 29% in 2021 from the previous year, indicating the growing need for the company to involve itself in such environmentally friendly practices.

According to a report from the United Nations, the world's population is expected to be 57% urban in 2030 and 68% in 2050, indicating people will require efficient indoor greening solutions.

Table N°07: Trends in Indoor Gardening and Air quality improvements

YEAR	HOUSEHOLDS ENGAGING IN INDOOR GARDENING (U.S.)	PROJECTED URBAN POPULATION (% OF TOTAL)	INDOOR AIR QUALITY IMPROVEMENT (% REDUCTION)
2019	23%	55%	80%
2020	25%	56%	85%
2021	29%	57%	87%
2022	32%	60%	87%
2023	35%	62%	87%
2024	40% (Projected)	65% (Projected)	90% (Projected)

Source: https://www.precedenceresearch.com/vertical-garden-construction-market

7. Restraint of choosing vertical gardens

Hamper high initial costs

High initial costs hamper the adoption of vertical gardens, deterring potential customers from investing in these installations and further hampering the vertical garden

construction market. These costs include the cost of the material used to make the structure and installation costs, which are more expensive than general gardening. Furthermore, as consumers focus on isles and adopt a more price-conscious approach, the growth of the segment may offer a significantly lower vertical gardening product.

Studies also show that the costs of implementing vertical gardens in residential spaces amount to USD 100- USD 300 per square foot, making it expensive for homeowners or businesses.[1]

8. Opportunities that come with vertical gardens

Rising technological advancements

Rising technological advancements in vertical gardens are expected to create immense opportunities for the players competing in the vertical garden construction market. Modern advances in the field of irrigation practices and controls, smart applications to manage gardens, and innovative architectural designs make it easier and more convenient to maintain and make gardens available widely. Manufacturers are focusing on developing smart technologies that make it easy to monitor the health of the plants in the vertical gardens in real time, hence enabling users to manage the gardens well.

A study that ASLA conducted shows that 57% of the current landscape architecture firms integrate technology in their design, thus enhancing the innovativeness factor.

9. Type Insights

The outdoor vertical garden wall segment accounted for a considerable share of the vertical garden construction market in 2023 due to the growing need for additional green areas. A high number of the world's population lives in urban areas where land is scarce, creating demand for vertical garden solutions. This method is effective in improving the quality of the block facade, public areas, and squares, providing for the biotic diversity of plantings. Moreover, the higher than traditional business growth of environmentally friendly architecture and the urban greening projects further boosts the utilization of outdoor vertical garden walls.

Research shows that studies conducted by the U.S. Environmental Protection Agency suggest that the use of green walls lowers urban temperatures by as much as 5 degrees Fahrenheit.

[1] Vertical Garden Construction Market Size; Share and Trends 2024 to 2034, Precedence agricultural experts, reviewed by Aditi Shivarkar, Previeously mentioned reference

Chapter 01: Problem Identification

The indoor vertical garden wall segment is anticipated to grow with the highest CAGR in the vertical garden construction market during the studied years, owing to the increasing customer demand for indoor plants and general uptake in the use of plants within households and workplaces. Bringing the gym to an indoor vertical garden creates beauty and quality air, and studies show that quality air conditions lead to an increase in productivity and reduced stress levels. Furthermore, new technological trends in smart irrigation and plant care systems reduce the complexity of maintenance, further creating demand for indoor vertical garden wall solutions among property owners and companies.

According to the National Gardening Association's survey, in 2022, 35% of U.S. households participated in indoor gardening practices as the people felt the need to have greenery indoors that was pleasing to the eyes.

Research carried out by Harvard University established that plants take a direct proportion of enhancing productivity by about 15%.

10. Garden Type Insights

The green wall vertical garden segment led the global vertical garden construction market due to the rising levels of urbanization and the emerging biophilic design that incorporates natural aspects into manmade buildings. Green walls give considerable aesthetic value since they change dull walls to eye-catching green walls with vegetation on them. Megastores hotels join other businesses that incorporate the green walls in the supply chain as a way of enhancing the customer's experience.

According to the analysis conducted by the World Health Organization, by adopting green walls, the airborne particulate matter was brought down by 30%, thus improving the general health of the people living in urban areas.

The green facades vertical garden segment is projected to expand rapidly in the vertical garden construction market in the coming years. Climbing Plants grown on trellises or frameworks that are categorized as green facades have the big advantage of lowering heat absorption insulation. They assist in fostering the conservation of biodiversity since they afford the wildlife in urban areas a space to live, making them desirable to environmentally friendly stakeholders, additionally, with the rising popularity of green solutions and demand for eye-catching urban looks.

Studies conducted by the U.S. Department of Energy show that the construction of green façade can reduce energy bills by up to 20% because of better insulation.

Chapter 01: Problem Identification

11. Application Insights

The commercial segment held a dominant presence in the vertical garden construction market in 2023 due to the growing trend for making green space within cities. Companies understand the value of integrating vertical gardens into their design since such features improve looks and provide a boost to ventilation. Public areas, including the hotel restaurant and office facilities, use vertical gardens to entice buyers, creating improved buyer environments and improving employee health. Furthermore, the expanding number of greening activities by municipalities and commercial installations further boosts the segment.

According to the World Green Building Council, research shows that by implementing green spaces, there is an improvement in employee productivity by 15%.

The residential segment is expected to grow at the fastest rate in the vertical garden construction market during the forecast period of 2024 to 2034, owing to the increase in small spaces, also known as indoor gardening, and homeowners' desire to make their homes aesthetically appealing. People are coming up with some techniques to incorporate features that have greenery in them within their homes, especially those living in towns. People have become aware of the health benefits associated with indoor plants, such as improving the quality of air and mental well-being. Furthermore, improvements in technology, including smart gardening systems, will make gardening easier.

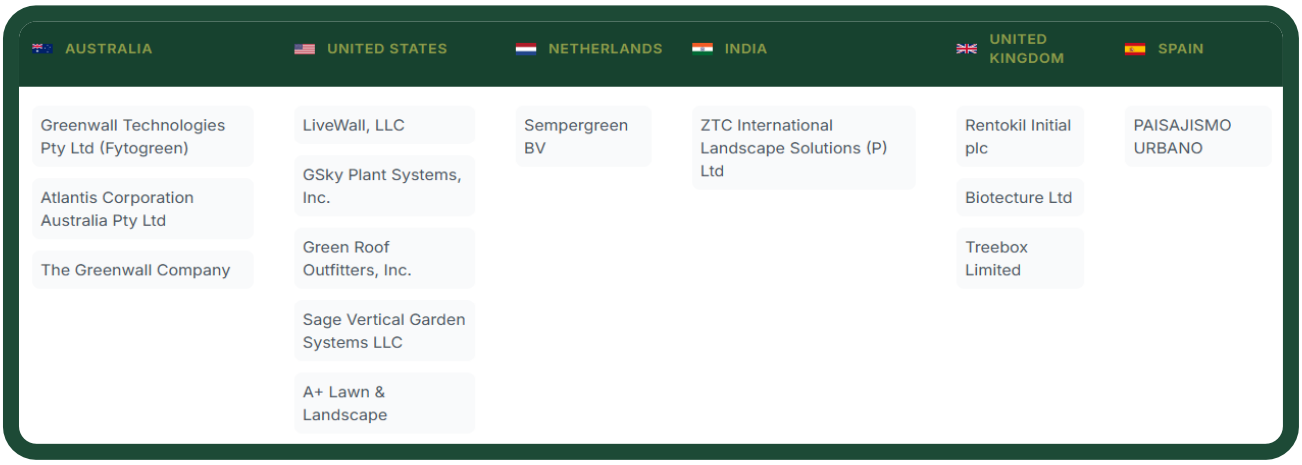
The National Gardening Association reported that 35% of households practiced indoor gardening in the year 2022, as compared with previous years.

According to one survey made by the American Society of Landscape Architects, being surrounded by indoor plants raises the human feeling of well-being by 20%.

12. Key Companies in the Vertical Garden Construction Market

Vertical Gardens market is a very competitive market and there are a lot of players, with each key player trying to outdo the others. There is dynamic interplay between them in this growing area of activity--the so-called vertical garden construction business. Coupled with modular green wall systems and living wall installations, numerous companies are actively promoting a variety of different solutions for the differing needs of various market segments. Yet innovation is the crucial factor in competition. Nearly all companies are innovating to pioneer new technologies, materials and design methods so as to get a leg up on their competitors.

Table N°08: Key companies in the Vertical Garden construction market



Source: Produced by the student

Top Players in Vertical Garden Construction Market

- Greenwall Technologies Pty Ltd (Fytogreen) (Australia)
- LiveWall, LLC (United States)
- Sempergreen BV (Netherlands)
- ZTC International Landscape Solutions (P) Ltd (India)
- Rentokil Initial plc (United Kingdom)
- Biotecture Ltd (United Kingdom)
- Atlantis Corporation Australia Pty Ltd (Australia)
- GSky Plant Systems, Inc. (United States)
- Green Roof Outfitters, Inc. (United States)
- Treebox Limited (United Kingdom)
- Sage Vertical Garden Systems LLC (United States)
- A+ Lawn & Landscape (United States)
- PAISAJISMO URBANO (Spain)
- The Greenwall Company (Australia)[1]

4- Algerian market for vertical gardens

4-1- The agricultural sector in Algeria

With its vast territory - 2,381,741 km², more than 4 times the size of France - Algerian agriculture accounts for 12.3% of GDP, on a useful agricultural area of 8.5

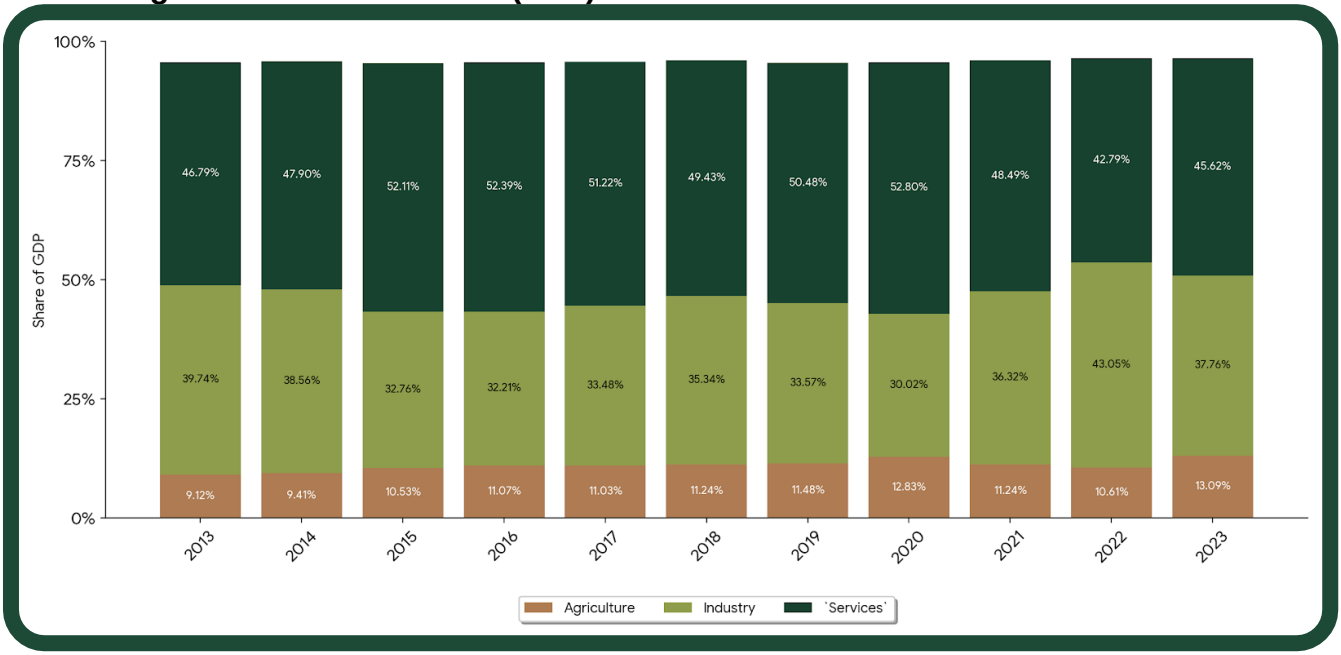
[1] Top Vertical Garden Construction Companies, Skyquest Technology's expert advisors, Published in 2024, https://www.skyquestt.com/report/vertical-garden-construction-market/companies

Mha with the main limiting factors being climate, as well as the scarcity of fertile land and water.

This agricultural and agri-food sector is a priority for the Algerian authorities in order to reduce food dependency and the food bill: since 2000, the development of Saharan agriculture has been made possible thanks to the creation of large irrigated perimeters.[1]

public authorities prioritized partnerships across the country, achieving significant milestones despite recent challenges. With a contribution of $37 billion to the economy, agriculture accounted for 15% of Algeria's GDP, making it the second-largest economic sector after hydrocarbons and a critical job creator.[2]

Figure N°15: Distribution of (GDP) across economic sectors from 2013 to 2023



Source: Produced by the student

4-2- Agricultural Trends in Algerian market

Promoting food security necessitates the implementation of a comprehensive range of policies. Algeria has pursued this through various agricultural development programs, with the most recent being the 2020-2024 agricultural model aimed at fostering sustainable development. This model has yielded encouraging results compared to previous periods.

[1] AGRICULTURE IN ALGERIA, DJAZAGRO Exhibition, 2025, https://www.djazagro.com/en/news-trends/studies-trends/agriculture-in-algeria

[2] Algeria's Agriculture Sector Flourishes in 2024 with Strategic Investments and Partnerships, Djazia Khirri, Published on Jan 4th 2025, https://www.algerianewsgate.com/post/algeria-s-agriculture-sector-flourishes-in-2024-with-strategic-investments-and-partnerships

However, the sustainability of its implementation is uncertain when considering the significant impacts of climate change on Algerian food security. Climate change adversely affects agricultural resources and production branches, leading to a decline in agricultural output.

The declining rainfall in Algeria, combined with inadequate water resource management and concerns over the exploitation of shale gas in the southern regions, is expected to negatively impact agricultural production and, consequently, food security.

To address these challenges, sustainable agricultural development offers effective solutions that can adapt to climate change and mitigate the effects of reduced rainfall. Key strategies include:

1. Aquaculture

In Algeria, aquaculture remains underdeveloped and is primarily practiced by smallholders, impacting both food security and ecosystem services, while also serving as an indirect economic driver. Various aquaculture methods are employed in Algeria, with the choice of method depending on factors such as water availability, resources, and climatic conditions. These methods include:[1]

- **Hydro distillation Agriculture (Fog Harvesting):** This method extracts water from fog in desert regions. Fog is captured through specialized networks or nets, collected, and then directed to irrigation systems for vegetation.
- **Hydroponics Agriculture:** This technique involves cultivating plants without soil, using nutrient-rich solutions instead. The water solution in hydroponics systems is recycled and reused, promoting efficient water use.
- **Semi-Floating System Agriculture:** Plants are placed on floating boards that rests on the water's surface. Nutrients are supplied through the purification of surrounding water, enhancing plant growth and improving water utilization.
- **Urban Spraying Agriculture (Aeroponics):** In this method, plant roots are sprayed with a nutrient solution. This technique is efficient in water usage and supports uniform and rapid plant growth.

[1] Components of Algerian Sustainable Agricultural Development for Enhancing Food Security in Light of Climate Change, Bouchenafa Redha, University of Blida -2- Lounici Ali, Journal of Contemporary Business and Economic Studies Vol.(08) No.(01), Published on Jan 20th 2025, Pages: 84-85

2. Renewable energies

Algeria possesses significant solar energy potential, estimated to be equivalent to four times the total global energy consumption, approximately 37,000 billion cubic meters of gas annually.

It has pioneered the establishment of a hybrid solar power plant, the world's first of its kind, which utilizes both gas and solar energy. This plant has a production capacity of up to 150 megawatts, with an additional facility operating at 1.1 megawatts. The deployment of solar energy in the Algerian Sahara offers several benefits, including mitigating climate change by reducing greenhouse gas emissions and providing essential energy resources for desert agriculture.

Solar energy can be utilized in various agricultural applications in the Algerian desert. It facilitates the drying of crops, heating of greenhouses, barns, and other agricultural structures, and provides hot water for processing and operational needs. Additionally, solar power can drive agricultural machinery and water pumps, enhancing the efficiency and sustainability of farming activities in the region.

4-3- Algerian market for vertical farming

The Algerian agricultural sector is undergoing a transformation as urbanization, climate change, and water scarcity push stakeholders to explore more sustainable and efficient food production models. In this context, vertical farming—particularly hydroponic and aeroponic systems—has begun to attract attention as a viable solution to overcome land limitations, improve yields, and reduce water consumption.

While traditional agriculture remains dominant, the market for controlled-environment agriculture (CEA) is expanding, especially in urban and peri-urban areas where demand for fresh, locally grown produce is rising. Restaurants, hotels, schools, and eco-conscious consumers are increasingly seeking alternatives to imported or pesticide-treated vegetables, creating space for compact, clean, and high-yield systems.

Despite this growing demand, the competitive landscape remains relatively underdeveloped. A limited number of startups and individual initiatives have emerged in recent years, often relying on imported equipment or foreign know-how. These players are typically concentrated in major cities like Algiers, Oran, and Constantine, with few operating at scale or offering integrated technological solutions. Most existing systems focus on basic hydroponics without automation or smart monitoring, leaving a significant gap in advanced, locally adapted offerings.

Moreover, the absence of strong regulatory frameworks specific to urban agriculture and a lack of public awareness still pose challenges. However, support from incubators, government innovation programs, and international cooperation initiatives has begun to lay the foundation for more structured growth in this sector.

Given these factors, the Algerian market presents both a clear demand for innovation and relatively low levels of saturation, making it a promising space for entrepreneurs and investors interested in sustainable agriculture and food tech.

4-4- Context Analysis:

In this context analysis we are using the context map which provides a structured overview of the external factors that influence the project, including demographic trends, regulatory conditions, economic and environmental dynamics, technological developments, competitive landscape, customer expectations, and market uncertainties. This analysis focuses specifically on the Algerian market, offering a realistic and data-informed foundation for strategic planning and decision-making.

1. Demographic Trends

- **Urbanization:** Over 75% of Algeria's 46 million people live in urban areas as of early 2024; urban population grows at ~2.6% annually
- **Youth Population:** A significant proportion of the population is under 30, creating potential adopters who are digitally literate and open to agritech innovation.
- **Overcrowding in Capital:** Rapid migration to cities like Algiers has intensified demand for living space and urban services

2. Rules & Regulations

- **Startup Promotion:** The government supports entrepreneurship, especially in tech and agritech, via incubators and national innovation programs
- **Water Policy and Infrastructure**: New desalination and wastewater reuse projects aim to increase water security—a positive policy backdrop for efficient irrigation systems
- **Import Barriers:** High customs duties and import restrictions on electronics and sensors may raise costs and delay sourcing components.

3. Economy & Environment

- **Water Scarcity**: Algeria is considered water-scarce—average renewable water availability is ~430 m^3 per person annually (well below the 1,000 m^3 threshold)

- **Frequent Droughts:** Reservoirs hold only around one-third of capacity; emphasizing the need for efficient water systems
- **Green Investments**: The government has allocated USD 5.4 billion for desalination, signaling a move toward sustainable resource management

4. Competition

- **Traditional Agricultural Sector:** Dominated by conventional inputs and equipment providers; smart farming technologies are just emerging.
- **Emerging Agritech Solutions**: Few local agritech startups exist as potential direct competitor in the Algerian market, one of the is:

  4.1. **Gardens of Babylon** is a startup in agritech located in Mascara in the west of Algeria. It offers a solution by integrating aquaponics with vertical farming, aiming to reduce environmental impact while increasing agricultural yield.
- **Methods and Technology:** The system employed merges hydroponics and aquaculture, forming a closed-loop system. Fish waste provides nutrients for plant growth, while plants purify water that is cycled back to the fish tanks. This method reduces water usage significantly—an essential advantage in arid regions.

The startup grows a diverse range of crops: leafy greens (lettuce, kale, spinach), herbs (basil, mint, thyme), microgreens, edible flowers (violet, borage), and fruits like strawberries and cherry tomatoes. Their production site spans 640 square meters.

- **Innovation and Circular Economy:** Gardens of Babylon integrates a zero-waste philosophy. Wastewater is treated through reverse osmosis and enriched with cactus by-products to create a natural germination gel. Aquatic plants are used to further purify the system, acting as biofilters and enhancing overall ecosystem health.
- **Business Development and Impact:** With support from Algeria's national startup accelerator and the SwitchMed program, Gardens of Babylon transitioned from prototype to commercial operation. Partnerships with hotels and restaurants allow for the local distribution of fresh, sustainably-grown produce.
- **Future Vision:** The founder envisions a scalable, automated “garden box” that enables individuals or small communities to grow food autonomously. This

innovation aligns with broader goals of food sovereignty and decentralized agriculture.[1]

- **Alternative Imports:** Some off-grid irrigation and greenhouse kits are available via imports, but often at high cost and with limited customization for Algerian conditions.

5. Technology Trends

- **Digital Connectivity**: Internet penetration is ~73% with 33.5 million users; mobile subscriptions exceed population at 110% penetration
- **IoT & Mobile Usage:** With 50 million mobile internet subscriptions, there is strong infrastructure for app-based agritech solutions
- **Nascent 5G Deployment:** Operators are preparing for 5G rollouts, which may enhance connectivity and IoT reliability over time

6. Customer Needs

- **Water Efficiency:** Agriculture uses ~59% of freshwater; efficient irrigation tech meets critical demand
- **Urban Growing Solutions:** Over urbanization and limited private outdoor space create demand for compact, home-friendly growing systems.
- **Ease of Use**: Consumers, farmers, and institutions seek automated, low-maintenance growing setups.
- **Local Food and Sustainability:** Concerns about food security and rising prices make local production increasingly attractive.

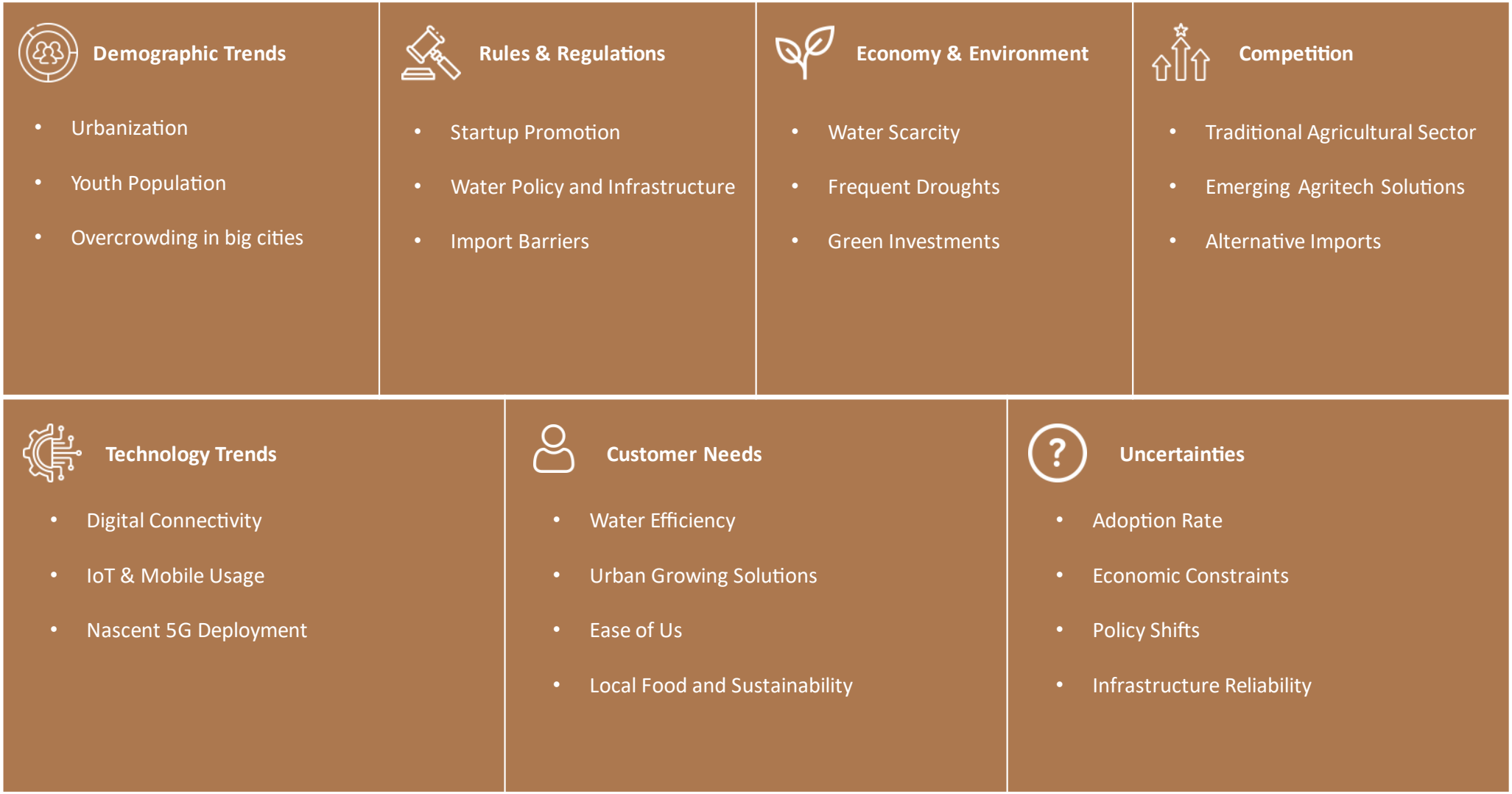
7. Uncertainties

- **Adoption Rate:** The speed at which users will embrace smart farming solutions depends on awareness, training, and cultural acceptance.
- **Economic Constraints**: Inflation and purchasing power fluctuations may affect accessibility unless pricing is carefully adapted.
- **Policy Shifts**: Future changes in import duties or agricultural policy could influence operational costs or market access.
- **Infrastructure Reliability:** Dependence on electricity and internet may pose challenges in some regions, requiring fallback features.

[1] Algeria Sustainable Food and Agriculture, TheSWITCHERS.community, Published on 23 Apr 2024, https://www.theswitchers.eu/switchers/algerian-startup-gardens-of-babylon-blooms-hope-for-sustainable-food-security/

Chapter 01: Problem Identification

Figure N°16: Context map canvas



Source: Produced by the student

Chapter 01: Problem Identification

Conclusion

Through various interviews conducted with agricultural professionals, urban dwellers, and sustainability-focused organizations in Algeria, as well as a detailed market study, a clear picture has emerged of the key challenges, needs, and expectations within the urban agriculture and smart farming sector —namely, water scarcity, limited arable land, and the growing need for sustainable food production— This research helped uncover not only recurring obstacles but also valuable opportunities to design a solution tailored to the specific needs of this growing segment. Based on these findings.

1. **Key Challenges Identified**

- **Water scarcity and inefficient irrigation:** Traditional irrigation systems consume significant amounts of water—an unsustainable approach in regions suffering from drought and low rainfall. There is an urgent need for more efficient water management.
- **Limited cultivation space in urban settings:** Many urban and suburban households or institutions lack the land required for conventional farming, reducing their access to fresh, home-grown food.
- **Lack of monitoring and automation:** Many existing home gardening or small-scale farming systems operate manually, leading to inefficiencies, crop loss, and inconsistent results due to uncontrolled environmental variables.
- **Low awareness and access to sustainable alternatives:** A large portion of the population remains unaware of modern, accessible solutions, and affordable options are still limited in the local market.

This analysis highlights the need for a technological solution that goes beyond simple automation. The goal is to address both the operational and structural limitations that hinder the development of sustainable, decentralized agriculture.

2. **Key Opportunities Identified**

- **Rising demand for food self-sufficiency:** Increasing food prices and economic instability are pushing individuals and institutions to explore local, small-scale food production as a more affordable and resilient alternative.
- **Government support for startups and innovation:** Algeria’s policy push for entrepreneurship and sustainable development provides access to incubators, funding opportunities, and institutional partnerships that can accelerate project deployment.

- **Growing digital literacy and mobile adoption:** With the majority of the population connected to the internet via smartphones, there is a strong foundation for app-based agricultural tools and remote system management.
- **Youth engagement in environmental initiatives:** Younger generations are increasingly interested in ecological innovation, offering a receptive and engaged audience for urban agriculture technologies that combine sustainability and tech.
- **Untapped urban and educational markets:** Schools, universities, and community centers represent high-potential channels for awareness, demonstration, and scaled deployment of smart gardening systems.

Chapter 02:
Solution Proposal

Chapter 02 : Solution Proposal

To effectively address the needs and challenges identified within the Algerian agriculture landscape—particularly in urban and semi-urban contexts—we adopted an iterative approach to build an innovative smart farming solution based on vertical gardens and environmental monitoring. This solution aims to tackle water inefficiency, limited cultivation space, and lack of access to clean, locally grown produce by integrating IoT, automation, and user-friendly mobile technology.

The development strategy was grounded in the continuous validation of the identified problems through interviews, field surveys, and expert feedback, combined with the progressive refinement of our Business Model Canvas (BMC).

BMC0 – Initial Concept: In the first iteration, the proposed solution was broad and loosely defined, targeting a wide range of users including farmers, urban families, businesses, and public institutions. At this early stage, the lack of clarity regarding the unique value proposition and customer segments revealed the need for a more focused and structured offer.

BMC1 – Focused Refinement: After validating real needs through interviews and market study—such as the need for water-efficient systems, real-time monitoring, and simplified crop management—we refined our approach to focus on the intelligent system itself, composed of connected sensors (monitoring pH, temperature, and water levels) and a mobile application that provides users with real-time data and recommendations. This new direction allows us to address both households and professional farmers, offering them a smart system that can be integrated into existing setups or combined with our own vertical units. By shifting the emphasis from the physical structure to the core smart technology, we open new possibilities for collaboration, scalability, and adaptation across diverse agricultural environments.

Through this iterative design-thinking process, the solution evolved into a smart, compact, and eco-efficient farming system built to democratize sustainable agriculture and improve food resilience at the local level.

Section 1: Business Model Canvas Version 1

Compared to BMC0, we made several adjustments to better align the solution with the realities of the market and the core expectations of our target users. The focus shifted from the physical product alone (the vertical unit) to a more complete system built around connected sensors and a smart mobile application.

Chapter 02 : Solution Proposal

Customer Segments

- Urban and suburban households interested in sustainable home food production.
- Small and medium-scale farmers seeking smart, water-efficient solutions.
- Agri-solution providers who want to integrate our system into their own products

Value Proposition

- Smart farming system with real-time monitoring of water level, pH, and temperature.
- Automated irrigation system that reduces water usage by up to 90%.
- Mobile application that enables users to manage their crops easily, even without agricultural knowledge.
- Modular solution: the system (sensors + app) can be sold independently or integrated into other farming setups or structures.
- Promotes food self-sufficiency, eco-conscious living, and precision agriculture.

Channels

- Direct sales via website and social media.
- Local agricultural fairs and startup exhibitions.
- Partnerships with agritech suppliers, NGOs, and eco-retailers.
- Online marketplaces and local tech/agriculture distributors.

Customer Relationship

- Educational onboarding via app and content (how to grow, how to maintain).
- After-sales support and maintenance (especially for the tech system).

Revenue Streams

- Sale of complete vertical garden units (hardware + system): **8000DA/UNIT**
- Subscription model for Premium app features (AI-based recommendations, alerts, data history): **500DA/Month**
- B2B licensing or integration deals of the smart system with other agriculture-based startups or projects (sensors + mobile app): **40000DA one-time**

Key Partners

- Sensor manufacturers and IoT suppliers.
- Universities and research centers (for agronomic validation).
- Government or NGO programs promoting sustainability and food security.
- Tech incubators and startup support platforms.

- Agriculture cooperatives or distributors.

Key activities

- Production of Vertical Gardens and their components.
- Hardware and software development and integration.
- Continuous design updates.

Key resources

- Hardware: sensor manufacturing/sourcing.
- Software: mobile app development, cloud infrastructure, AI integration.
- R&D team: agronomist, IoT engineer, mobile developer.
- Branding and marketing materials.
- Distribution network.

Cost structure!

- Production cost: 30%
- Marketing cost: 20%
- Technologies and content: 50%

Figure N°17: Business Model Canvas 1

<table>
<tr>
<td rowspan="2">Key Partners
• Sensor manufacturers and IoT suppliers.
• Universities and research centers .
• Government/NGO programs for sustainability and food security.
• Tech incubators/support platforms.
• Agriculture cooperatives or distributors.</td>
<td>Key Activities
• Production of Vertical Gardens and their components.
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• Continuous design updates.</td>
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</tr>
<tr>
<td>Key Resources
• Hardware.
• Software.
• R&D team.
• Branding and marketing materials.
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<td>Channels
• Website and social media.
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</tr>
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</tr>
</table>

Source: Produced by the student

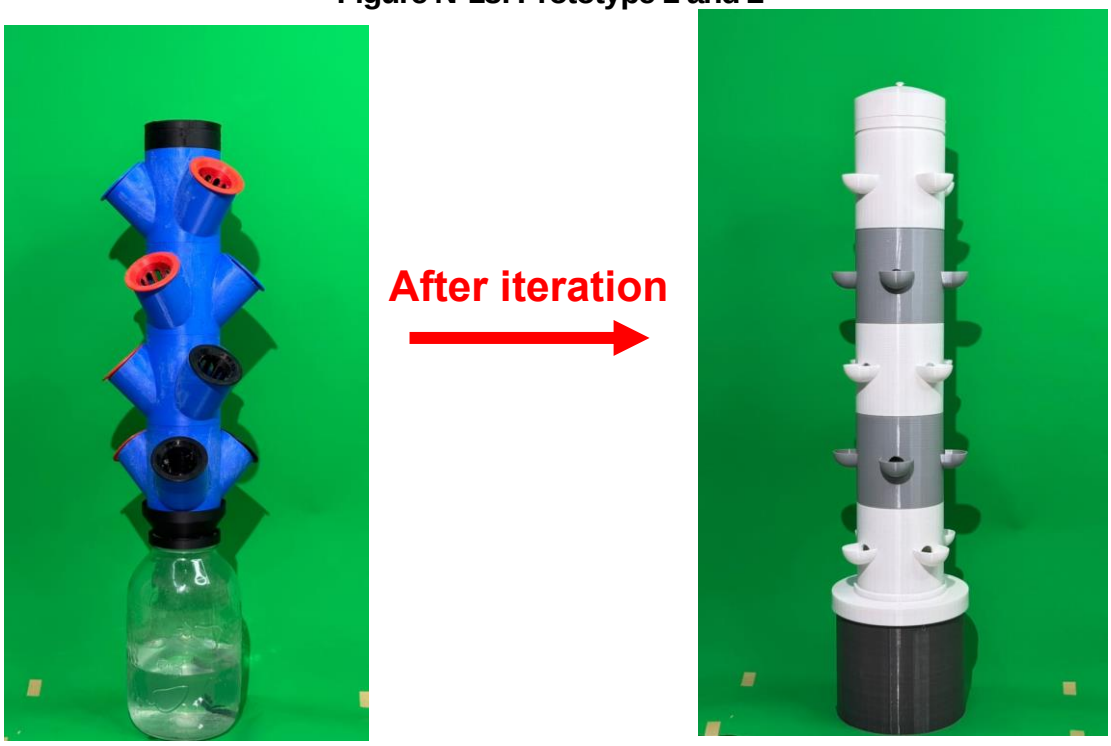
Chapter 02: Solution Proposal

Section 2: Prototype

AMAN is a smart, modular vertical farming system developed to address the growing challenges of modern agriculture—namely water scarcity, limited space, and lack of accessible cultivation tools. Designed for urban households, small-scale farmers, and educational institutions, the AMAN prototype takes the form of a vertical garden equipped with a submersible motor for efficient water distribution and integrated sensors that monitor water level, temperature, and pH in real time. Controlled through a multilingual mobile application, the system allows users to manage their crops remotely with ease, even without prior agricultural experience. By combining automated irrigation, real-time environmental monitoring, and an intuitive digital interface, AMAN simplifies food production, reduces water consumption by up to 90%, and promotes sustainable, self-sufficient practices in both urban and rural settings.

The current version of the prototype **is v2.5**, reflecting an iterative development process. An initial prototype **(v1)** was built and tested, followed by a complete redesign **(v2)** to address functional and structural improvements. The second version was retained as the core model, with minor refinements implemented based on technical evaluations, resulting in the enhanced **v2.5** currently in use.

Figure N°18: Prototype 1 and 2



Prototype 1 **Prototype 2**

Source: Produced by the student

Chapter 02: Solution Proposal

1-Key Functionalities of AMAN

To effectively address the challenges of urban agriculture and small-scale farming, the AMAN system integrates a range of smart, modular, and user-centric functionalities The following section outlines the core functional components that define the AMAN solution and contribute to its value proposition.

1. Vertical Garden Unit

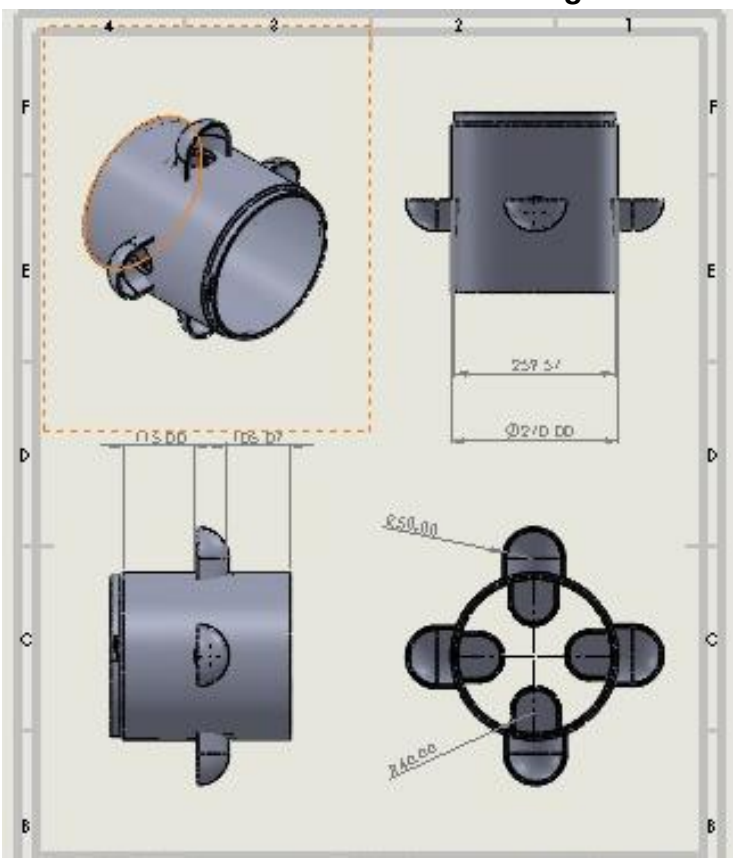
Function

A physical structure enabling vertical cultivation using hydroponic and aeroponic techniques.

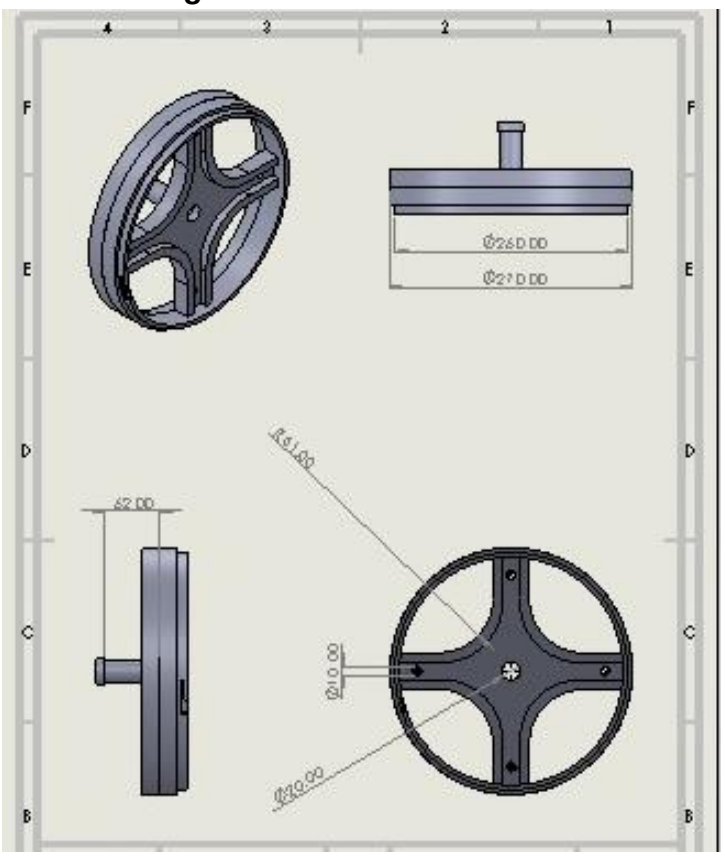
Key Features

- **Modular design:** A stackable system that allows efficient vertical growing, particularly suited for limited urban spaces such as balconies, rooftops, and patios.

Figure N°19: AMAN unit design



Cultivation unit design

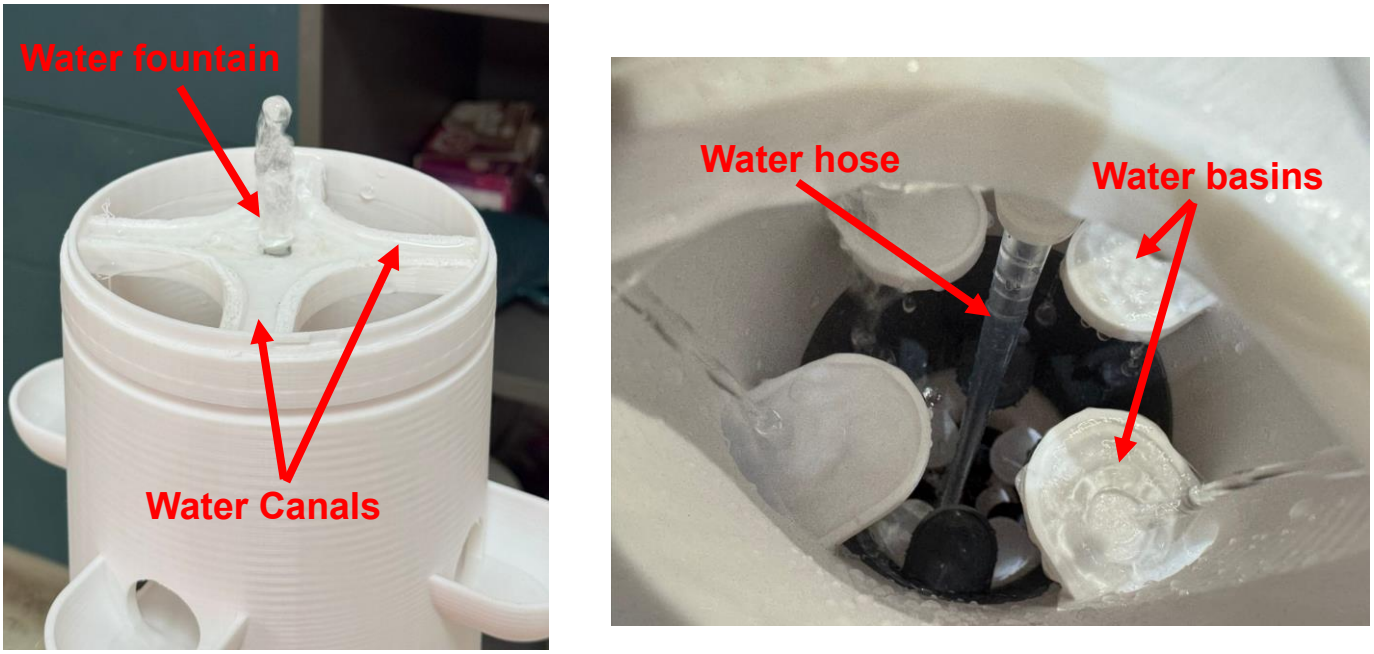


Water distribution unit design

Source: Produced by the student

- **Soilless irrigation:** Utilizes hydroponic and aeroponic methods to deliver nutrients directly to plant roots, significantly reducing water consumption (up to 90% less than traditional methods).

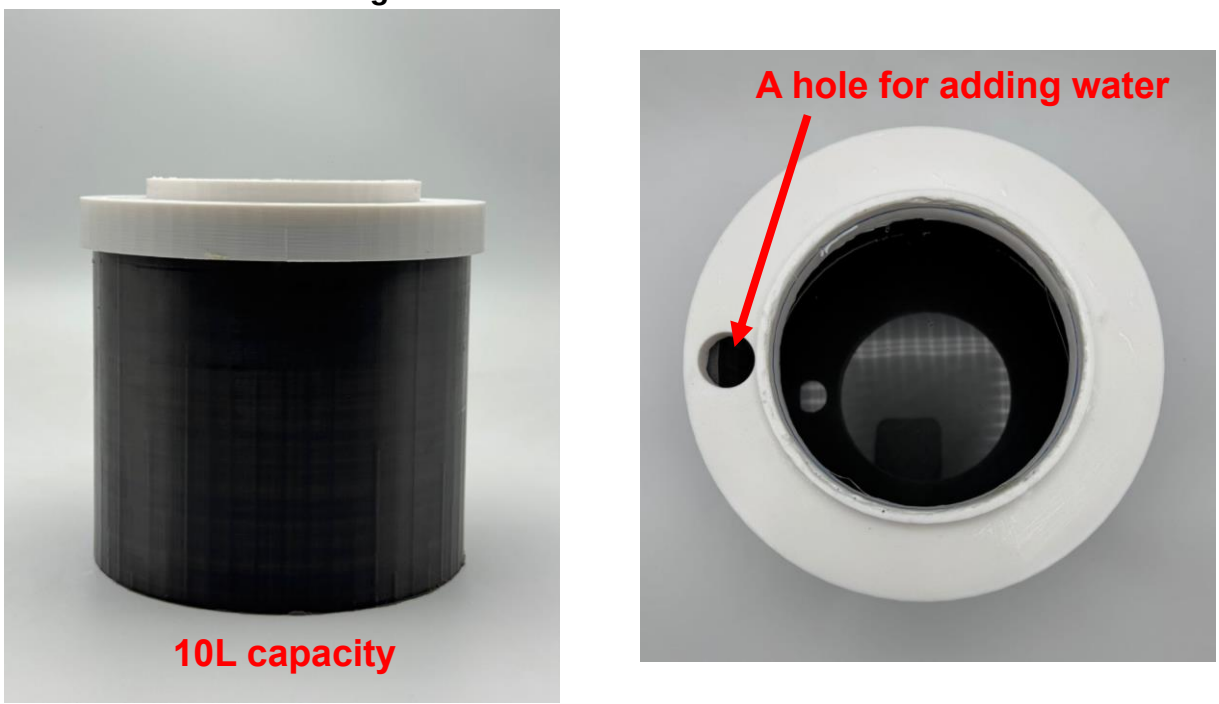
Figure N°20: The unit's irrigation system system



Source: Produced by the student

- **Integrated water reservoir:** Includes a built-in tank for nutrient solution storage.

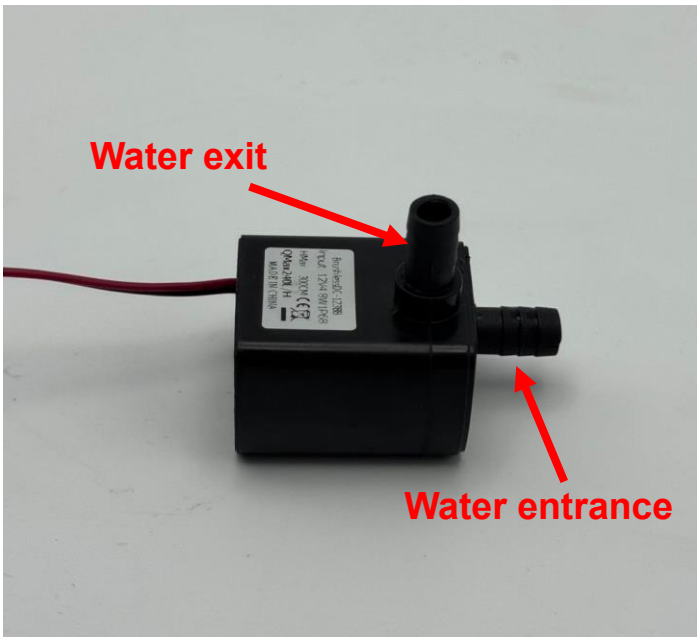
Figure N°21: The unit's water reservoir



Source: Produced by the student

- **Submersible motor:** Distributes water evenly and continuously throughout the system.

Figure N°22: The submersible motor



Source: Produced by the student

- **Compact footprint and portability:** The structure is designed for small areas while maximizing growing capacity

2. Sensor System (Integrated IoT Components)

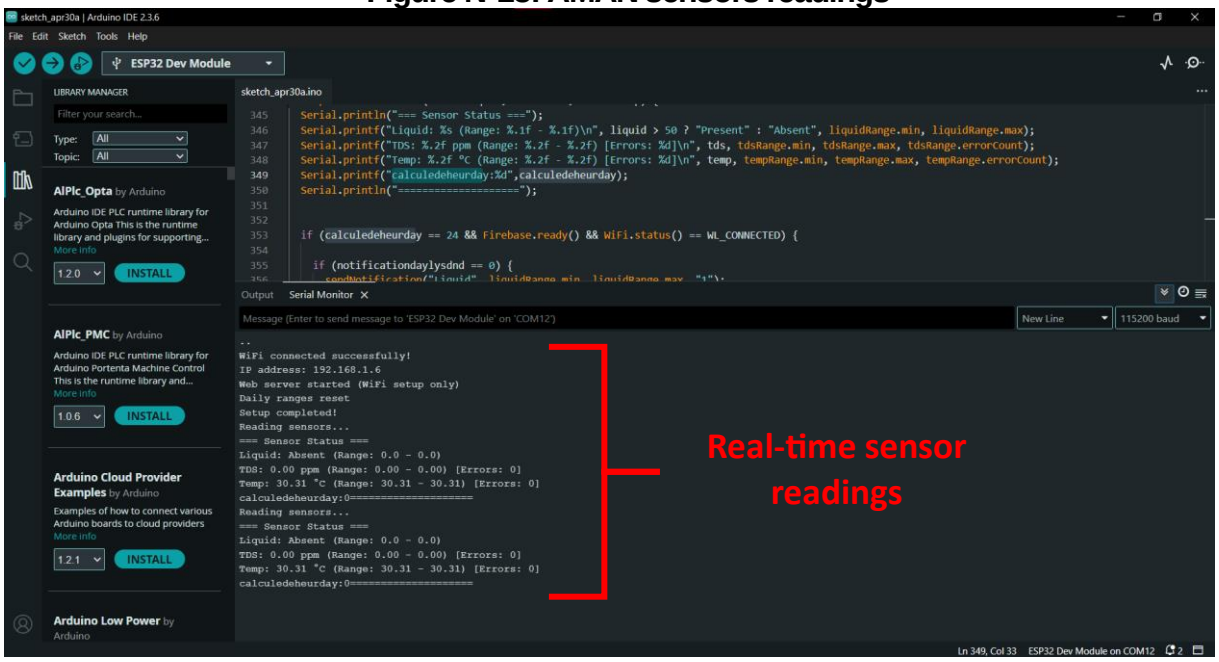
Function

Collects real-time data to monitor the growing environment and ensure optimal conditions for plant development.

Key Sensors and Features

- **Water level sensor:** Detects when the reservoir is low and alerts the user.
- **TDS sensor:** Monitors the total dissolved solids in the water to evaluate nutrient concentration and water quality.
- **Temperature sensor:** Measures ambient temperature to identify potential plant stress.

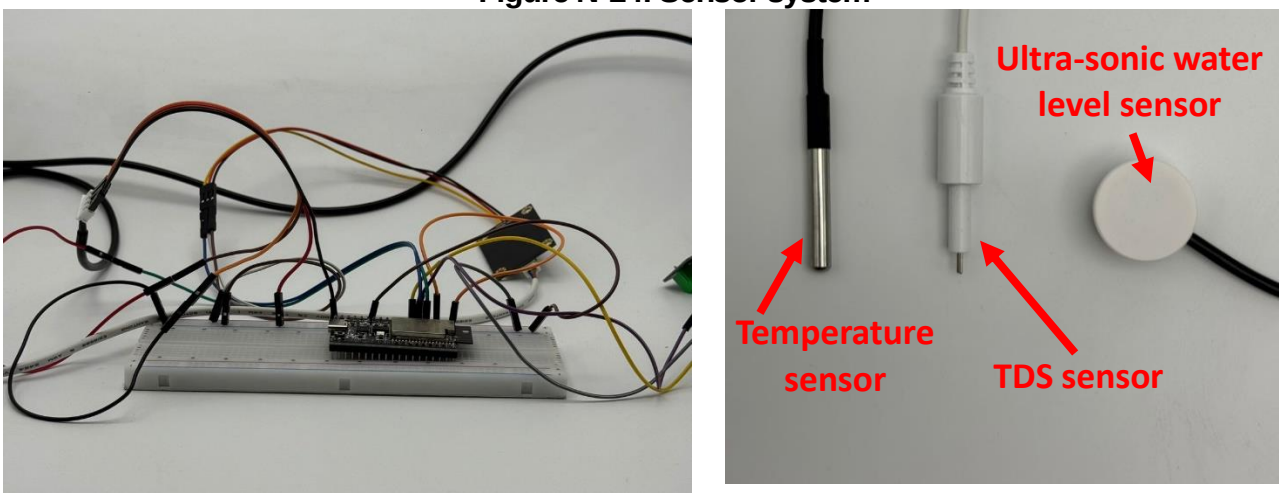
Figure N°23: AMAN sensors readings



Source: Produced by the student

- **Real-time data transmission:** Sends live readings to the mobile application for immediate analysis.
- **Alert system:** Generates warnings when sensor readings deviate from optimal ranges.
- **Sensor calibration:** Allows for adjustment and recalibration through the mobile interface.
- **Plug-and-play integration:** Sensors are preconfigured for quick installation and easy replacement.

Figure N°24: Sensor system



Source: Produced by the student

3. Mobile Application (Smart Farming App)

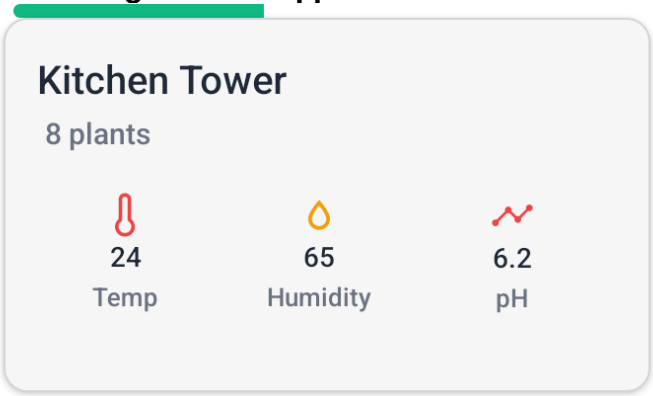
Function

Provides users with a centralized platform to manage, monitor, and optimize their cultivation system.

Key Functionalities

- **Live dashboard:** Displays current sensor readings, including water level, TDS level, and temperature.

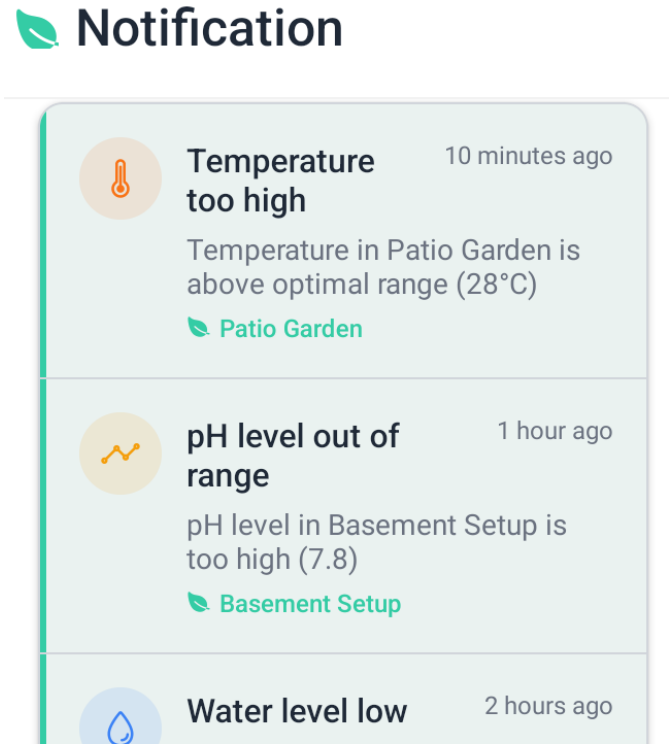
Figure N°25: application dashboard



Source: Produced by the student

- **Smart notifications:** Sends alerts to the user's smartphone for timely interventions.

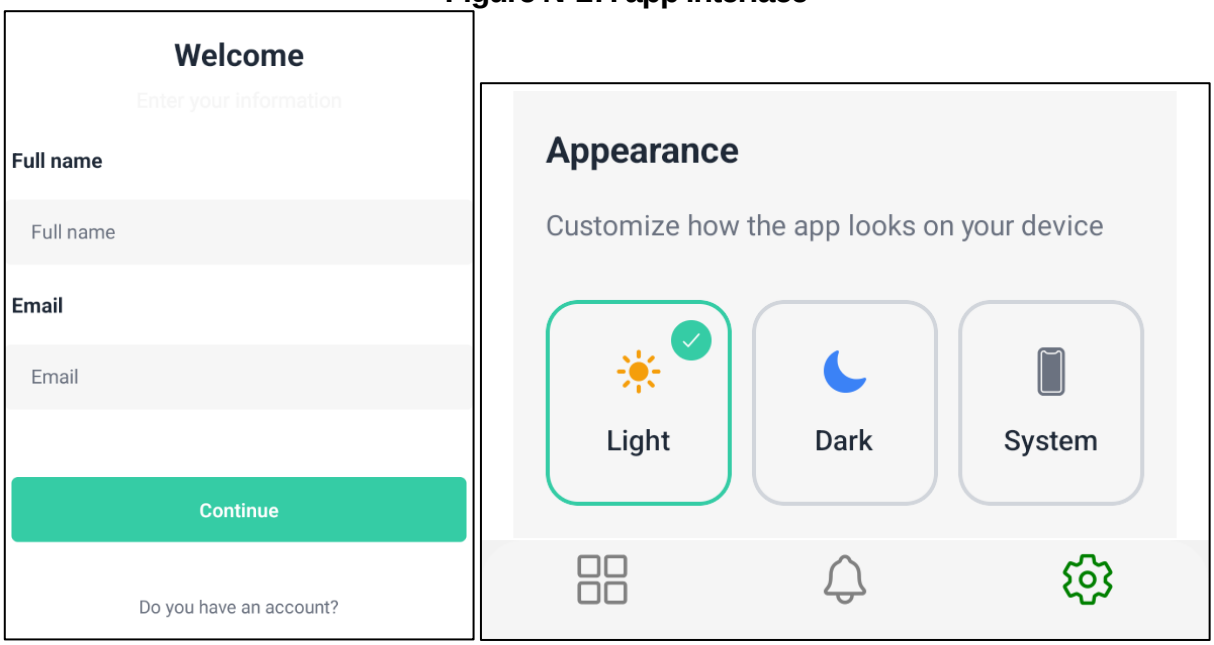
Figure N°26: app notifications



Source: Produced by the student

- **Crop guidance and calendars:** Offers localized planting recommendations and care tips based on selected crops.
- **User interface:** Designed to be accessible and intuitive, even for individuals without technical or agricultural expertise.

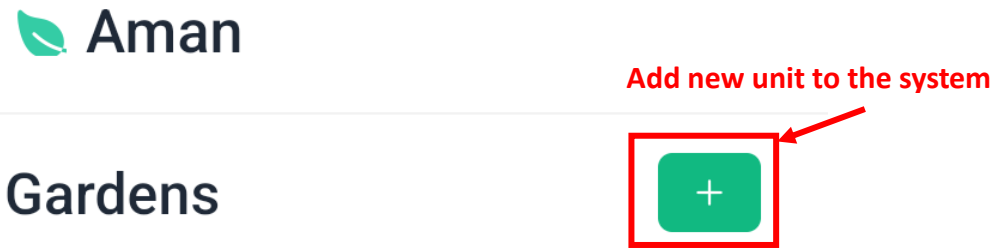
Figure N°27: app interface



Source: Produced by the student

- **Multi-unit management:** Enables control and supervision of multiple garden units within the same account.

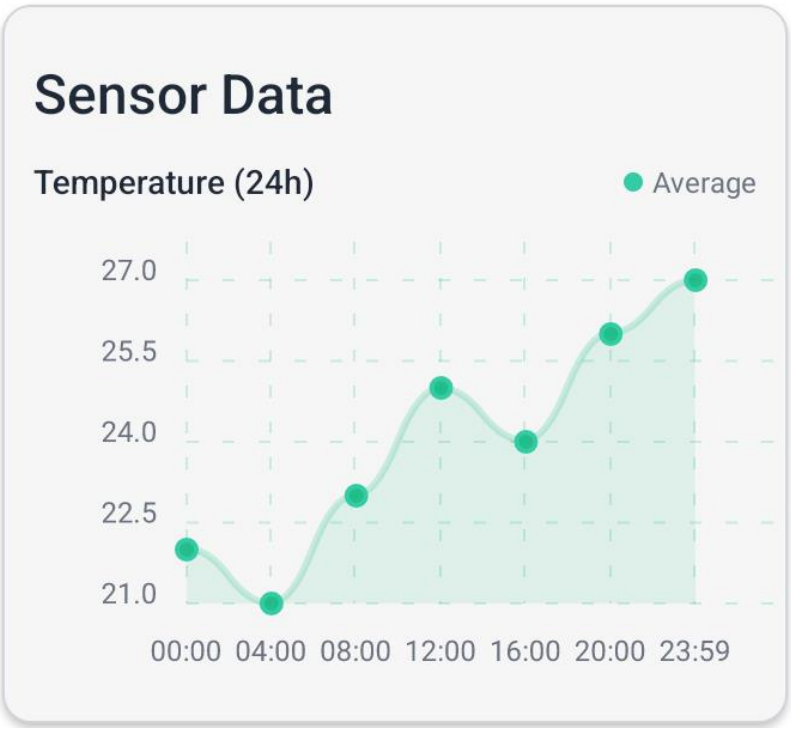
Figure N°28: Multi-units management



Source: Produced by the student

- **Data history and visualization:** Provides visual analytics for water use, TDS level variation, and temperature trends.

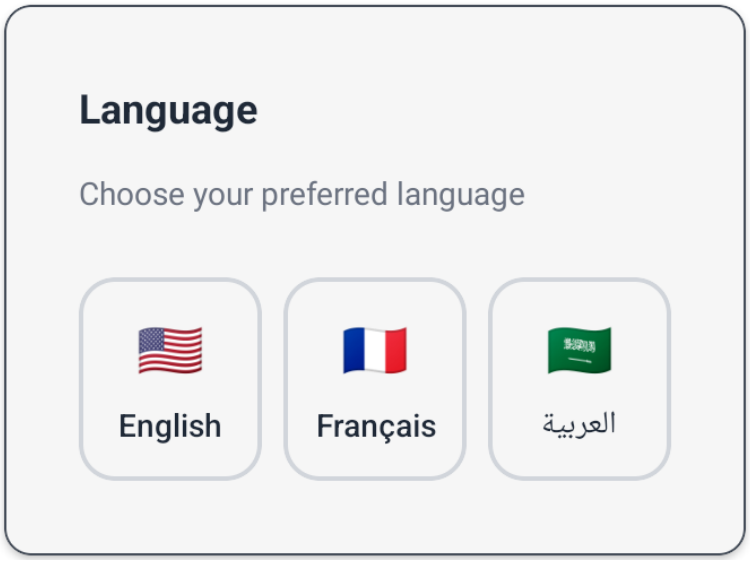
Figure N°29: Data vusual analytics



Source: Produced by the student

- **Customized advice:** Generates recommendations based on real-time data and specific crop requirements.
- **Multi-language support:** Available in Arabic, French, and English for broader accessibility.

Figure N°30: Multi-Language support



Source: Produced by the student

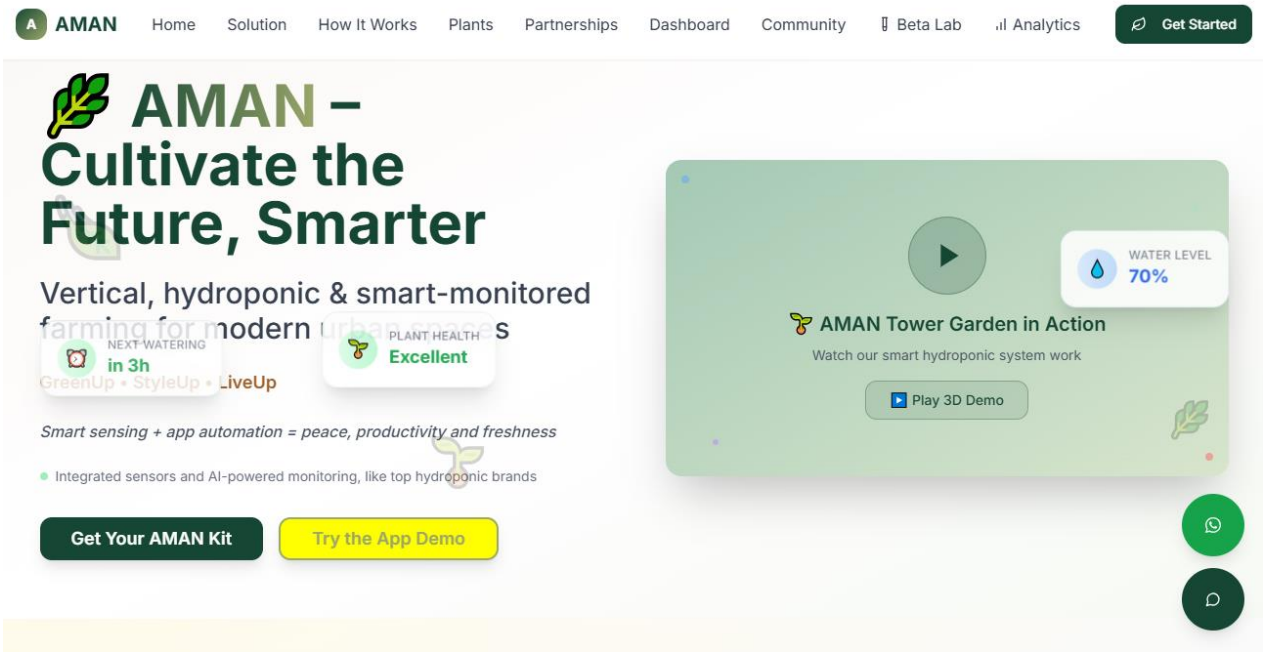
- **Offline mode (planned feature):** Data is stored locally and synchronized when internet connection is restored.
- **Secure account access:** Ensures data privacy and the possibility of data backup.

4. Website

Function

Serves as the digital hub for product access, community engagement, educational content, and marketplace transactions.

Figure N°31: Website home page



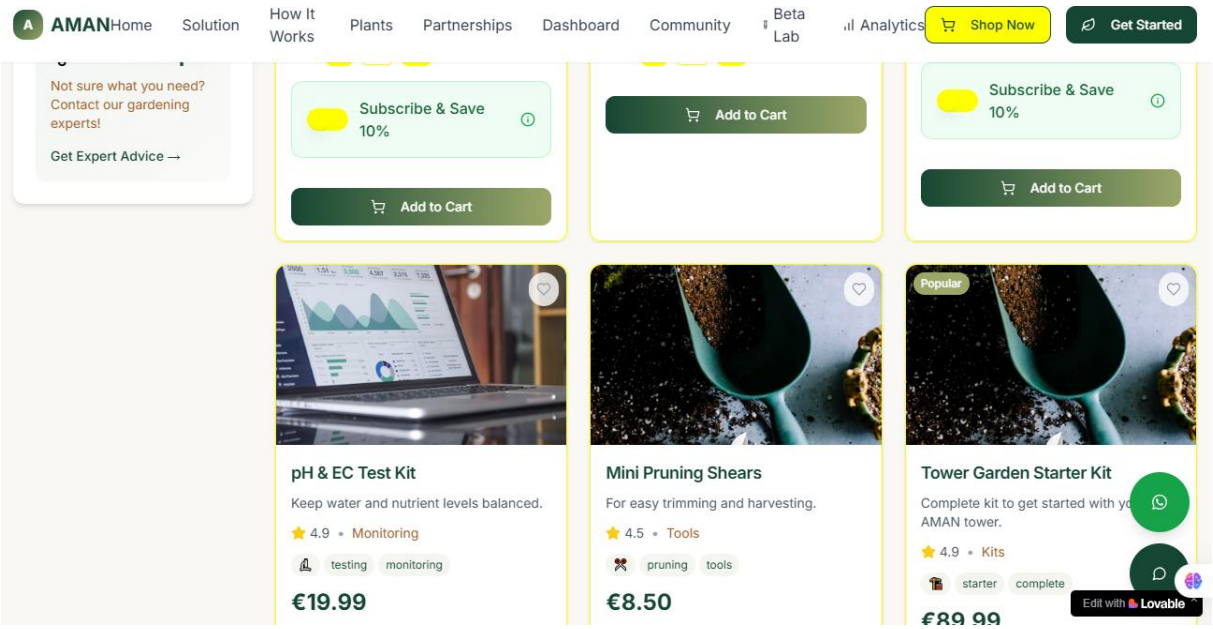
Source: Produced by the student

Key Functionalities

- **E-commerce store:** Users can purchase AMAN kits, accessories, replacement parts, nutrients, and crop supplies.

Chapter 02: Solution Proposal

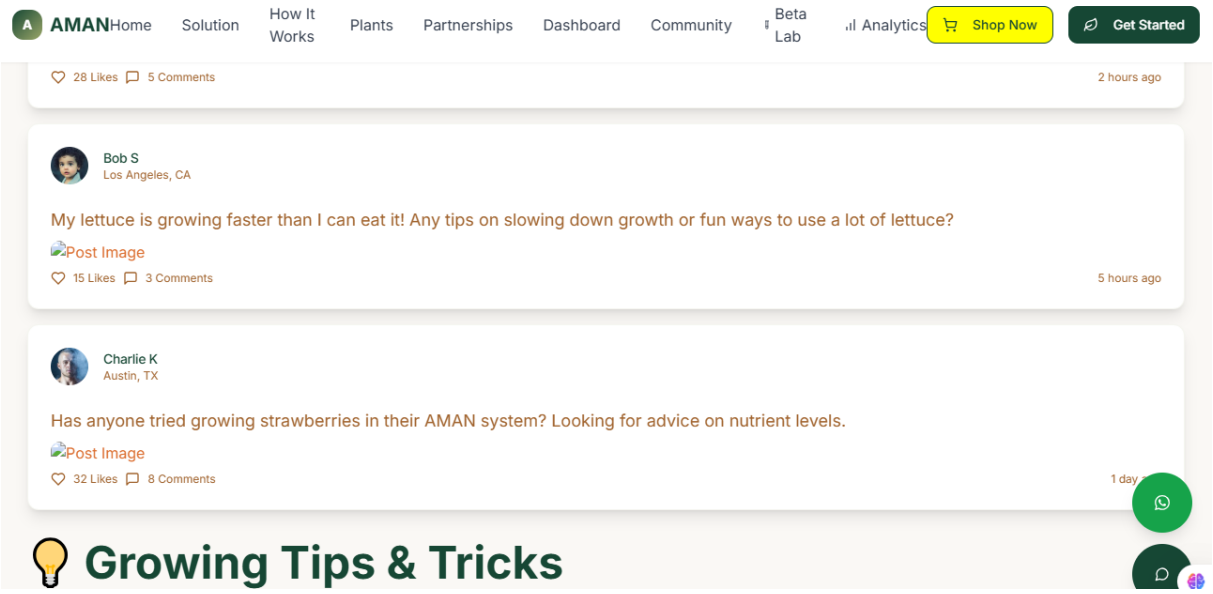
Figure N°32: Website store



Source: Produced by the student

- **User marketplace:** Enables individuals to sell or exchange their home-grown produce directly with others.
- **Community forum:** A space for users to share growing tips, ask questions, and connect with fellow growers.
- **Knowledge base:** Offers tutorials, care guides, FAQs, and expert advice for continuous learning.
- **User profiles and project showcases:** Highlights individual setups and success stories to encourage peer learning.

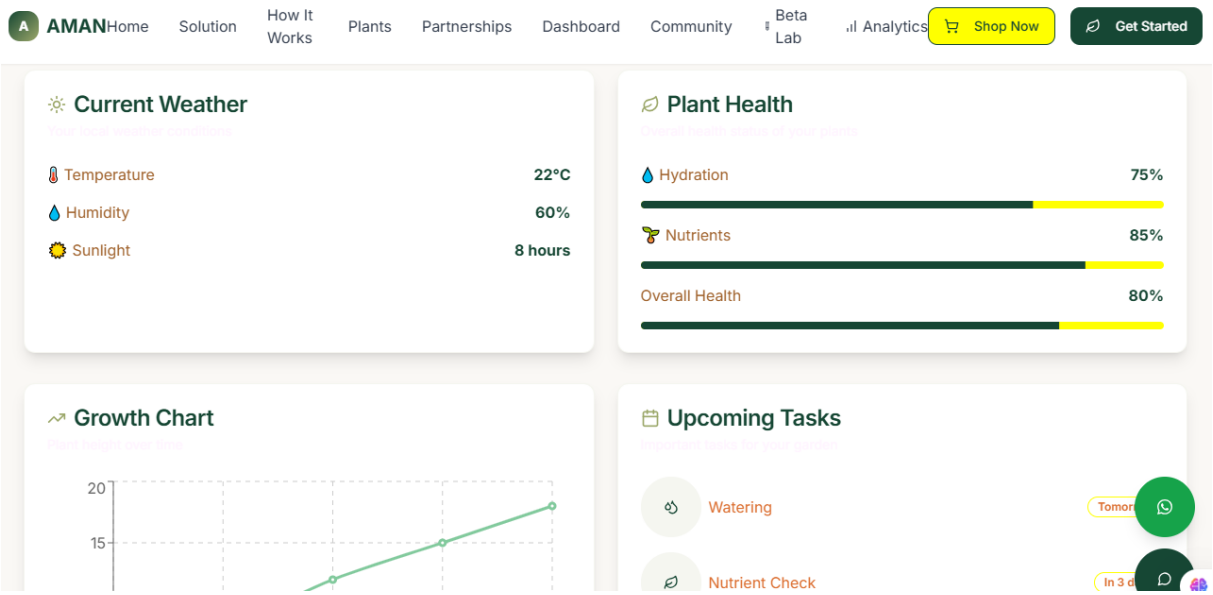
Figure N°33: Website community



Source: Produced by the student

- **Account synchronization:** Linked with the mobile app for unified user experience across platforms.

Figure N°34: Website/App synchronization



Source: Produced by the student

- **Blog and updates:** Regular posts on sustainability, urban agriculture trends, and feature announcements.
- **Multilingual interface:** Available in Arabic, French, and English to serve a diverse national and regional audience.

2-Value Proposition and associated fonctionnalities of AMAN

This section presents the core value proposition of the AMAN project and details the key functionalities that support and operationalize this value in real-world use.

Table N°09: Value Proposition and associated fonctionnalities

FEATURE	FUNCTIONALITY	VALUE
Time-Saving and Automation	Automated irrigation and nutrient distribution – A submersible motor controlled by the app ensures consistent and efficient water circulation without manual intervention.	Saves time for users by reducing the need for daily plant care, making it ideal for busy households or farmers.
Smart Monitoring and Real-Time Feedback	Integrated sensors (TDS level, water level, temperature) – Continuously monitor environmental conditions and send data to the mobile application.	Allows users to track and maintain optimal growing conditions, improving productivity and reducing risks of crop stress or failure.
Water and Resource Efficiency	Soilless irrigation system (hydroponic or aeroponic) – Delivers water and nutrients directly to roots with minimal waste.	Reduces water consumption by up to 90%, aligning with sustainable agriculture goals and conserving resources.
Remote Control and Access	Mobile app integration – Users can manage the system remotely, adjust settings, and receive alerts in real time.	Provides flexibility and convenience, especially for users who are not always present on-site.
Data-Driven Cultivation	Historical data logging and visual analytics – Tracks variations in temperature, water levels, and TDS level over time.	Helps users make informed decisions about crop cycles improving planning and yield optimization.
Ease of Use and Accessibility	User-friendly app with multilingual support – Available in Arabic, French, and English with simple navigation.	Makes the technology accessible to a wide audience, including individuals without prior agricultural experience.
Customizability and Expandability	Modular design and multi-unit control – Supports different types of plants and allows expansion for larger installations.	Offers scalability for users, from small home gardens to larger semi-professional or urban farming setups.
Safety and Reliability	Real-time alert system – Notifies users of abnormalities (e.g., low water level or high PH level).	Reduces the risk of crop loss and ensures a stable growing environment through preventive intervention.

Source: Produced by the student

These functionalities require specific technical Requirements to insure achieving them, these technical requirements are:

- **Microcontroller:** ESP32
- **Connectivity:** WiFi

- **Power Supply:** Household electric plug
- **App:** iOS & Android
- **Data Sync:** real-time DB
- **Sensors:** Food-grade, waterproof, long-life sensors
- **Unit Structure:** PLA, uPVC, food-safe plastic, or recycled eco-materials

3. Goals & Success Criteria

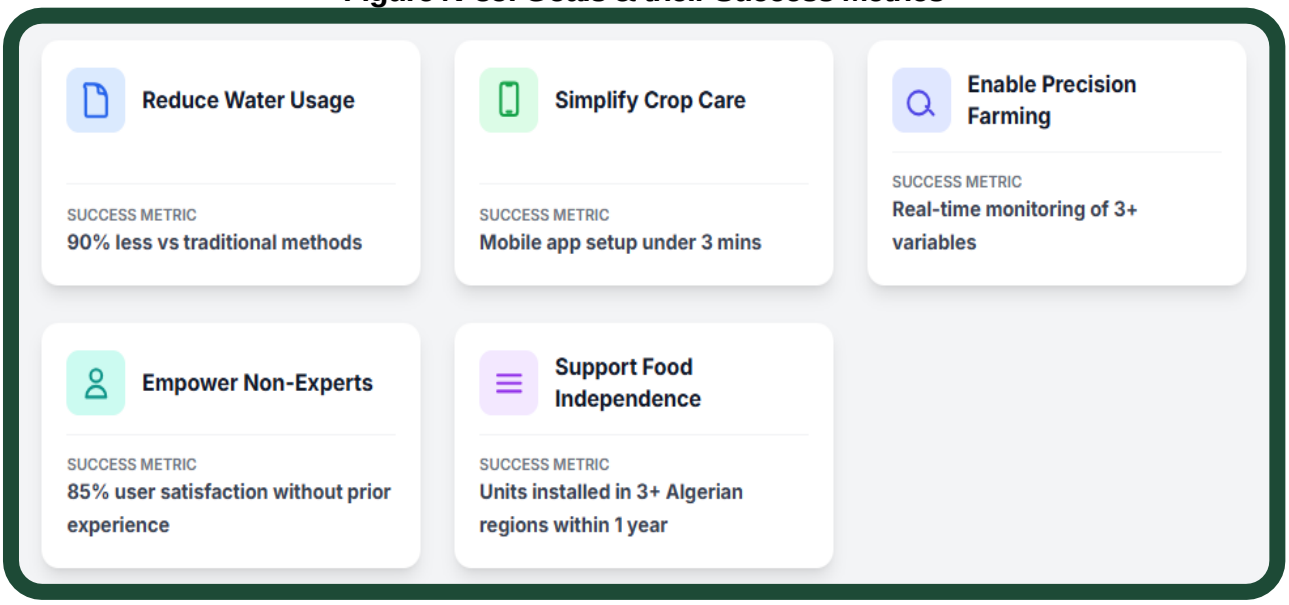
To ensure the strategic development and measurable impact of the AMAN project, clearly defined goals have been established alongside corresponding success criteria. These are supported by key performance indicators (KPIs), which provide a quantitative basis for evaluating progress, guiding decision-making, and ensuring accountability throughout the project lifecycle, that are:

- **Water saved per month per unit (estimated to be from 80% to 90%):** This KPI measures the reduction in water consumption achieved by using the AMAN system compared to traditional soil-based irrigation methods. The target of 80–90% savings reflects the efficiency of the hydroponic/aeroponic design, which recycles and optimizes water usage. Tracking this metric validates the environmental value proposition of the system.
- **App downloads & user retention:** This indicator monitors both the number of users who download the AMAN mobile application and the percentage who continue using it over time (30-day, 90-day retention). High download numbers reflect market interest, while strong retention signals ongoing user engagement and satisfaction with the app's functionalities. Together, they serve as critical indicators of digital adoption and product usability.
- **User satisfaction score (Targeting 85% user satisfaction):** This metric gauges the perceived value and ease of use of the AMAN system through surveys and user feedback. Achieving or exceeding an 85% satisfaction rate will indicate strong user alignment with the system’s features, support quality, and overall experience. It also contributes to building brand trust and organic word-of-mouth growth.
- **Monthly units sold:** Sales performance is tracked monthly to assess market traction. Starting with a modest goal of 10 units in the launch month, the strategy targets a compounded growth rate of 50% per month in the first year. This KPI

supports revenue projections and helps determine manufacturing and distribution scaling needs.

- **Cost recovery per unit after 12 months:** This financial KPI assesses the percentage of production and operating costs recouped through unit sales and related services after one year of launch. A 50% cost recovery target reflects the goal of achieving early-stage financial sustainability while continuing to invest in growth and product refinement.

Figure N°35: Goals & their Success Metrics



Source: Produced by the student

4. Target Users / Needs

Urban Grower – Small Space, High Efficiency

Typically lives in an apartment or home with little or no garden space. Interested in sustainability and food autonomy. Seeks a compact and low-maintenance solution to grow fresh herbs and vegetables indoors or on balconies.

Farmer – Resource Optimization

Owns or manages small agricultural land. Struggles with rising irrigation costs and labor inefficiencies. Seeks tools to automate and optimize production, especially in regions affected by drought.

Educational Institution – Learning Through Practice

Schools and universities aiming to incorporate practical sustainability and agricultural learning into their curricula. Needs a safe, intuitive, and tech-enabled solution that students can engage with easily.

Hospitality Sector – Sustainable On-Site Production

Includes hotels, eco-lodges, and restaurants that want to grow fresh produce on-site to reduce dependence on external suppliers. Requires a solution that is aesthetic, productive, and easy to maintain by non-agricultural staff.5. Product Scope.

5. Product Scope

This section defines the functional boundaries and key components of the system, outlining what the product will include and deliver to meet user needs. It provides a clear overview of the hardware, software, and platform features that together form the complete solution.

Hardware (Tower Unit):

- Multi-tier vertical structure
- Sensors: pH, water level, temperature
- Electric-powered automated irrigation system
- Refillable water tank
- Modular pipes and crop holders

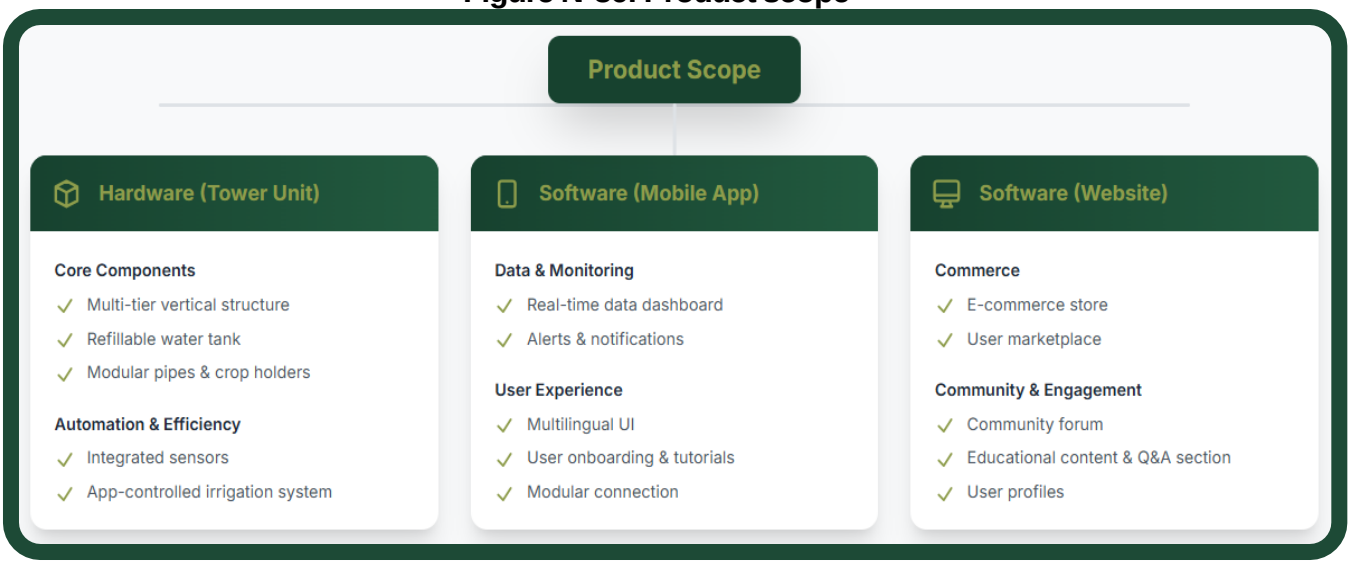
Software (Mobile App):

- Real-time sensor data dashboard
- Multilingual UI: Arabic, French, English
- Alerts: low water, extreme pH, temp fluctuation
- User onboarding + tutorials
- Manual control mode & Auto irrigation toggle
- Modular connection (connect multiple towers)

Web Platform:

- E-commerce store for ordering kits, components, and growing supplies
- User marketplace to sell or exchange home-grown produce
- Community forum for sharing tips, advice, and experiences
- Educational content and expert Q&A section
- User profiles and success stories to encourage engagement and peer learning

Figure N°36: Product scope



Source: Produced by the student

6. Challenges and Constraints

Despite the potential impact of the AMAN system, several technical, market, and operational constraints must be considered:

a. Technical Constraints

Power Dependency:

The current version of the AMAN system requires a constant electrical supply through a plug-in power source. Solar integration is still under development, which may limit usability in remote or off-grid areas.

Sensor Calibration and Accuracy:

Real-time monitoring depends on the precision of water level, pH, and temperature sensors. Calibration and stability across various climates remain a challenge, especially with uncertain supplier reliability.

Hardware Modularity Limits:

While the system is modular in design, retrofitting it into existing agricultural infrastructure (e.g., traditional greenhouses) may require custom adaptations that are currently not automated or standardized.

b. Operational Constraints

Supply Chain Dependencies:

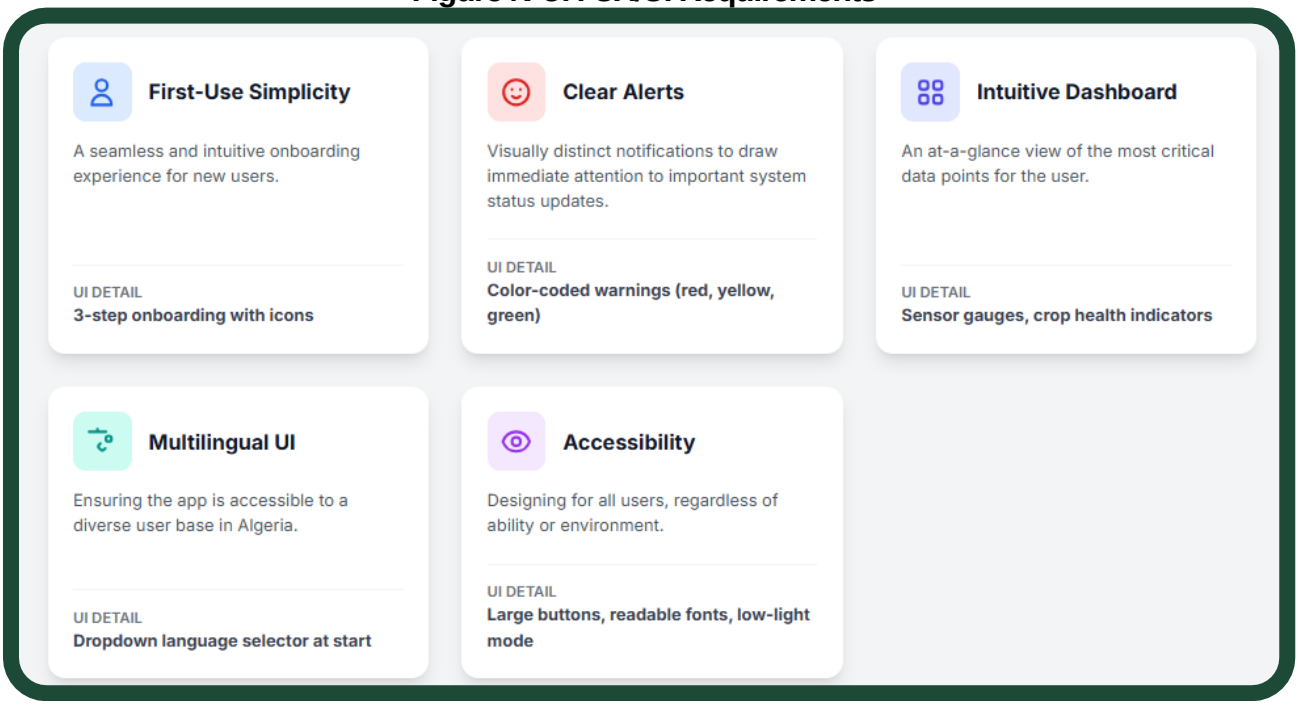
The availability of high-quality, durable sensors and components is reliant on external suppliers. Any disruption or delay—especially during importation—may affect production timelines and scalability.

Scaling Manufacturing Capacity:

Current production is handled manually or at a semi-industrial scale. Rapid growth in demand may challenge production capabilities unless further investment is secured for automation and logistics.

7. UX/UI Requirements

Figure N°37: UX/UI Requirements



Source: Produced by the student

8. Non-Functional Requirements

- **Reliability:** Should function autonomously for at least 1 week without maintenance
- **Security:** Basic login + encrypted data sync
- **Performance:** Updates every hour max
- **Offline Mode:** Partial functionality without internet
- **Sustainability:** Designed for longevity and adaptability to other agricultural systems

9. Key Dependencies

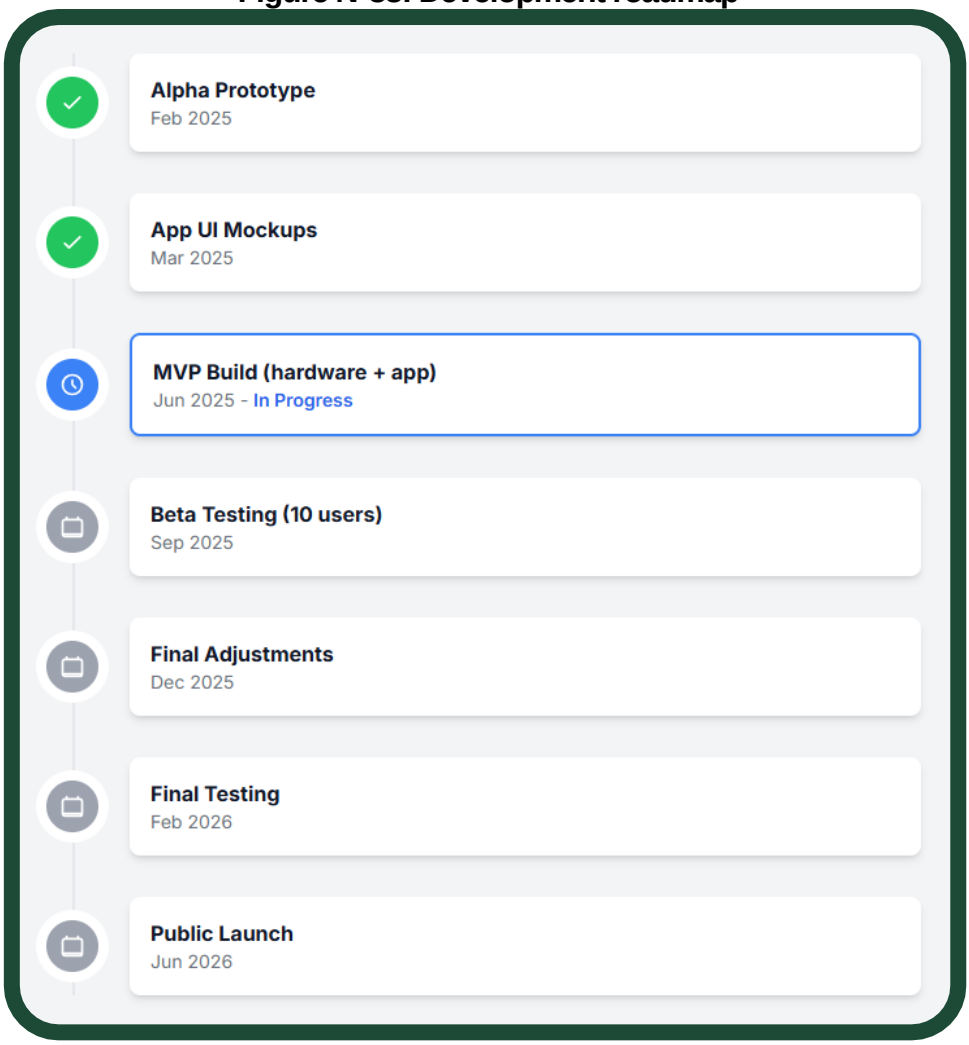
Table N°10: Key dependencies

AREA	STATUS
Sensor Supplier	Identified, pending final agreement
App Development Team	In-house or outsourcing TBD
Manufacturing	Based on prototype test results
Funding	Self-financed + incubator support, grants needed
Distribution	Online, events, partner outlets planned

Source: Produced by the student

10. Development Roadmap

Figure N°38: Development roadmap



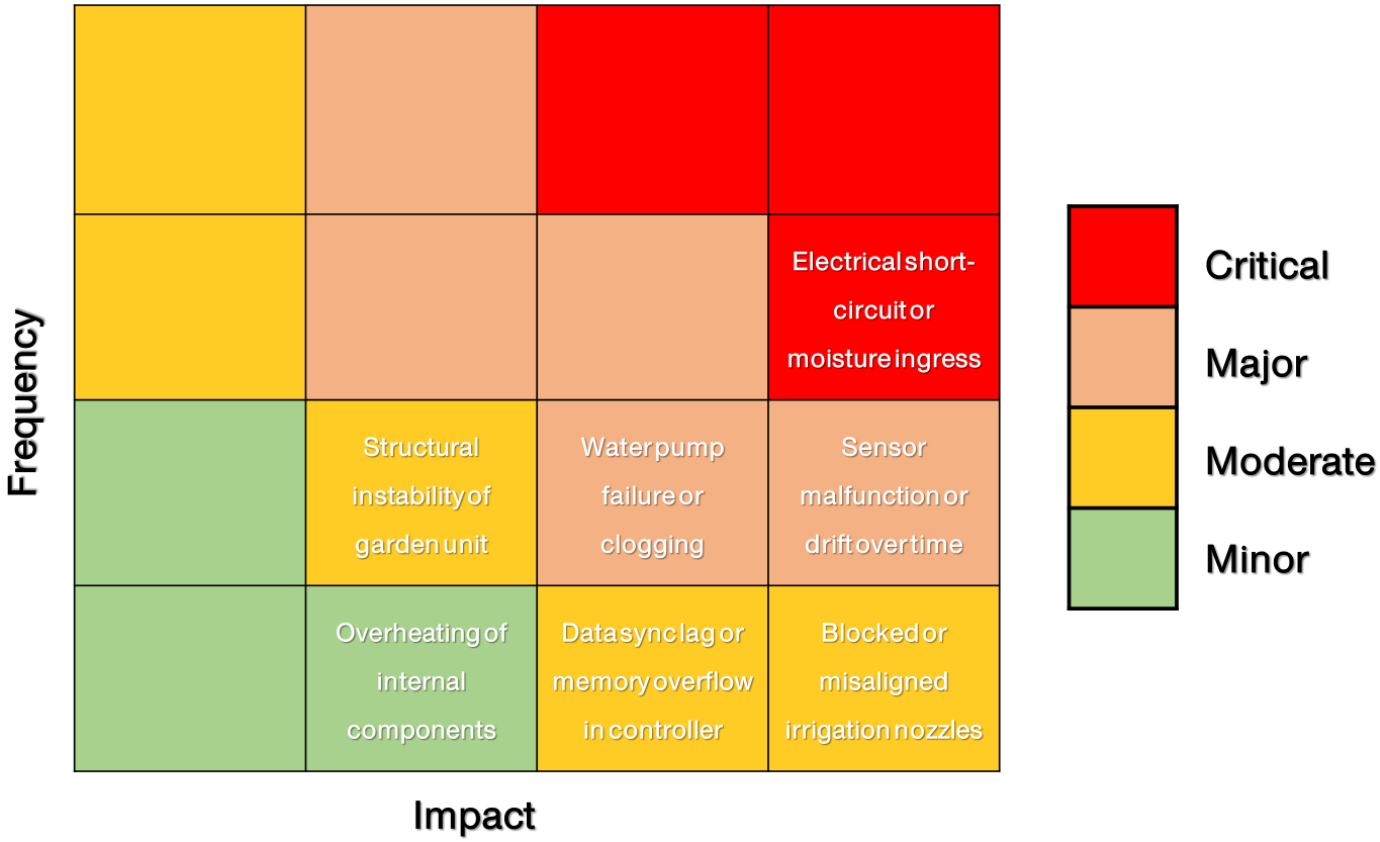
Source: Produced by the student

Chapter 02: Solution Proposal

11. Technical risk management

This part outlines key technical risks within the AMAN system itself—covering hardware, irrigation, and software logic—along with their impact levels and mitigation strategies.

Figure N°39: Risks and mitigations



Source: Produced by the student

The AMAN system faces several internal technical risks that could affect performance and reliability. These include:

1. **Sensor malfunction or drift over time,** which can lead to inaccurate readings and poor irrigation decisions. This risk can be mitigated by using high-quality, industrial-grade sensors and allowing users to calibrate sensors through the mobile app.
2. **Water pump failure or clogging**, potentially disrupting the irrigation cycle and harming plant health. Preventive measures include using pumps with protective filters and integrating maintenance alerts into the system.
3. **Moisture ingress or electrical short-circuits,** which could damage internal electronics. This can be reduced through the use of waterproof casings, sealed circuits, and humidity-resistant materials.

4. **Blocked or misaligned irrigation nozzles,** which cause uneven water distribution. This can be addressed through the use of self-cleaning nozzles or easy-access designs for user maintenance.
5. **Data synchronization delays or memory overflow in the controller,** which may result in missing logs or outdated monitoring data. Solutions include firmware optimization, memory management, and automated data overwrites.
6. **Component overheating, particularly in hot environments.** Passive cooling methods, ventilation, and auto-shutdown safety limits can be used.
7. **Structural instability of the garden unit,** which may cause tilting, leaking, or collapse. A stable, center-weighted design and strong materials are essential to ensure physical durability.

Section 3: Pimento Map

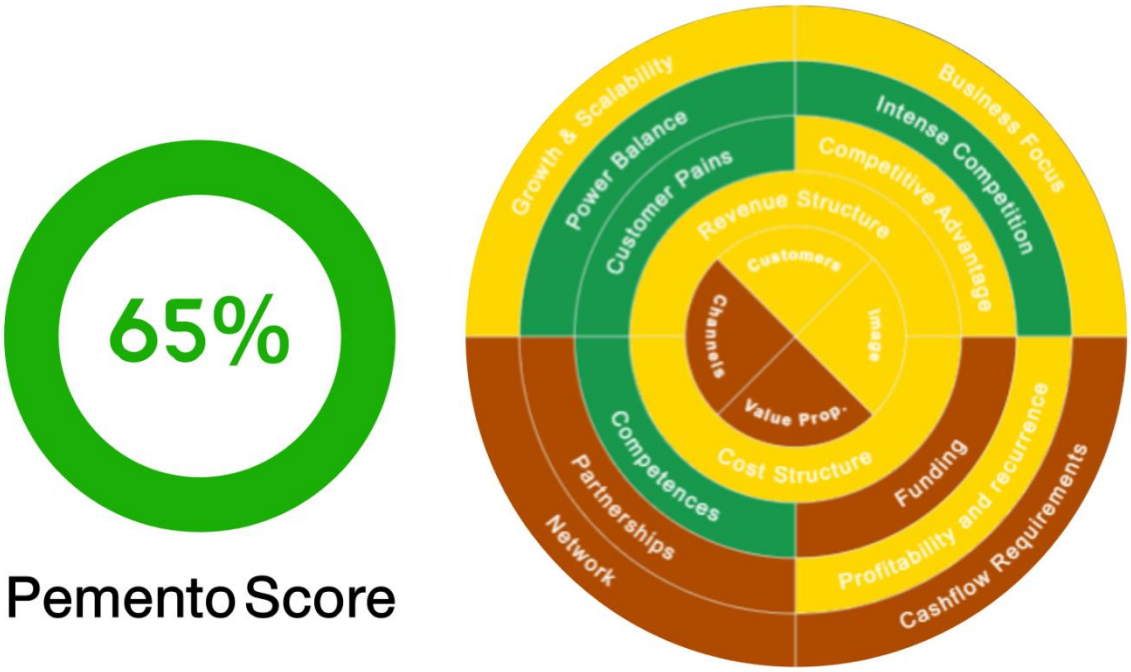
Pimento Map is a methodology designed to facilitate the relevance assessment process that project initiators must undertake. It is also useful for anyone seeking to evaluate the potential of a business model—or even just the underlying idea behind a project.

Pimento Map enables a comprehensive analysis of all aspects of a business plan, including:

- The market / demand
- The industry / supply
- Financial aspects
- The team (human resources)

After registering on the platform http://www.pimentomap.com , we responded to a series of 18 questions covering the main components of our business plan. Each question offered four answer choices, each represented by a color code (green, yellow, orange, red), and these were our results:

Figure N°40: result of Pemento Map for BMC0



Source: http://www.pimentomap.com

Interpretation of Results – BMC0

The score of 65% indicates that our initial Business Model Canvas (BMC0) has a moderately solid foundation, but still requires important adjustments. Our project demonstrates potential, particularly in areas like competitive advantage, customer pains, and power balance, which are marked in green. These strengths confirm that the problem we are solving is real, and that our value proposition is beginning to align with market needs.

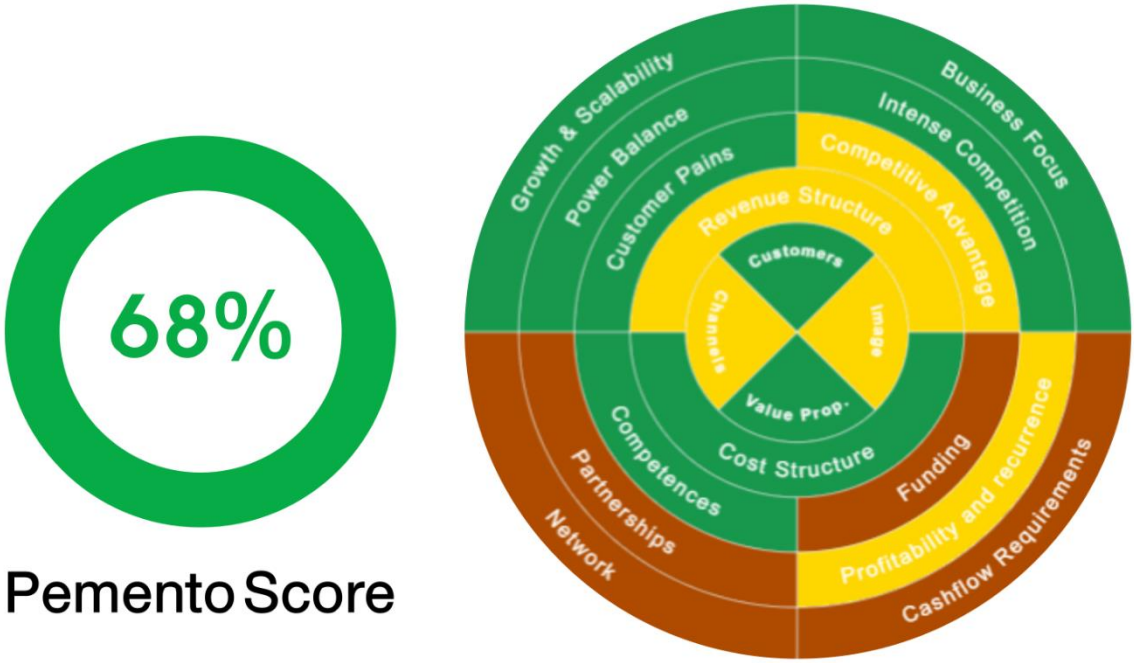
However, the presence of orange and yellow segments, especially in aspects like partnerships, cost structure, and funding, reveals structural weaknesses that may limit our project's development and long-term sustainability.

Identified Weaknesses

- **Partnerships & Network (Orange):** We have not yet established strong strategic alliances. This could limit our access to market distribution, technical knowledge, or support for scaling.
- **Value Proposition & Channels (Orange):** Our value proposition lacks precision and needs to be better defined. The distribution channels through which we will deliver the product are also unclear or insufficiently detailed.

- **Cashflow & Profitability (Yellow):** Our financial model still needs work, particularly in defining how we will generate recurring revenue and ensure a stable cashflow.
- **Business Focus & Scalability (Yellow):** Our project has promise, but we need to better target specific market segments. Scalability is feasible, but it depends on how modular and reliable our system becomes.

Figure N°41: result of Pemento Map for BMC1



Source: http://www.pimentomap.com

Interpretation of Results – BMC1

The transition to BMC1 reflects a clear improvement over our initial model (BMC0, 65%). This higher score indicates that our business model is becoming more coherent and aligned with the market realities. The refinements made demonstrate a deeper understanding of our project's key value drivers and operational challenges.

Key Improvements

- A more precise identification of our target customer segments, allowing us to better address their specific needs.
- A more relevant and well-defined value.
- Stronger articulation of competitive advantage and clearer revenue streams.
- Enhanced internal capabilities and better use of partnerships to support growth and deployment.

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Section 4: BMC2

Although BMC1 marks substantial progress in structuring our project, several areas still require improvement in order to achieve a fully optimized model (BMC2).

Customer Segments

Primary:

- Small and medium-scale farmers needing cost-effective, water-efficient farming technology.
- Agri-solution providers (e.g., greenhouse manufacturers, irrigation companies) seeking to integrate smart systems into their offerings (B2B).

Secondary:

- Eco-conscious urban and suburban households interested in self-sufficient home gardening.
- Educational institutions and restaurants looking to demonstrate sustainability.

Value Proposition

- Real-time monitoring of water level, TDS, and temperature via sensors.
- Automated irrigation reducing water usage.
- A mobile app offering actionable insights for better crop care and system maintenance.
- A standalone system (sensors + app) that can be integrated into third-party agri-infrastructure (ideal for B2B).
- Contribution to sustainable agriculture and food security.

Channels

- Direct B2B outreach to agri-solution providers and cooperatives.
- Distribution via agricultural expos, fairs, and sector-specific events.
- Strategic partnerships with government programs and sustainability NGOs.
- Digital channels: official website, LinkedIn, and agriculture-focused platforms.

Customer Relationship

- Personalized onboarding for farmers and B2B clients with detailed system training.
- Dedicated technical support and remote maintenance services.
- Regular updates and data-driven recommendations through the mobile app.

Revenue Streams

- Sales of the smart system (sensors + app) integrated into other setups: 40,000 DA (one-time B2B price).
- Sales of complete vertical garden units: 10,000 DA/unit.
- Subscription for advanced app features (data analytics, recommendations, reports).

Table N°11: Subscription Plans

FEATURE	FREE PLAN (BASIC ACCESS)	STARTER PLAN 500 DA/MONTH	PRO PLAN 1200 DA/MONTH	EXPERT PLAN 2500 DA/MONTH
Target Audience	All users with unit/system	Households & beginner urban gardeners	Advanced users & small-scale farmers	Large households & small farms
Live Monitoring (Water, Temp, TDS)	✓	✓	✓	✓
Basic Dashboard View	✓	✓	✓	✓
Manual Crop Tracking	✓	✓	✓	✓
Critical Sensor Notifications	✓	✓	✓	✓
Basic Planting Calendar	3-5 crops	10+ crops	10+ crops	10+ crops
Smart Alerts & AI Recommendations	–	✓	✓	✓
Interactive Crop Calendar	–	✓	✓	✓
Data History	–	7 days	90 days	Unlimited
Daily Care Tips	–	✓	✓	✓
Priority In-App Support	–	✓	✓	✓
User Profiles per Account	1	3	5	10+
Advanced Trend Analytics	–	–	✓	✓
Custom Alerts	–	–	✓	✓
Weather Integration	–	–	✓	✓
Exportable Reports	–	–	✓	✓
Offline Mode & Sync	–	–	–	✓
Dedicated Business Dashboard	–	–	–	✓
API Access	–	–	–	✓

Source: Produced by the student

Key Partners

- IoT and sensor technology suppliers.
- Local cooperatives and farmer associations.
- Government agencies and international development programs.
- Agri-tech and smart farming startups.
- R&D institutions and agronomic consultants (external, until internal agronomist is onboarded).

Key Activities

- Design and production of smart system hardware (and optional garden units).
- App development and integration with sensors.
- Customization for B2B partners.
- Technical support and maintenance logistics.
- Field testing and continuous system optimization.

Key Resources

- IoT and sensor supply chain.
- Mobile app and cloud-based platform.
- In-house technical team (hardware, software, support).
- Brand, network, and partnerships.
- Manufacturing and prototyping facilities.

Cost Structure

- R&D and tech development: 40%
- Production and hardware sourcing: 30%
- Marketing and B2B outreach: 20%
- Customer support, logistics, and training: 10%

Figure N°42: BMC2

<table>
<tr>
<td rowspan="2">Key Partners
• Sensor manufacturers.
• Universities and research centers .
• Government/NGO programs.
• Tech incubators and startup support platforms.
• Agriculture cooperatives or distributors.</td>
<td>Key Activities
• Production of VG
• Hardware and software development and integration.
• Continuous design updates.</td>
<td rowspan="2">Value Proposition
• Smart farming system with real-time monitoring
• Automated irrigation system that reduces water usage
• Mobile application to manage crops easily
• Modular solution
• Promotes self-sufficiency and eco-conscious living</td>
<td>Customer Relationship
• Educational onboarding via app and content.
• After-sales support and maintenance</td>
<td rowspan="2">Customer Segments
• Small and medium-scale farmers.
• Agri-solution providers
• Urban and suburban households.
• Educational institutions eco-friendly businesses cafés and restaurants.</td>
</tr>
<tr>
<td>Key Resources
• Hardware and Software.
• R&D team.
• Branding/marketing materials.
• Distribution network.</td>
<td>Channels
• Agri-solution providers .
• Agricultural events.
• Strategic partnerships.
• Digital channels</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• R&D and tech development: 40%
• Production and hardware sourcing: 30%
• Marketing and B2B outreach: 20%
• Customer support, logistics, and training: 10%</td>
<td colspan="2">Revenue streams
• Sale of complete vertical garden units (hardware + system): 10000DA/UNIT
• Subscription plans for Premium app features (AI-based recommendations alerts, data history): 500DA/Month – 1200DA/Month – 2500DA/Month
• B2B licensing or integration deals of the smart system (sensors + mobile app): 40000DA one-time</td>
</tr>
</table>

Source: Produced by the Student

Chapter 03:

Market Strategy Implementation

Chapter 03 : Market Strategy Implementation

This chapter outlines the strategic approach for bringing the AMAN system to market and ensuring its adoption among target users. It covers the go-to-market strategy, growth hacking methods, marketing actions, and long-term objectives designed to position the product effectively in the agricultural and smart gardening sectors. Through a combination of digital tools, customer-focused messaging, and scalable outreach, the chapter defines how AMAN plans to enter the market, build trust, drive adoption, and ensure sustainable growth over time.

1- The Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) are a set of 17 global objectives adopted by all United Nations Member States in 2015 as part of the 2030 Agenda for Sustainable Development. They aim to address urgent global challenges and promote prosperity while protecting the planet.

The AMAN project aligns with several of the United Nations Sustainable Development Goals (SDGs), promoting sustainability, resilience, and innovation in the agricultural sector. Below are the specific SDGs directly supported by the project:

- **SDG 2 – Zero Hunger:** Supports local food production and improves food security by enabling individuals and institutions to grow fresh produce using efficient and scalable vertical farming systems.
- **SDG 4 – Quality Education:** Provides educational value by integrating smart agriculture into school curricula, workshops, and learning centers, offering hands-on exposure to sustainable technologies.
- **SDG 6 – Clean Water and Sanitation:** Promotes efficient water use through an automated irrigation system that reduces water consumption by up to 90%, and monitors water quality in real time.
- **SDG 8 – Decent Work and Economic Growth:** Encourages entrepreneurship and job creation in the agritech sector through manufacturing, distribution, and maintenance of smart farming systems.
- **SDG 11 – Sustainable Cities and Communities:** Facilitates green spaces and local food production in urban areas by offering compact, modular vertical gardens suitable for rooftops, balconies, and community spaces.

- **SDG 12 – Responsible Consumption and Production:** Optimizes resource use by controlling water, nutrients, and energy inputs, while reducing food waste and promoting sustainable consumption patterns.
- **SDG 13 – Climate Action:** Minimizes environmental impact by lowering agricultural resource use and promoting localized, low-emission food production practices.
- **SDG 17 – Partnerships for the Goals:** Developed in collaboration with the incubator of the university of Guelma, and technical experts, the project demonstrates the value of cross-sector partnerships in advancing sustainability.

Figure N°43: AMAN Project Alignment with the SDGs

Source: Produced by the Student

2- Go To Market (GTM) Strategy

This section outlines the strategic approach adopted to position the AMAN project in the market. It covers the segmentation of target audiences, the value proposition tailored to each segment, the chosen communication channels, and the promotional tactics designed to drive adoption. The strategy focuses on building awareness, generating early traction, and ensuring long-term customer engagement.

2.1. Target Market Strategy

This part analyzes the main customer segments for the AMAN system. It outlines how each segment is targeted through tailored messaging, appropriate distribution channels, and strategic outreach to maximize market penetration.

Chapter 03 : Market Strategy Implementation

1. Target Market

AMAN focuses on three underserved but high-potential segments in Algeria:

- Urban households with limited space but growing ecological interest
- Small-scale farmers needing water-efficient, productive systems
- Educational institutions seeking practical sustainability tools

2. Unmet Needs & AMAN's Solutions

- Lack of compact, affordable systems → AMAN offers vertical, modular gardens
- Water scarcity → Uses up to 90% less water
- Limited farming knowledge → Guided mobile app for users of all levels
- Educational gaps → Curriculum-friendly kits for schools

3. Strategic Competitive Positioning (SCP) Strategy

The SCP strategy outlines how AMAN differentiates itself from competitors by leveraging its unique features, technological advantages, and sustainable impact to establish a strong and defensible market position;

- **Segmentation:** Urban households, small farmers, and schools all measurable, reachable, and responsive to sustainable solutions.
- **Targeting**: Initial focus on small-scale farmers due to high ROI potential, followed by expansion to households and schools.
- **Positioning Statement:** AMAN empowers Algerians to grow food sustainably with less space, less water, and more intelligence.
- **Perceived strengths:** Water-saving, user-friendly, compact, reliable, and educationally impactful.

4. Market Size & Share Goals

- **Total Addressable Market (TAM)**

All agricultural market in Algeria: USD 5.09 billion in 2025, projected to grow to USD 6.38 billion by 2030 (CAGR 4.65%)

Automated hydroponic & vertical farming is part of a global USD 1.68 billion market, expected to reach USD 1.87 billion in 2025 (CAGR 11.2%)

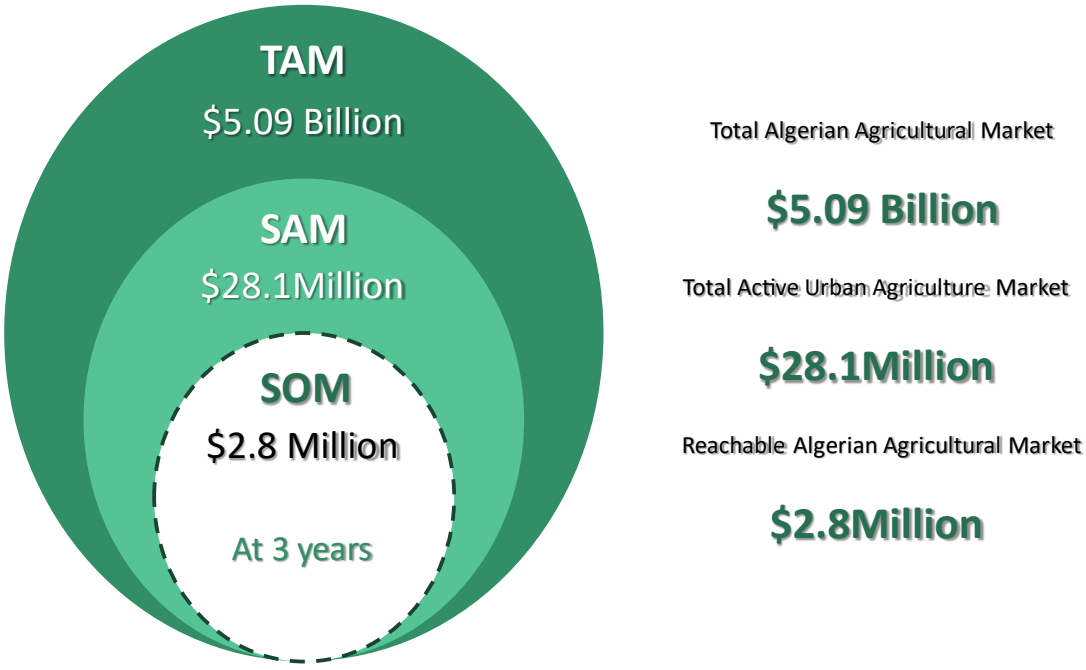
Urban population: 75% of 46.7 million = ~35 million urban residents

The opportunity includes the entire Algerian veggie/agriculture spend (USD 5 billion+) and a share of the growing smart urban gardening subsegment within urban areas.

- **Serviceable Available Market (SAM)**
- Gardening households in urban Algeria are about 35 million urban residents:

  35 million ÷ 5 ≈ 7 million households.
- Assuming 40% are actively gardening → 2.8 million potential customers.
- We target early adoption 1% of those households → 28,000 units. +100 pilot installations across schools, farms, and community centres. Which mean approximately ~28,100 units in Year 1.
- **Serviceable Obtainable Market (SOM)**
- Our year 1 realistic goal is to capture ~0.5–1% of target households which is about 14,000–28,000 units (plus 100 institutionals).
- Our 3 year ambition is to Reach 5% penetration of gardening households → ~140,000 units; or 10% for aggressive expansion → ~280,000 units.

Figure N°44: Market size for AMAN



Source: Produced by the Student

5. Key Differentiators (USP)

- Compact vertical design for small spaces
- Water-efficient system (up to 90% savings)
- Connected mobile app for learning and control
- Locally made, affordable, and modular
- Educational integration for schools and NGOs

Table N°12: Key features of AMAN

Feature	Benefit
Compact vertical design	Fits small homes, rooftops, schools
Mechanized irrigation	Reduces water usage by up to 90%
Mobile app integration	User-friendly experience, education, tracking
Locally designed & made	Affordable, contextualized, creates local jobs
Modular & customizable	Adaptable to different needs: herbs, vegetables, etc.
Educational component	Attracts schools, NGOs, community programs

Source: Produced by the student

2.2. Product/Service Strategy

This section details how the AMAN product is presented and adapted to different user needs. It includes pricing, modularity, scalability, and the integration of value-added features such as the mobile app and smart sensors, all aimed at ensuring a strong market fit and user satisfaction:

a. Pricing Strategy

The pricing model adopted for the AMAN system and its components, designed to ensure affordability, market competitiveness, and alignment with the perceived value by target users

1. Overall Pricing Approach

Our product is no longer the vertical gardens themselves but the monitoring system, because that's where our core value lies in enabling smart, water-efficient, and self-managed farming through technology.

We apply a value-based, tiered subscription pricing model, which reflects the benefits of our smart farming system: real-time monitoring, automated irrigation, and a mobile application for crop management.

The pricing is designed to be:

- Accessible to our main segments (small farmers, households, schools)
- Aligned with the product's value including water savings, ease of use, and increased productivity
- Scalable starting with a free tier and growing with user needs (500–2,500 DZD/month)

This strategy lowers barriers to entry, encourages upgrades as users see value, and ensures affordability without compromising quality or performance.

2.Evidence of Market Acceptance

- Pilot feedback: Early adopters (schools and small farms) confirmed the price was acceptable, especially when compared to the costs saved on water and fertilizer.
- Market behavior: Algerian consumers are increasingly investing in eco-friendly and tech-enhanced home solutions, even at a slightly premium price.
- NGO & institutional interest: Educational and sustainability-focused organizations see AMAN as an investment in impact, not just a product cost.
- Households already pay for smart services (e.g., mobile subscriptions, streaming), making small monthly plans culturally and economically acceptable.

Table N°13: Price adaptation by segment

PLAN	PRICE (DZD)	TARGET USERS
Free Plan	0	All system users (basic access)
Starter Plan	500	Urban households, beginner growers
Pro Plan	1,200	Advanced users, small-scale farmers
Expert Plan	2,500	Large farms, institutions, B2B users

Source: Produced by the student

2. Long-Term Price Strategy

As AMAN continues to grow and streamline its operations, we aim to reduce production and operational costs over time through improved sourcing, local partnerships, and technology optimization.

- Maintain an accessible base subscription tier Instead of anchoring the price at 10,000 DZD (which was tied to the previous physical product), our new focus is on keeping the basic digital monitoring service affordable, starting with a Free Plan, followed by progressive paid tiers (500 DZD, 1,200 DZD, and 2,500 DZD per month) to support different user needs.
- Introduce premium models (larger size, solar-powered, more sensors)

b. Distribution Strategy

AMAN's distribution strategy is designed to reach farmers, urban users, and institutions efficiently across Algeria by combining agri-industry partnerships, local visibility, and digital accessibility.

Our product is a smart farming monitoring system that requires a distribution model that enables both hardware delivery (sensors, control units) and software onboarding (mobile app activation), while supporting education and trust-building in a new tech segment.

1. Distribution Channels

AMAN will use a **hybrid distribution model** combining:

1. **Agri-Solution Providers (Retailers & Distributors)**
   - Local agricultural equipment retailers will stock AMAN kits and help with setup support.
   - These partners already have trusted relationships with smallholder farmers.
   - They also act as demo points for physical exposure to the product.
2. **Agricultural Events & Trade Shows**
   - Presence at agri-tech expos, eco-fairs, and regional agricultural gatherings.
   - Ideal for live product demonstrations, educational workshops, and direct B2B deals.
   - Events help AMAN gain institutional visibility and collect high-intent leads.
3. **Strategic Partnerships**
   - Collaboration with NGOs, schools, municipalities, and agricultural co-ops.
   - These partnerships support volume sales, pilot deployments, and training programs.
   - They serve as entry points to underserved regions and educational networks.
4. **Digital Channels**

AMAN will leverage e-commerce platforms, its own website, and social media for:

- Direct-to-user orders (D2C)

- Software onboarding (app downloads, subscriptions)
- Customer support and updates via WhatsApp and email

This channel is essential for urban households and tech-savvy farmers.

Why These Channels?

- **Agri-retailers** and **event-based outreach** are trusted and localized critical for farmers and NGOs.
- **Digital platforms** allow low-cost scaling, particularly in urban markets.
- **Partnerships** increase adoption through aligned interests (education, sustainability, food security).

Together, these channels create a **balanced, scalable, and high-trust distribution network** that matches AMAN's hybrid nature (hardware + software).

2. Accessing and Activating These Channels

To access and activate these channels, we will:

- Offer **margin incentives** to agri-retailers and distributors.
- Provide **demo kits and training materials** to partners and event organizers.
- Launch **co-branded campaigns** with schools, NGOs, and local authorities.
- Run **targeted digital marketing** to drive traffic to our website and app.
- Equip local reps and ambassadors with **sales kits** for events and outreach.

3. Logistics & Fulfillment

A reliable logistics and fulfillment system is essential to support the delivery of AMAN's smart farming kits (hardware) and onboarding of software users across both urban and rural areas in Algeria.

Table N°14: The logistics for different components

COMPONENT	APPROACH
Hardware Delivery	Sensor kits will be delivered through a mix of direct shipping, agri-retailers, and event pickups.
Software Access	Users activate their plan through mobile app onboarding post-purchase.
Packaging & Assembly	Units will be pre-assembled or modular, with manuals and QR-based app links inside.

Source: Produced by the student

a. Delivery Infrastructure

- **Urban Zones:** Use in-house delivery or trusted local couriers for fast, direct service.
- **School/NGO Programs:** Bulk delivery with scheduled deployment and on-site support.

b. Customer Support

- **WhatsApp/facebook Business:** Real-time tracking, support, and setup assistance.
- **Knowledge Hub:** App-integrated videos, FAQs, and manuals.
- **Phone support:** Hotline for schools, NGOs, and elderly customers.

This logistics system ensures smooth product access and satisfaction regardless of location.

2.3. Methods of Promotion

Effectively promoting AMAN's smart farming system is critical to building awareness, educating the market, and driving adoption especially among small-scale farmers, eco-conscious households, and institutions. Our strategy combines digital outreach, local trust-building, and educational engagement.

1. Digital Advertising Strategy

To reach Algeria's increasingly connected urban and rural population, AMAN will implement a balanced digital marketing mix combining both organic and paid strategies.

1.1 Organic Digital Strategy (Owned & Earned Media)

AMAN's **organic marketing** efforts focus on long-term visibility, credibility, and community engagement through content and SEO.

Table N°15: Organic marketing channels

CHANNEL	ACTIONS
Instagram & Facebook	Daily posts with DIY tips, user stories, behind-the-scenes content Vertical garden & app feature walkthroughs
Blog (Website)	SEO-optimized articles on vertical farming, urban gardening, water-saving techniques Keyword targeting: jardin vertical Algérie, agriculture urbaine, économie d'eau
Email Newsletter	Biweekly updates with crop tips, feature announcements, case studies
Press Coverage	Articles and interviews in Algerian agri-tech and sustainability media

Source: Produced by the student

1.2 Paid Digital Strategy (Advertising & Sponsored Content)

Paid media will be used to accelerate reach, capture leads, and drive conversions, especially in urban areas and high-farming zones.

Table N°16: Paid marketing channels

CHANNEL	ACTIONS
Facebook & Instagram Ads	Target small farmers and urban eco-gardeners Promote key benefits: water-saving, smart alerts, easy crop management
Google Ads (Search + Display)	Target keywords: kit agriculture intelligente, capteurs agricoles Algérie, gestion de l'irrigation
Influencer Collaborations	Partner with local eco-farmers, educators, and agri-YouTubers to showcase real use cases
Boosted Content	Promote top-performing posts and blogs to reach non-followers

Source: Produced by the student

Goal: Drive high-intent traffic, generate leads, and convert interest into subscriptions or sales.

Tracking tools: Google Analytics, Meta Ads Manager, link trackers for email

KPIs: Click-through rate (CTR), conversion rate, cost per acquisition (CPA), engagement rate, ROI

1.3 Printed Materials & Field Promotion

Printed assets reinforce the brand physically and support customers with low digital literacy.

Table N°17: Printed materials ad their use

MEDIUM	USE
Flyers & Brochures	Distributed at markets, agri-stores, and during events
Instruction Manuals	Printed setup guides bundled with hardware and app QR codes
Banners & Posters	Placed in retail partner locations, municipalities, and school partners

Source: Produced by the student

2. Demonstration Events & Personal Selling

Live interaction is crucial for AMAN's adoption, especially for farmers and institutions unfamiliar with agritech. Because face-to-face interaction builds trust and boosts adoption in low-tech zones

Table N°18: Live interaction methods

TYPE	PURPOSE
Pop-up Booths	At markets, agri-fairs, or city gardens for hands-on product demos
School & NGO Workshops	Demonstrate AMAN kits in action; promote educational use
Field Ambassadors	Local reps trained in setup, support, and sales for rural outreach
Partnership Roadshows	Meet with cooperatives, municipalities, and institutional stakeholders

Source: Produced by the student

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Why This Strategy Works?

- **Multi-channel reach**: It touches all major segments — digital for urban users, physical for rural areas, and personal selling for institutions.
- **SEO foundation + Paid acceleration**: Long-term growth is powered by content, while ads deliver immediate traction.
- **Localized & educational**: AMAN's product is new our strategy focuses on **explaining, demonstrating, and de-risking** the purchase for skeptical users.
- **Low-cost, high-impact**: Most channels are cost-efficient and adapted to the Algerian media and tech landscape.

Figure N°45: Timeline of Promotion (First 12 Months)

Source: Produced by the Student

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2.4. Sales Strategy

In a market where smart agriculture is still emerging, an effective sales strategy must do more than sell — it must educate, build trust, and support. AMAN's sales strategy focuses on personalized outreach, regional coverage, and long-term customer relationships, especially given the hybrid nature of our product (hardware + digital subscription).

1. Sales Channels & Approach

Each sale includes both hardware distribution and digital service activation (subscription plans).

Table N°19: Primary sales channels

CHANNEL	SALES METHOD
Direct-to-Customer (Online)	Website orders, WhatsApp, and app-based onboarding
Agri-Retailers	In-store staff promote and assist with the sale
Demonstration Events	Field reps and ambassadors handle in-person demos
NGO/School Partnerships	B2B-style consultative sales
Digital Sales Funnel	Lead capture via social media, followed by sales follow-up

Source: Produced by the student

2.Sales Force Structure

This section describes the organization of AMAN's sales efforts, which include an internal sales team for direct coordination, field ambassadors for on-site promotion, retail partner staff for in-store sales, and institutional sales leads focused on large-scale and educational partnerships.

Table N°20: Sales force structure

SALES ROLE	FUNCTION
Internal Sales Team	Handles inbound leads (via website, social media, WhatsApp), follow-ups, and CRM
Field Ambassadors	Conduct in-person sales, demos, and installations in rural and peri-urban areas
Retail Partner Staff	Upsell and support customers in physical stores
Institutional Sales Lead	Manages B2B/NGO/government sales, proposals, and contracts

Source: Produced by the student

3. Recruitment, Training & Compensation

Recruitment

- Hire from agricultural schools, sustainability programs, or local community leaders
- Partner with youth entrepreneurship incubators to engage motivated sales agents

Training

- Product setup and troubleshooting (hardware + app)
- Sales pitch: benefits of smart monitoring, pricing tiers
- Segment-specific approaches: farmer vs. household vs. school
- Tools: WhatsApp CRM, or basic sales tracking systems

Table N°21: Sales force compensation

ROLE	COMPENSATION TYPE
Internal Sales Agent	Base salary + performance bonuses
Field Ambassador	Commission per sale + travel stipend
Institutional Lead	Monthly salary + bonus per closed contract
Retail Partner Staff	Margin-based incentives or co-promotion deals

Source: Produced by the student

4. Sales Objectives (First Year)

To build traction in the Algerian market and validate both product and channel strategies, AMAN will focus on realistic, impact-driven sales objectives during its first 12 months of operation.

Key Objectives:

- Sell **200+** units across all channels (direct sales, events, retail partners, and online)
- Train and deploy **5+** sales representatives or field ambassadors in priority urban and semi-rural regions
- Close **10+** institutional agreements with schools, NGOs, or local government programs to drive volume adoption and social proof
- Maintain a lead-to-purchase conversion rate of **15–20%** by leveraging targeted outreach, personalized demos, and trust-based selling

These objectives will serve as core performance indicators to measure market fit, channel effectiveness, and early revenue generation, setting a strong foundation for Year 2 scale-up.

Why This Strategy Works?

AMAN’s sales strategy is built for realities on the ground: a diverse customer base, a new tech-driven solution in a traditional sector, and the need for both education and trust. Here's why it works:

- Grounded in real customer behavior
- Adaptive across urban and rural zones
- Designed to educate while selling
- Built for long-term loyalty, not just one-time transactions

It’s about creating a network of informed users, local advocates, and repeatable, scalable growth.

2.5. Marketing and Sales Forcast

This part provides an overview of anticipated marketing activities and projected sales performance. It includes growth expectations, estimated customer acquisition, and revenue projections informed by research and initial market response.

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1. Key Assumptions

Table N°22: Key assumptions of Marketing/Sales forcast

CATEGORY	VALUE
Core Offering	Smart farming monitoring system (hardware + mobile subscription)
Pricing Tiers (Monthly)	Free (0 DZD), Starter (500 DZD), Pro (1,200 DZD), Expert (2,500 DZD)
Avg. Monthly Revenue/User	Estimated 1,000 DZD average (across all paid users)
Year 1 Paid User Base	~200 paid subscriptions (15–20% conversion from leads)
Target Growth Rate	2x user growth year-over-year in Years 1–3, slowing to 1.5x in Y4–5
Market Context	Algeria: ~€0.61B lawn & garden market, growing 1.81% annually

Source: Produced by the student

2. Marketing Expense Forecast (by Channel)

This is a breakdown for the total Marketing Investment over 5 Years which is estimated to be 14,660,000 DZD:

Table N°23: Marketing expenses forecast

CATEGORY	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL (DZD)
Facebook & Instagram Ads	200,000	800,000	1,200,000	1,500,000	1,800,000	**5,500,000**
Google Ads	150,000	500,000	700,000	850,000	900,000	**3,100,000**
Influencer Partnerships	60,000	250,000	400,000	500,000	600,000	**1,810,000**
Flyers & Printed Materials	50,000	100,000	120,000	150,000	160,000	**580,000**
Event & Demo Costs	100,000	400,000	500,000	600,000	700,000	**2,300,000**
Website & SEO Content	20,000	100,000	150,000	200,000	250,000	**720,000**
Email Marketing Tools	10,000	40,000	50,000	60,000	70,000	**230,000**
Press & PR Outreach	10,000	30,000	50,000	60,000	70,000	**220,000**

Source: Produced by the student

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3. Units Sold Forecast with Increasing Prices

This is the estimated number of units sold over the first 5 years where:

- Unit prices increase from 10,000 DZD to 15,000 DZD across 5 years.
- Total hardware revenue over 5 years reaches 89.3 million DZD.

This strategy reflects increased perceived value, improved features, and rising brand strength.

4. Subscription Pricing & Revenue Forecast (Y1–Y5)

This section presents the planned subscription pricing model and outlines revenue projections over the first five years, based on expected adoption rates, customer retention, and product scaling strategies.

4.1 Subscription price evolution

Table N°24: Subscription price evolution

PLAN	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL % INCREASE
Starter	500 DZD	550 DZD	600 DZD	660 DZD	730 DZD	+46%
Pro	1,200 DZD	1,300 DZD	1,400 DZD	1,520 DZD	1,650 DZD	+37.5%
Expert	2,500 DZD	2,650 DZD	2,800 DZD	3,000 DZD	3,150 DZD	+26%

Source: Produced by the student

4.2 Subscribers per Plan

Table N°25: Subscribers per plan

YEAR	STARTER SUBS	PRO SUBS	EXPERT SUBS	TOTAL SUBS
Y1	50	100	50	**200**
Y2	150	300	120	**570**
Y3	300	600	180	**1,080**
Y4	400	900	230	**1,530**
Y5	600	1,200	360	**2,160**

Source: Produced by the student

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4.3 Total Subscription Revenue Forecast (Monthly Revenue × 12)

Price increases begin in Year 2 and rise modestly year over year, and the cumulative subscription revenue over 5 years: **101.5 million DZD**

Table N°26: Total Subscription Revenue Forecast

YEAR	STARTER REVENUE	PRO REVENUE	EXPERT REVENUE	TOTAL SUBSCRIPTION REVENUE
Y1	50 × 500 × 12 = 300,000	100 × 1,200 × 12 = 1.44M	50 × 2,500 × 12 = 1.5M	**3.24M DZD**
Y2	150 × 550 × 12 = 990,000	300 × 1,300 × 12 = 4.68M	120 × 2,650 × 12 = 3.816M	**9.49M DZD**
Y3	300 × 600 × 12 = 2.16M	600 × 1,400 × 12 = 10.08M	180 × 2,800 × 12 = 6.048M	**18.29M DZD**
Y4	400 × 660 × 12 = 3.168M	900 × 1,520 × 12 = 16.416M	230 × 3,000 × 12 = 8.28M	**27.86M DZD**
Y5	600 × 730 × 12 = 5.256M	1,200 × 1,650 × 12 = 23.76M	360 × 3,150 × 12 = 13.608M	**42.62M DZD**

Source: Produced by the student

Supports a strategy of increasing product value, loyalty, and profitability over time.

3- Growth Hacking Strategy

Growth hacking is a lean and innovative approach focused on rapid and cost-effective growth. For AMAN, a smart agritech solution, growth hacking is essential to acquire early users, generate awareness, and build traction without relying on heavy marketing budgets.

1. Objectives

- Acquire a loyal base of early adopters (urban growers, farmers, institutions)
- Generate buzz and credibility through community and institutional networks
- Optimize the user journey to increase referrals and retention
- Create scalable acquisition loops that support long-term growth

2. Key Growth Levers

a. Product-Led Growth (PLG)

- **Interactive demo mode** in the app (free access to core features to test value)
- **Built-in referrals**: users who invite others get discounts on rock wool or fertilizer
- **Gamification**: achievements for crop cycles completed or water saved

b. Community Building

- **Launch a social community** for urban farmers and eco-conscious users (Facebook, WhatsApp, and Telegram groups)

- **Customer spotlight stories** on social media: featuring successful harvests using AMAN
- **Early adopter program**: exclusive access to new features and branding visibility

c. Influencer & Ambassador Programs

- Partner with **eco-influencers, agri-tech YouTubers**, and **Instagram gardeners**
- **Field ambassadors**: trained local users advocating and demonstrating the product in real communities
- Leverage **student ambassadors** in agricultural schools and universities

d. Institutional and B2B Entry Points

- **Pilot programs** with educational institutions or municipalities
- **Free trial installation** for hospitality businesses and schools in return for testimonials and visibility
- **Collaborations with NGOs** or environmental initiatives aligned with SDGs

e. Content Marketing and SEO

- Educational blog posts about **hydroponics, vertical farming, and food self-sufficiency**
- Short videos on TikTok, Instagram Reels, and YouTube showing system use and benefits
- SEO-optimized landing pages targeting terms like "vertical garden Algeria" or "reduce irrigation cost"

3. Viral & Referral Loops

- **In-app referral system** with double-sided rewards
- **Share your garden** feature: users can share growth stats and plant photos on social media with AMAN branding
- **Competitions** for the best garden setup, with winners showcased and rewarded

4. Strategic Partnerships

- Partner with **agricultural stores** and **urban farming cooperatives** to act as local growth hubs
- Work with **startup incubators** and **green innovation networks** to gain visibility
- Collaborate with **eco-friendly brands** for bundled offers (e.g., sustainable planters, eco tools)

5. Data-Driven Optimization

- Use app analytics to identify **drop-off points** and improve onboarding
- Track **referral performance**, most-shared features, and high-retention user profiles
- Run **A/B tests** on pricing, messaging, and visuals to continuously refine the funnel

6. Timeline Overview (First 12 Months)

Table N°27: Actions to take in the first year

QUARTER	KEY ACTIONS
Q1	Finalize MVP, start pre-launch buzz, build email waitlist, partner with influencers
Q2	Launch referral program, distribute content, begin pilot installs, social media contests
Q3	Scale influencer outreach, push B2B pilots, launch ambassadors program
Q4	Analyze KPIs, iterate, and prepare for wider market rollout and international exposure

Source: Produced by the student

7. KPIs to Track

These KPIs help assess traction, optimize campaigns, and guide strategic decisions:

- **Monthly Active Users (MAU):** The number of unique users who engage with the system (mobile app or garden interface) within a 30-day period. It measures user engagement and product adoption. A growing MAU indicates rising interest and sustained user interaction. Its goal is to maintain consistent growth in MAU to demonstrate increased market presence.
- **Cost per Acquisition (CPA):** The average amount of money spent on marketing and outreach to acquire one new customer. It helps evaluate the efficiency and ROI of marketing campaigns. Its goal is to minimize CPA while maintaining or increasing acquisition volume.

  Formula: Total marketing spend ÷ number of new users acquired.
- **Referral Rate:** The percentage of new users who join the platform through referrals from existing users. It indicates customer satisfaction and organic

word-of-mouth growth. Its goal is to increase referral rate over time to reduce dependency on paid acquisition.

- **User Retention Rate (30-day, 90-day):** The percentage of users who continue using the product after 30 or 90 days from onboarding. It reflects product stickiness, satisfaction, and long-term value. Its goal is to achieve high retention rates, especially within the first 90 days, to ensure customer loyalty and reduce churn.
- **Conversion Rate from Free to Paid:** The percentage of users who upgrade from a free plan or trial to a paid subscription (if a subscription model is implemented). It measures the effectiveness of the freemium model in demonstrating value and driving monetization. Its goal is to optimize onboarding and feature usage to boost conversions.
- **Revenue Growth:** The percentage increase in total revenue over a defined period (monthly, quarterly, annually). It captures the financial health and expansion pace of the business. Its goal is to insure steady, scalable revenue growth aligned with user acquisition and product expansion strategies.

4- Action Plan

The successful development and deployment of the AMAN project require a structured, phased approach that aligns with both strategic goals and operational capabilities. The action plan outlines the key steps, milestones, and timelines necessary to move from concept to implementation, while also addressing resource allocation, partnership development, and market entry. This section provides a detailed roadmap that ensures the project remains focused, efficient, and scalable over time.

AMAN’s core objective is to design and deliver a complete, compact, and autonomous technological solution that enables vertical plant cultivation in urban and peri-urban environments, using minimal resources, achieving high yield, and managed through an intelligent digital platform.

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Table N°28: SMART Objectives (Years 1–3)

OBJECTIVE	SMART BREAKDOWN
1. Launch a market-ready vertical farming monitoring system with app integration	**S:** Launch MVP system **M:** By Q2 Y1 **A/R:** R&D & pilot partnerships secured **T:** 6 months
2. Sell 200+ units and onboard 200+ paid subscribers in the first year	**S:** Reach target adoption **M:** 200 units **A:** Supported by local demand **T:** Year 1
3. Close 10+ institutional partnerships (schools, NGOs, local gov.) by end of Year 1	**S:** Institutional outreach **M:** 10 contracts **A:** Leverage social impact **T:** 12 months
4. Reduce system costs progressively to make units scalable by Year 3	**S:** Lower production costs **M:** Achieve affordability goals **A:** Via local supply chain **T:** 36 months
5. Reach 1,000+ recurring subscribers and 2,000+ hardware units sold by end of Year 3	**S:** Expansion & retention **M:** Sales KPIs **A:** Growth via multi-channel strategy **T:** 3 years

Source: Produced by the student

4-1- Actions to be Taken

Phase 1: Short-Term Actions (Months 1–12)

Table N°29: Short-Term Actions (Months 1–12)

OBJECTIVE	KEY ACTIONS
Launch MVP system + mobile app	Finalize product design (hardware + software) Develop basic app features and test firmware
Sell 200 units & onboard 200 subscribers	Run demo events in 3 major cities Launch digital ad campaigns Set up retail pilot partnerships
Close 10+ institutional partners	Present to NGOs, schools, and local municipalities Offer educational demo kits + CSR deals
Build sales & ambassador network	Recruit 5+ field reps Train them in product use, app onboarding, and customer service
Create digital & physical support tools	Launch onboarding guides (QR/manual) Set up WhatsApp support & in-app chatbot

Source: Produced by the student

Phase 2: Mid-Term Actions (Year 2–3)

Goal: Market expansion, cost reduction, and growth of subscriber base

Table N°30: Mid-Term Actions (Year 2–3)

OBJECTIVE	KEY ACTIONS
Reach 1,000+ paid subscribers	Launch referral program Add in-app features (weather sync, insights) Optimize pricing tiers
Sell 2,000+ units cumulatively	Expand to new provinces Improve logistics & packaging Leverage seasonal campaigns
Reduce production and deployment costs	Source local hardware components Optimize inventory & regional distribution
Strengthen institutional adoption	Formalize partnerships with school networks & agricultural programs Publish case studies
Improve user retention	Add app personalization by profile (farmer / home / school) Offer seasonal care plans

Source: Produced by the student

Phase 3: Long-Term Actions (Year 4–5)

Goal: Regional scale-up and long-term sustainability

Table N°31: Long-Term Actions (Year 4–5)

OBJECTIVE	KEY ACTIONS
Develop advanced/premium models	Launch solar-powered version Integrate AI diagnostics and open API
Reach 5,000+ paid subscribers	Add multi-year plans Collaborate with influencers & industry thought leaders
Build certified reseller & installer network	Create training program for local technicians Launch HaaS (Hardware-as-a-Service) option
Become a reference in eco-agri-education	Develop curriculum partnerships Expand app to include gamified learning for students

Source: Produced by the student

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4-2- Responsible Persons / Core Team Roles

Team Member 1: Entrepreneurship / Business Lead

Role: Business strategy, operations, marketing, finance, partnerships

Key Responsibilities:

- Coordinate project timeline and deliverables
- Lead go-to-market strategy (pricing, promotion, customer targeting)
- Handle partner outreach (NGOs, schools, institutions)
- Manage budget, fundraising, and investor relations
- Oversee customer service setup, onboarding processes
- Recruit and manage ambassadors and external sales reps
- Track sales KPIs and marketing performance

Team Member 2: Mechanical Engineering Lead

Role: Product design, hardware prototyping, irrigation system, manufacturing

Key Responsibilities:

- Design and prototype the vertical system hardware
- Optimize materials, irrigation efficiency, and modularity
- Collaborate with local suppliers or fab labs for production
- Ensure technical feasibility and scalability
- Oversee logistics and assembly instructions for users
- Support field setup and demo unit installation

Team Member 3: AI Engineer / Tech Lead

Role: Software development, app architecture, AI recommendation system, data platform

Key Responsibilities:

- Build the mobile app and connect it to sensor inputs
- Develop AI-based crop recommendations and alerts
- Set up databases, dashboards, and smart calendar logic
- Ensure sensor calibration and real-time monitoring system
- Implement updates, bug fixes, and backend infrastructure
- Plan for future API access and offline sync mode

This structure ensures the 3-member founding team remains **lean but effective**, with:

- **Clear ownership** over core areas
- A model that's **scalable and realistic** for a startup phase

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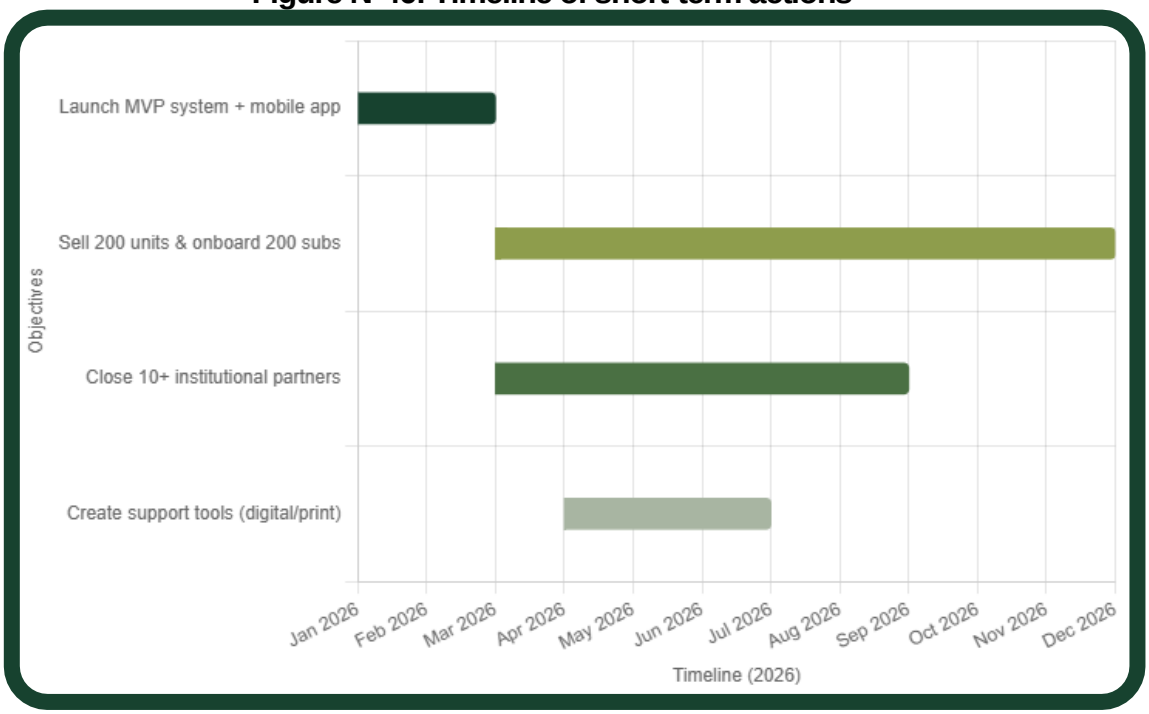
4-3- Timeline and Deadlines

Phase 1: Short-Term Actions (2026)

Goal: Product launch, early adoption, and market validation

Figure N°46: Timeline of short-term actions



Source: Produced by the student

This phase focuses on: Launch readiness, initial sales, and early market validation

Table N°32: KPIs of short-term actions (2026)

OBJECTIVE	KEY KPIS
Launch MVP system + app	MVP system operational by Q1 2026 Bug rate < 5% App store rating ≥ 4.0
Sell 200 units & onboard subscribers	200+ units sold 200+ active subscriptions Conversion rate ≥ 15%
Close institutional partnerships	10+ MOUs signed At least 3 successful pilot demos Partner satisfaction ≥ 80%
Build support tools	WhatsApp support active 100% of users onboarded with digital/manual tools Avg. support response time < 24h

Source: Produced by the student

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Phase 2: Mid-Term Actions (2027–2028)

Goal: Market expansion, cost reduction, and user base growth

Figure N°47: Timeline of mid-term actions

Source: Produced by the student

This phase focuses on: Growth, retention, operational efficiency

Table N°33: KPIs of mid-term actions

OBJECTIVE	KEY KPIS
Launch MVP system + app	MVP system operational by Q1 2026 Bug rate < 5% App store rating ≥ 4.0
Sell 200 units & onboard subscribers	200+ units sold 200+ active subscriptions Conversion rate ≥ 15%
Close institutional partnerships	10+ MOUs signed At least 3 successful pilot demos Partner satisfaction ≥ 80%
Build support tools	WhatsApp support active 100% of users onboarded with digital/manual tools Avg. support response time < 24h

Source: Produced by the student

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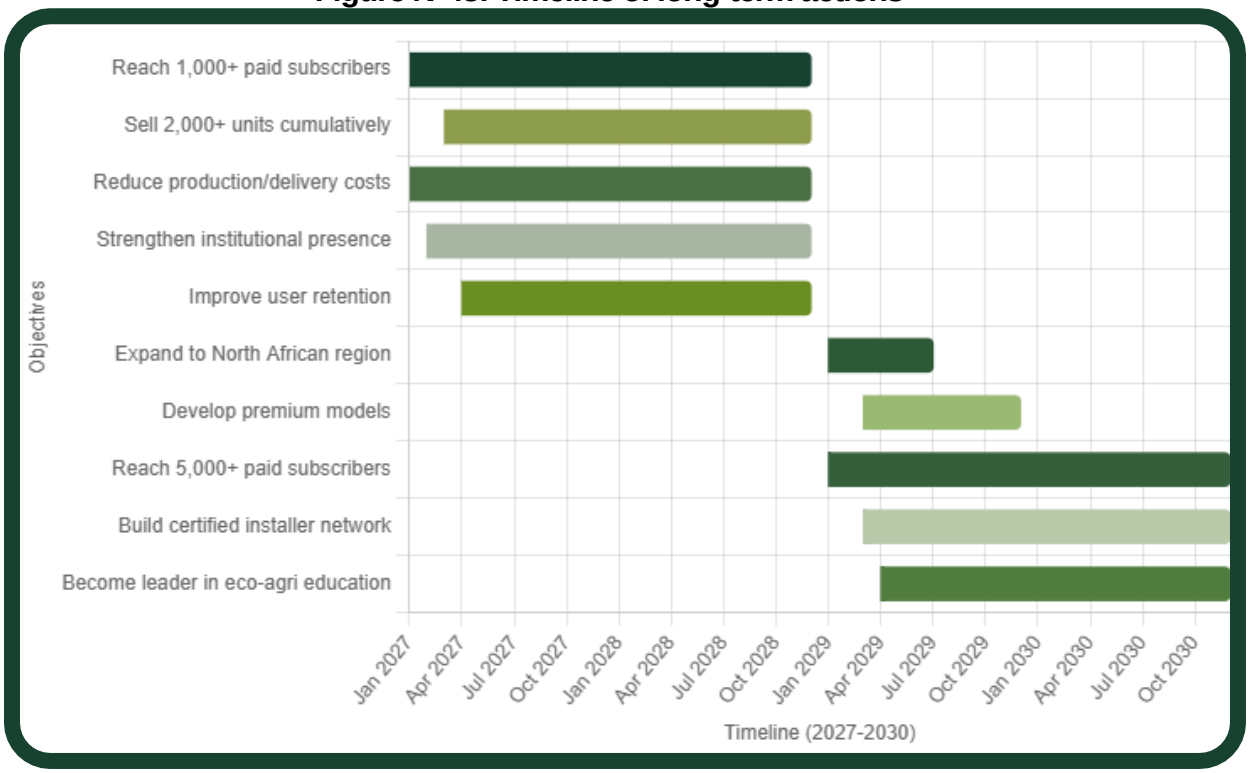
Phase 3: Long-Term Actions (2029–2030)

Goal: Regional scale-up and long-term sustainability

Figure N°48: Timeline of long-term actions



Source: Produced by the student

This phase focuses on: Regional reach, product innovation, industry leadership

Summary by Phase

- **2026:** MVP launch, 200 units sold, first institutions onboarded
- **2027–2028:** App improvements, pricing evolution, 2,000 units sold, 1,000+ subscribers
- **2029–2030:** Expansion into Morocco/Tunisia, 5,000+ subscribers, premium tech rollout

Table N°34: KPIs of long-term actions

OBJECTIVE	KEY KPIS
Expand to North African region	Market entry in 2 countries (e.g., Morocco, Tunisia) Localization complete Regional sales ≥ 500 units
Develop premium models	2+ new models launched Premium model sales ≥ 15% of total Hardware uptime ≥ 98%
Reach 5,000+ paid subscribers	5,000+ active subs Retention ≥ 85% for yearly plans LTV:CAC ratio ≥ 3:1
Build certified installer network	50+ certified installers Coverage in all major regions Installer satisfaction ≥ 90%
Eco-agri education leadership	10+ curriculum partners 2,000+ students impacted Educational module usage rate ≥ 60%

Source: Produced by the student

4-4- Required Resources (Now)

To achieve AMAN's mission and roadmap objectives, the following resources are required. Thanks to our incubation, many core needs are already covered or partially supported.

Human Resources

The development and operation of the AMAN system rely on a multidisciplinary team. Each plays a vital role in research, prototyping, user support, and system optimization.

Table N°35: Human resources

ROLE / PROFILE	NEEDED FOR	STATUS
Business Lead	Strategy, partnerships, operations, marketing	✅ Available
Mechanical Engineer	Product design, irrigation system, materials sourcing	✅ Available
AI Engineer / Developer	App development, sensor integration, AI crop guidance	✅ Available
Sales Ambassadors (x5+)	Local outreach and demonstrations	❌ To be recruited
Legal & Accounting Support	Contracts, registration, compliance	✅ Available via incubator
Customer Support Reps	User onboarding & app/hardware guidance	⏳ Future (Year 2+)

Source: Produced by the student

Financial Resources

Initial funding is essential to cover product development, testing, marketing, and operational costs. Financial support may come from self-funding, grants, incubators, or future investment rounds.

Table N°36: Financial resources

USE CASE	BUDGET RANGE (DZD)	STATUS
Hardware batch production	~800,000–1,200,000 DZD	❌ Requires seed funding
Marketing campaigns (Y1)	~800,000 DZD	❌ To be funded via grants or pitch competitions
App hosting & dev tools	~150,000 DZD/year	✅ Covered by Guelma Business Incubator
Packaging, logistics	~500,000 DZD	❌ External support needed
Events & demos	Covered via local outreach	✅ Partially supported

Source: Produced by the student

Equipment & Technical Infrastructure

Building the AMAN system requires access to manufacturing tools, assembly stations, sensor modules, and irrigation components, along with facilities for testing and quality control.

Table N°37: Equipment & Technical Infrastructure

RESOURCE	USE	STATUS
3D Printer for Prototyping	Hardware design and iteration	✅ Provided by Guelma Business Incubator
Sensor Modules (TDS, temp, water)	Core monitoring components	✅ Provided by Guelma Business Incubator
Irrigation & plumbing components	For building the mechanical system	✅ Provided by Guelma Business Incubator
Demo kit materials	Events and institutional outreach	✅ Available through Guelma Business Incubator

Source: Produced by the student

Digital Tools

Software development and user engagement depend on robust digital tools such as cloud platforms, IoT management systems, mobile development environments, and data analytics solutions.

Table N°38: Digital Tools

TOOL	PURPOSE	STATUS
GitHub, Trello, Notion	Project coordination & development	✅ Available (leveraging free collaborative tools)
Meta Ads, Google Ads	Marketing & performance tracking	⏳ Easily deployable when budget permits and the time comes
Canva / Figma	Design of visuals and content	✅ Active — utilizing free-tier plans
CRM Tool	Lead tracking & contact management	⏳ Configurable — setup planned in initial sales phase
Hosting & Backend Infrastructure	App deployment & system updates	✅ Managed in-house by the tech lead

Source: Produced by the student

Incubation Support : Guelma University Business Incubator

AMAN is proudly **incubated at the Guelma University Incubator**, which **covers key resource gaps** including:

- Access to **3D printers**, **design assistance**, and **mechanical workshops**
- Support in **electronic prototyping and sensor acquisition**

- **Mentorship and legal/accounting guidance**
- Access to **pilot test zones** within the university or partner institutions

This incubation drastically reduces initial CAPEX and enables AMAN to **focus on product-market fit and go-to-market strategy** from Day 1.

4-5- Risks and Mitigation Strategies

To ensure resilience and reduce disruption, AMAN has identified key operational, market, technical, and financial risks along with clear mitigation strategies.

a. **Market Risk: Low initial demand or customer hesitation:** Urban households and farmers may be slow to adopt new agri-tech solutions.

– **Mitigation:**

- Run early demo events and offer **pilot programs with NGOs and schools**
- Emphasize **economic benefits** (water savings, self-sufficiency)
- Build social proof through **early adopters and testimonials**

b. **Technical Risk: Product malfunctions or app bugs :** MVP could face sensor issues or app crashes

– **Mitigation:**

- **Thorough testing** of app and hardware during MVP phase
- **Fast response support team** via WhatsApp or chatbot
- Gradual feature rollouts to minimize risk

c. **Supply Chain Risk: Delays or cost spikes in hardware components :** Sensors, valves, the units …etc.

– **Mitigation:**

- Localize sourcing where possible
- Keep buffer inventory for key components
- Build supplier relationships early via incubator contacts

d. **Financial Risk: Insufficient funding for scaling:** May delay app upgrades, marketing, or logistics improvements

– **Mitigation:**

- Apply for **national innovation grants, pitch competitions**
- Use **lean marketing** and prioritize digital channels
- Seek early traction to attract **business angel or investors.**

e. **Regulatory/Institutional Risk: Bureaucratic delays or lack of school/government buy-in:** May slow partnerships with public institutions

– **Mitigation:**

- Partner with **local NGOs or associations** to access communities
- Emphasize **SDG and educational alignment** for school use
- Document impact through **pilot case studies** to convince new partners

f. Competitive Risk: Entry of better-funded or foreign competitors : Larger players may replicate AMAN's concept in North Africa

– **Mitigation:**

- Focus on **local relevance** and **modular design**
- Leverage **first-mover advantage** and **localized user experience**
- Build **brand loyalty** through educational impact and support

g. Team Capacity Risk: Small team may be stretched across tasks: 3 founders may face operational overload

– **Mitigation:**

- Leverage incubator resources (design, prototyping, legal)
- Phase tasks logically across roadmap (short, mid, long-term)

4-6- Monitoring and Evaluation

To ensure strategic alignment and data-driven decisions, AMAN will implement a **light but effective monitoring and evaluation (M&E) system**. This will allow the team to track performance, adjust tactics, and report progress to stakeholders (incubator, partners, potential investors).

Table N°39: Monitoring frequency

TYPE OF TRACKING	FREQUENCY	PURPOSE
Weekly Check-ins	Every Monday	Quick syncs on ongoing tasks and blockers
Monthly Performance Review	End of each month	Track KPIs (sales, subscriptions, support)
Quarterly Strategic Review	Every 3 months	Assess phase objectives and pivot if needed
Annual Evaluation	Once per year	Deep assessment of results, goals, market fit

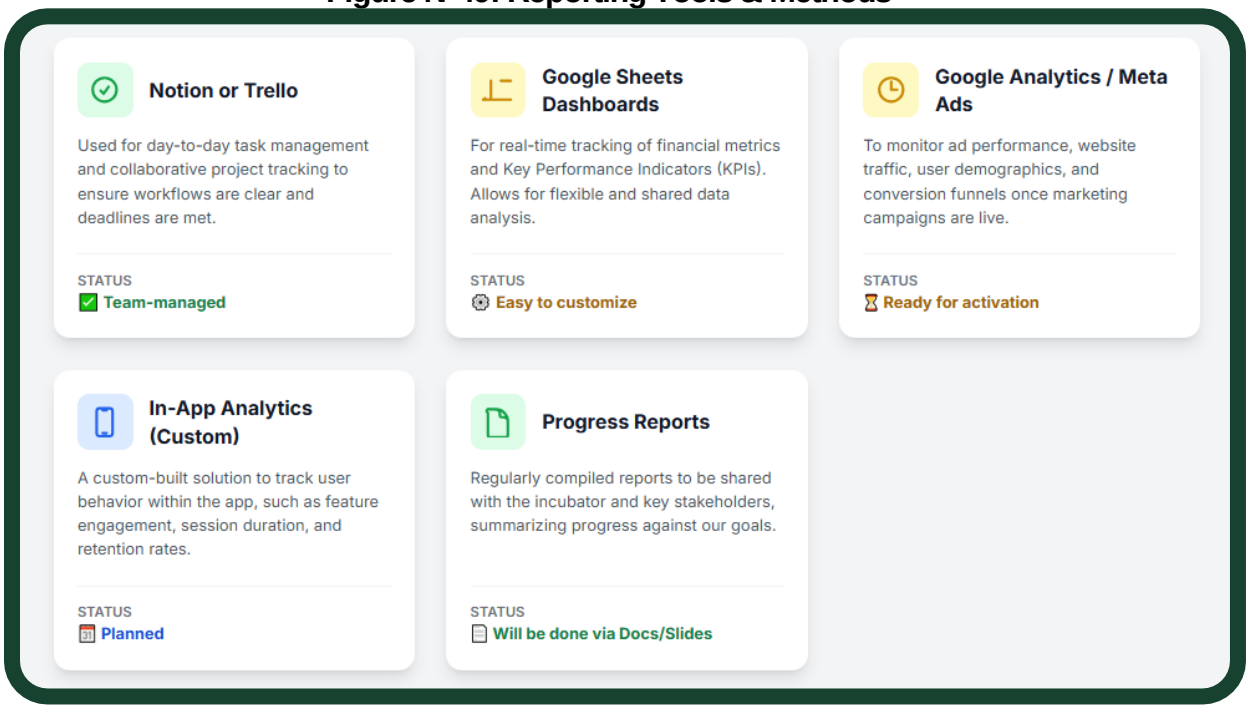
Source: Produced by the student

1. Evaluation Metrics

Each review will focus on key performance indicators established in Section 6 including:

- Sales volumes and growth rate
- Subscription count and retention
- App performance (crash rate, active users)
- Customer feedback and support satisfaction
- Institutional partnerships signed
- Production and delivery metrics
- Marketing ROI (CTR, CPA, conversions)

Figure N°49: Reporting Tools & Methods



Source: Produced by the student

2. Responsibility

- **Entrepreneurship Lead**: Coordinates all monitoring activities, compiles reports
- **Tech Lead**: Monitors app performance, user behavior, bug rates
- **Mechanical Lead**: Tracks production metrics, logistics performance

3. Adaptive Strategy

Based on evaluation results, the team will:

- Adjust feature development priorities
- Reallocate marketing spend to better-performing channels
- Update pricing tiers or delivery models
- Prioritize scalable regions or partners

Chapter 03 : Market Strategy Implementation

General conclusion

The iterative transition from BMC0 → BMC1 → BMC2 for the **AMAN** project reflects a structured and strategic evolution towards a more focused, viable, and contextually relevant business model tailored to the real needs of farmers and agricultural stakeholders in Algeria. With BMC2, **AMAN** is positioned as an advanced agritech solution that combines sustainable vertical farming technologies with intelligent water management systems, offering a high-impact response to challenges related to water scarcity, limited space, and agricultural efficiency.

BMC0 introduced a general concept aimed at diverse market segments, including urban consumers, hobbyists, and environmental advocates.

BMC1 refined the model by emphasizing the product's value for individual households and small-scale users concerned with sustainability and food autonomy.

BMC2 represents a significant leap forward by prioritizing the needs of professional farmers and B2B partners through tailored modules, integrated sensor systems, and mobile app connectivity—turning AMAN into a smart, scalable, and high-performance agricultural tool.

This evolution has been guided by a user-centered and data-driven approach, utilizing in-depth field research, interviews with agricultural professionals, and strategic tools such as the Business Model Canvas and Pimento Map. The refined value proposition focuses on key functionalities such as:

- Efficient hydroponic and aeroponic irrigation systems that reduce water usage by up to 90%.
- Modular and space-saving design for urban and rural deployment.
- Real-time monitoring of critical agricultural parameters (pH, temperature, water level) via mobile application.
- Support services including maintenance, nutrients, seeds, and agri-wool, fostering long-term user engagement.

By adopting a B2B-oriented model in its latest iteration, **AMAN** enables agricultural cooperatives, businesses, and institutions to invest in sustainable food production, while still offering direct-to-consumer options through a complementary B2C strategy. The SaaS integration ensures ease of access, remote supervision, and ongoing updates in line with technological and agronomic advancements.

Ultimately, the **AMAN** project showcases how digital transformation and green innovation can reshape agriculture in Algeria. It provides a pathway toward more

resilient farming systems, capable of addressing the pressing environmental and economic challenges of our time. The deployment of **AMAN** marks a significant step toward modern, automated, and sustainable agriculture aligned with international standards.

In conclusion, **AMAN** offers a visionary yet practical solution that merges technology, sustainability, and efficiency to empower Algerian agriculture. It supports farmers in their transition toward a smarter, climate-resilient, and competitive agricultural era—contributing to national food security and environmental stewardship.

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