MUSHNOMICS

Unlocking data-driven innovation for improving productivity and data sharing in mushroom value chain

D5.2 - Business models developed

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Disclaimer

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1. Introduction

Mushroom cultivation has emerged as a promising and dynamic sector within the agricultural industry, with a growing emphasis on controlled environment agriculture (CEA) methods. The utilization of controlled environments offers a host of advantages, including enhanced crop yields, year-round production, and optimized resource utilization. As the demand for mushrooms continues to rise globally, driven by their nutritional value and culinary versatility, businesses are increasingly turning towards innovative models to ensure sustainable and efficient production.
In 2022, the global Mushroom Market reached a value of USD 56 billion, with a projected growth to USD 136 billion by 2032, exhibiting a robust Compound Annual Growth Rate (CAGR) of 9.5% from 2023 to 2032. Despite not being technically plants, mushrooms and toadstools, categorized as edible fungi (Agaricomycetes, Ascomycota), are widely recognized as vegetables.

Often overlooked, mushrooms constitute a versatile category of food with a rich history of medicinal use. Traditional and folk medicine practitioners have long extolled the therapeutic and detoxifying properties of these bell-shaped fungi. Despite being low in calories and containing modest amounts of fiber and minerals, mushrooms stand out for their non-nutritive plant components, including polysaccharides, polyphenols, carotenoids, and indoles.

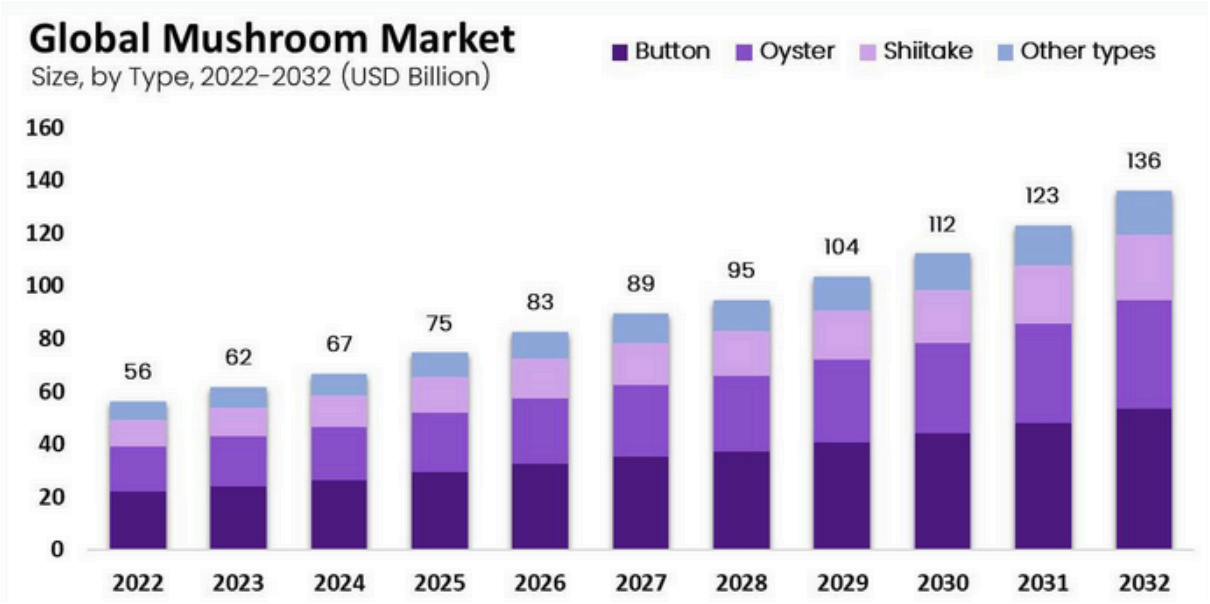


Figure 1 Global mushroom market (2022-2032). Source market.us

These components, validated through cell and animal studies, showcase antioxidant, anti-inflammatory, and anticancer effects, making mushrooms an intriguing dietary element. Over the forecast period, the Mushroom market is poised to be driven by the increasing demand for high-protein diets, particularly from the growing vegan population.

Regarded as a superfood, mushrooms boast significant nutritional value, housing four essential nutrients—selenium, vitamin D, glutathione, and ergothioneine. These nutrients play a crucial role in reducing oxidative stress and mitigating the risk of chronic diseases like cancer, heart disease, and dementia. Notably, the potent natural umami flavor of mushrooms allows consumers to reduce salt content in mushroom-based meals by 30–40%, promoting overall health benefits.

1.1. State of the Art: Mushroom Business

The current state of the mushroom cultivation industry is marked by a significant shift towards controlled environment solutions, leveraging advancements in technology and scientific understanding. Traditional methods of mushroom cultivation are being supplemented, if not replaced, by state-of-the-art facilities that provide precise control over environmental factors such as temperature, humidity, and lighting. This transition is essential to meet the increasing demand for mushrooms while addressing challenges posed by climate variability and seasonal limitations.

In recent years, several business models have evolved within the mushroom cultivation sector, aligning with the principles of controlled environment agriculture. One notable approach involves the establishment of high-tech mushroom farms equipped with automated systems and sensor networks. These farms are designed to create optimal conditions for mushroom growth, ensuring consistent quality and yield. Additionally, the integration of smart farming technologies allows real-time monitoring and adjustment of environmental parameters, maximizing efficiency and minimizing resource wastage.

Furthermore, vertical farming and modular cultivation systems have gained traction in the mushroom industry. Vertical farming not only optimizes space utilization but also facilitates a more controlled and scalable production process. The modular approach allows for flexibility in scaling operations based on market demand, making it an attractive option for both small-scale entrepreneurs and large-scale commercial ventures.

As sustainability becomes a focal point in agricultural practices, businesses in the mushroom cultivation sector are exploring environmentally friendly models. Circular economy principles are being applied to the management of waste generated during mushroom cultivation, with some enterprises utilizing spent mushroom substrate as a valuable resource in other agricultural or industrial processes.

In this evolving landscape, our research endeavors to explore and analyze the diverse business models developed within the controlled environment mushroom cultivation sector. By examining the current state of the art, we aim to identify trends, challenges, and opportunities that can shape the future of sustainable and economically viable mushroom production.

1.2.Driving forces in mushroom market growth

1.2.1. Surge in demand for functional food

Over the last two to three decades, significant shifts in dietary preferences and lifestyles have occurred. Urbanization has played a pivotal role, leading to a surge in the consumption of synthetic foods and a consequent rise in lifestyle-related diseases. This heightened awareness has steered individuals towards functional meals and beverages, recognized for delivering benefits beyond basic nutrition. These products not only provide essential nourishment but also contribute to disease prevention. With medicinal mushrooms increasingly integrated into various functional foods and beverages, a substantial rise in mushroom demand is expected in the forecasted period.

1.2.2. Growing vegan population

In the United States, a Statista survey in 2022 revealed that approximately 5% of respondents adhered to a vegan diet. Similarly, surveys conducted between 2016 and 2020 by The Harris Poll and the Vegetarian Resource Group indicated that around 3% of Americans identified as vegans. Notably, younger individuals and women in the United Kingdom showed a higher inclination toward meat-free diets, with 3% claiming to be vegans in a 2021 Statista survey. The rising prevalence of veganism, particularly among Generation Z, suggests an imminent surge in demand for vegan protein diets, consequently driving the demand for mushrooms.

1.2.3. Investment in Smart Automation

The cultivation of edible fungi is inherently labor-intensive, constituting nearly 30% of the total production cost. Recognizing this challenge, numerous commercial enterprises are strategically allocating funds towards smart automation for their processing systems and facilities.

In 2020, Panbo Systems B.V., a prominent edible fungus manufacturing company, spearheaded the establishment of an advanced production facility. This innovative facility seamlessly integrates cutting-edge robotics and control systems, resulting in an astounding productivity surge of over 300%. Robot trucks complement this state-of-the-art system, facilitating tasks such as filling, picking, and emptying racks, while cameras monitor growth dynamics.

The infusion of smart automation not only enhances yields but also drives down costs by optimizing crop areas and refining the picking process. Anticipated to be a pivotal catalyst for mushroom production, these strategic investments in smart automation are poised to propel the growth of the mushroom market significantly throughout the forecast period.

1.3.Restraining Factors

1.3.1. High cost of production

An exceptionally higher level of administrative or management efficacy and participation is during the process of mushroom production. For obtaining high-quality yields, a specific

treatment is very crucial. Conditions like humidity, temperature, and light have a significant effect on yield quality as well as production.
Especially in remote countryside regions, pests, insects, and animals can pose serious problems for farmers. Since some insects, such as fungus gnats, thrive in similar conditions, pest control is essential, which leads to an increase in the cost of production. Thus, high production and operational costs may restrain the mushroom market growth during the projected time period.

1.3.2. Low shelf-life

Due to their rapid rate of respiration and the fragile structure of the epidermis, mushrooms are extremely perishable by nature and start to degrade just one day after being harvested. Therefore, the shelf-life of freshly harvested mushrooms in ambient conditions is about 1-3 days. Therefore, the low shelf-life of mushrooms may limit the mushroom market growth during the forecast period.

2. Exploitation strategy for MUSHNOMICS Outputs

In the pursuit of advancing sustainable and innovative practices in the mushroom cultivation domain, the MUSHNOMICS project has generated a diverse array of outputs. These outputs, ranging from a comprehensive cultivation platform to cutting-edge artificial intelligence algorithms, represent the culmination of our commitment to revolutionizing the mushroom cultivation landscape. As we transition from research and development to real-world application, the formulation of a robust exploitation strategy becomes imperative to maximize the impact of MUSHNOMICS outputs.
The MUSHNOMICS toolbox comprises five pivotal components, each designed to contribute significantly to the efficiency, productivity, and ecological sustainability of mushroom cultivation. These components include the versatile cultivation platform, state-of-the-art growing cabinet, meticulously crafted composting recipes, innovative utilization of spent mushroom substrate, and a groundbreaking AI-driven mushroom photo detection algorithm. Together, these outputs form an integrated ecosystem poised to transform traditional practices and usher in a new era of smart and sustainable mushroom farming.
The exploitation strategy outlined in this section delineates our approach to translating the knowledge and innovations encapsulated in MUSHNOMICS outputs into tangible and impactful solutions. We envisage not only the widespread adoption of these technologies but also the fostering of a collaborative network that encourages continuous refinement and adaptation based on practical experiences.
Strategic partnerships with industry stakeholders, mushroom cultivators, and technology enthusiasts will play a pivotal role in the successful deployment of the MUSHNOMICS toolbox. By aligning our exploitation strategy with the diverse needs of these stakeholders, we aim to catalyze the integration of MUSHNOMICS outputs into varied contexts, ranging from small-scale local mushroom farms to large commercial enterprises.

2.1. Exploitation questionnaire

The exploitation questionnaire recaps information about a specific identified result. It is presented hereafter, with comments about what expected in the answers.
At this time in the project, some questions may seem difficult to answer, but it is important to give tentative answers or estimates, to be refined in coming versions of this deliverable.

Table 1 Template to describe results: Result no. X (Result name)

LEADER PARTNER NAME	MUSHNOMICS partner leading the development of the result.
Describe the innovation content of result	Describe the progress beyond state of the art brought by the result.
Who will be the customer?	Describe the profile for the customer of the results: public/private, sectors of activity, size etc.
What benefit will it bring to the customers?	Describe the benefits for the customer of the result in terms of, for example: • Saved time, better time to market • Increased consistency • More focused products or services • Increased communications
When is the expected date of achievement in the project (Mth/yr)?	When will the result be finished as per the project criteria.
When is the time to market (Mth/yr)?	Once completed in the project, if an additional development/refinement/industrialization phase is foreseen, when can be the time to market?
What are the costs to be incurred after the project and before exploitation?	Once completed in the project, if an additional development/ refinement/ industrialization phase is foreseen, what is its approximate cost?
What is the approximate price range of this result / price of licences?	Price at which the result will be commercialized.
What is the market size in Million € for this result and relevant trend?	What is the tentative market size for the results?
How will this result rank against competing products in terms of price / performance?	Compare the result to competition.
Who are the competitors for this result?	Identify the competition.
How fast and in what ways will the competition respond to this result?	Try to evaluate the response of the competition.

Who are the partners involved in the result?	List other partners involved in this result. Agreements should be reached before the end of the project for solving co-ownership and exploitation issues.
Who are the industrial partners interested in the result (partners, sponsors etc.)?	Identify the industrial players interested in the result.
Have you protected or will you protect this result? How? When?	Describe IPR protection plans.

3. Exploitation results

This chapter describes the exploitable results that are in scope of this document. For each exploitable result we provide a feature summary, describe its added value, the potential market and elaborate on its market readiness.

3.1. Result 1: MUSHNOMICS Platform

The MUSHNOMICS Platform is the central point of our project. It incorporates all the steps for growing oyster mushrooms:

1. **Feedstock** - What can you transform into a usable substrate. Here the users can add their sources of feedstock and the App will calculate some probable properties for it.
2. **Substrate preparation** - This guides the process of preparing the substrate for inoculation and mushroom growing. In this section, improvement suggestions will be presented to the user.
3. **Mushroom Growing** - contains yield estimation and a mushroom detector that uses advanced Machine Learning models.
4. **SMS Utilization** - contains state-of-the-art information about the proper disposal of spent mushroom substrate (SMS).

The major advantage that MUSHNOMICS promises is the valorisation of several sources of urban waste (like cardboard, coffee grounds, kitchen scraps, leaves, and branches) and turning them into edible delicious mushrooms and highly useful compost. The process that we propose is circular (or cyclical), meaning that we start from the soil (gathering fibrous and high in nitrogen waste), process it and obtain substances that nourish the soil (compost).

Table 2 Result no.1 MUSHNOMICS Platform

LEADER PARTNER NAME	HOLISUN
Describe the innovation content of result	The MUSHNOMICS Platform is an original and innovative approach for mushroom growers. In the last few years, due to the rising awareness for greener disposal of waste, curiosity sparked the demand for an integrated platform that would suggest ways of transforming useless waste into useful products. The companion App is created by fusing the latest advancements in mushroom

	growing, mushroom detection in images, yield forecasting and state-of-the-art composting methods.
Who will be the customer?	The Platform can be used widely by Hobby users with small-scale home mushroom cultivation kits, Urban Farmers with larger-scale equipment, and also for training purposes.
What benefit will it bring to the customers?	The companion App will provide the following benefits to all classes of customers (learners, home growers, urban farmers): ● Access to the digital e-course on mushroom growing in urban environments; ● Access to the Knowledge Base, continuously extended with the latest information about mushroom growing in general, composting methods, DIY hardware and much more information; ● Autodetecting the growing scale, to better suggest what the user should do; ● A complex computing digital twin that will analyze the waste sources and calculate various aspects of substrate preparation, mushroom growing and sms disposal; ● Suggestions of improving the substrate, how to prepare the substrate for production; ● Detection of mushroom clusters and yield estimation; ● Calculations and recipes for sms composting, with expected results.
When is the expected date of achievement in the project (Mth/yr)?	January 2024
When is the time to market (Mth/yr)?	January 2024
What are the costs to be incurred after the project and before exploitation?	Hosting costs and probably further developments and maintenance.
What is the approximate price range of this result / price of licences?	Unknown at the moment.
What is the market size in Million € for this result and relevant trend?	2.5 billion EUR.
How will this result rank against competing products in terms of price / performance?	To our best knowledge, there is no similar platform on the market.
Who are the competitors for this result?	No known competitors.
How fast and in what ways will the competition respond to this result?	Unknown at the moment.
Who are the partners involved in the result?	All partners.

Who are the industrial partners interested in the result (partners, sponsors etc.)?	HOLISUN, PILZE
Have you protected or will you protect this result? How? When?	Diligences for protecting the IPR will be taken

3.2. Result 2: Mushnomics module

Mushnomics' partner Pilze offers a variety of devices and know-how covering the whole value chain - from substrate processing to SMS utilization - to establish your urban oyster mushroom growing farm in different scales based on urban biowastes. Starting with the composting drum using the own heat forming during the composting process for pasteurization and ability to record the temperature and CO2 curves as key indicators for quality compost and food safety, and closing the circle with tools for vermicomposting of the SMS.

The key is though the whole process is the mushroom growing cabinet! The mushroom growing cabinet is an insulated box available in different sizes and equipped with ventilation and humidification units to secure the optimal growth conditions for the mushrooms. The control algorithm is based on the actual values recorded by sensors inside and outside the cabinet. Connected to the internet, remote access to data and intervention into the processes is also an option from your mobile phone. The pasteurized and spawned oyster mushroom substrate filled in plastic buckets with holes on the side are placed on the shelves within the cabinet. Easy to operate and manage, as well as harvest, the cabinet can be the basis of the urban farm or just simply a showcase demo unit in your restaurant!

Table 3 Result no.2 Mushroom growing cabinet

LEADER PARTNER NAME	PILZE
Describe the innovation content of result	Smart software for data collection and tailorable control algorithm. First mushroom growing cabinet specially designed for cities and urban biowaste where the modular system makes it possible to use it in different scales from household to urban farms.
Who will be the customer?	Part of general public with high interest in sustainability and following an environmental conscious lifestyle Offices and restaurants with urban wastes and will to valorize them Urban farming entrepreneurs and investors
What benefit will it bring to the customers?	• valorization of urban biowaste locally • growing food on site • communication and marketing value • short, transparent and trackable food value chain
When is the expected date of achievement in the project (Mth/yr)?	January 2024

When is the time to market (Mth/yr)?	January 2024 (with constant development and finetuning ongoing)
What are the costs to be incurred after the project and before exploitation?	Once completed in the project, if an additional development/ refinement/ industrialization phase is foreseen, what is its approximate cost?
What is the approximate price range of this result / price of licences?	Per module 9-12 k€.
What is the market size in Million € for this result and relevant trend?	Hard to estimate, there is a growing trend and legal pressure to switch to a circular economy including biowastes. One module (protype size) could convert approximately 1000 kg biowaste a year. In the EU around 130 million tonnes of biowaste is produced annually[1], If 5% of that (6 500 000 000 kg) could be used for the Mushnomics module would need 6.5 million modules meaning a market of 65 billion EUR.
How will this result rank against competing products in terms of price / performance?	To our best knowledge, there is no similar solution on the market.
Who are the competitors for this result?	No known competitors.
How fast and in what ways will the competition respond to this result?	Unknown at the moment.
Who are the partners involved in the result?	Pilze
Who are the industrial partners interested in the result (partners, sponsors etc.)?	Waste management companies, facility management firms.
Have you protected or will you protect this result? How? When?	No protection yet. Software code is owned by Pilze and not public. Design of the cabinet may be protected.

4. Business objectives

4.1.Short term objectives (1-2 years)

1. **User Acquisition and Engagement**:
   - Increase the user base for the MUSHNOMICS Platform through targeted marketing and awareness campaigns.
   - Enhance user engagement by providing user-friendly features and responsive customer support.
2. **Data Collection and Improvement**:

[1] https://www.compostnetwork.info/policy/biowaste-in-europe/

- Collect and analyze user data to improve the accuracy of the platform's calculations and suggestions.
- Gather feedback to identify and address any immediate issues or areas for improvement.

3. **Partnerships and Collaborations:**
   - Establish partnerships with local waste management entities to enhance the variety and quality of feedstock information.
   - Collaborate with agriculture and mycology experts for continuous improvement of substrate preparation recommendations.

4.2.Medium term objectives (< 5 years)

1. **Technology Advancements**:
   - Integrate more advanced Machine Learning models for improved yield estimation and mushroom detection in the Mushroom Growing section.
   - Implement updates to enhance the overall efficiency and effectiveness of the MUSHNOMICS Platform.
2. **Waste Valorification Expansion:**
   - Expand the range of urban waste sources that can be valorized, considering scalability and environmental impact.
   - Collaborate with local communities, businesses, and environmental organizations to promote sustainable waste management practices.
3. **Community Building:**
   - Foster a community of MUSHNOMICS users by introducing forums, discussion groups, and user-generated content features.
   - Organize workshops and events to educate and engage users in sustainable mushroom cultivation practices.

4.3.Long term objectives (> 5 years)

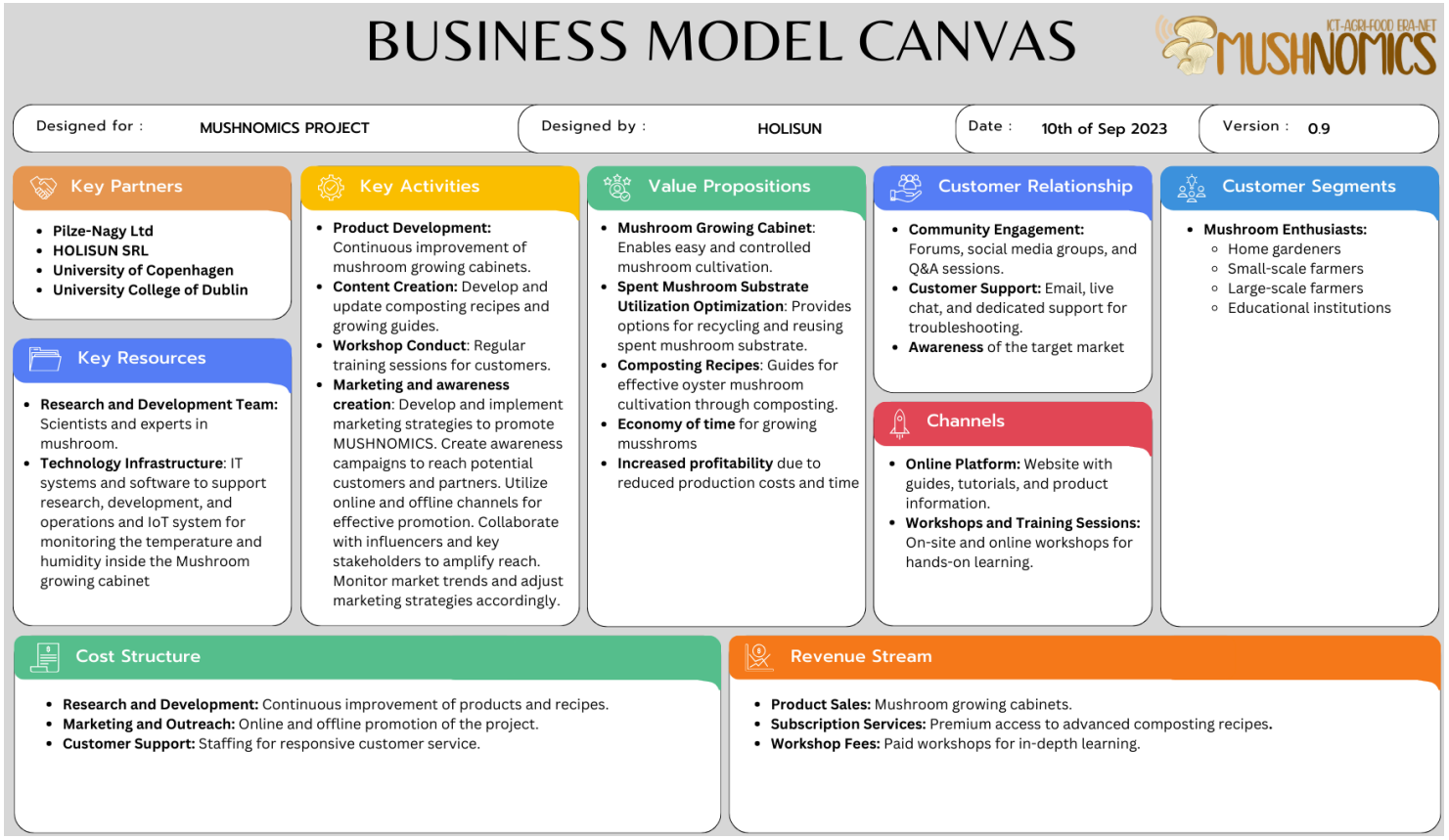
1. **Global Reach:**
   - Expand the MUSHNOMICS Platform to a global audience, adapting the platform to diverse cultural and environmental contexts.
   - Establish partnerships with international organizations to address global sustainability challenges through waste valorification.
2. **Research and Development**:
   - Invest in ongoing research and development to stay at the forefront of sustainable urban agriculture practices.
   - Explore innovative technologies and scientific advancements to continuously improve the MUSHNOMICS Platform.

The outlined business objectives encompass short, medium, and long-term perspectives, aiming to establish, grow, and sustain the impact of the MUSHNOMICS results in the field of sustainable mushroom cultivation and waste valorification.

5. Business model

5.1. Business canvas

This canvas provides a comprehensive overview of the MUSHNOMICS project, focusing on the key aspects of value delivery, customer relationships, and revenue generation.



5.2.Production costs

The slope of the curve is 43 degrees, which means that the price curve is elastic.

Cabinet version	Unit price, €
Prototype size, stand alone operation from grid	9000
Prototype size, stand alone operation off-grid (PV and battery)	12000
Prototype size, as module for urban farms	7000
Household scale	3000

6. Market analysis

This market analysis provides a comprehensive overview of the opportunities, challenges, and key factors to consider when launching the MUSHNOMICS results in the sustainable agriculture and urban farming market. Ongoing market research and adaptability will be crucial for the platform's success in a dynamic and evolving industry.

Market Overview:
The sustainable agriculture and urban farming industry are undergoing substantial growth, driven by an increasing global focus on environmental sustainability and a rising demand for locally sourced, organic products. MUSHNOMICS enters this dynamic landscape with a circular economy approach to mushroom cultivation, aligning perfectly with the prevailing industry trends.

Target Market:
MUSHNOMICS caters to a diverse audience, including mushroom enthusiasts, small-scale farmers, and educational institutions. These segments represent individuals and organizations with a shared interest in sustainable food production and urban waste valorization, making them prime targets for the platform's innovative features and circular economy practices.

Customer Needs:
The platform addresses key customer needs centered around sustainability, user-friendly interfaces, and educational resources. MUSHNOMICS not only provides a solution for mushroom cultivation but also empowers users with knowledge on waste valorization and composting practices, aligning closely with the growing demand for eco-friendly and educational platforms.

Competitive Landscape:
In navigating the competitive landscape, MUSHNOMICS sets itself apart by integrating an AI algorithm and offering a comprehensive waste valorization approach. By analyzing existing platforms and competitor offerings, we aim to position MUSHNOMICS as a leader, emphasizing its unique selling points and technological advancements.

Market Trends:
MUSHNOMICS taps into the rising trends of urban agriculture, technology integration, and the embracement of circular economy principles. By staying aligned with these trends, the platform stands poised to capitalize on emerging opportunities and establish itself as a forward-thinking solution in the sustainable agriculture market.

Regulatory Environment:
A thorough understanding of waste management and agricultural regulations is crucial for the platform's success. By adhering to local and regional regulations, MUSHNOMICS ensures the legality and compliance of its waste valorization practices, fostering a sustainable and ethical operational environment.

Market Entry Strategy:
MUSHNOMICS employs a targeted market entry strategy, focusing on effective marketing campaigns, collaborations, and pilot programs. By strategically reaching out to potential users and forming partnerships, the platform aims to establish a strong market presence and gain valuable insights through pilot initiatives.

Revenue Streams:
Diversified revenue streams, including product sales, subscription services, and workshops, are key components of MUSHNOMICS' financial strategy. These streams ensure financial resilience and sustainability, providing a robust foundation for the platform's long-term growth and success.

Future Opportunities:
MUSHNOMICS looks beyond its initial market entry, exploring opportunities for global expansion, research collaborations, and partnerships. By remaining agile and adaptive, the platform seeks to leverage its success to address broader sustainability challenges and contribute to global advancements in waste valorization.

Challenges:
Despite its promising outlook, MUSHNOMICS acknowledges potential challenges related to user adoption, technology risks, and market education. By proactively addressing these challenges and implementing effective mitigation strategies, the platform aims to overcome obstacles and establish itself as a resilient and adaptable solution in the market.

7. Marketing plan

7.1. The Role of Promotion Techniques

Marketing management involves how an organization obtains the best opportunities and market chances, considering its objectives and resources. Policies and strategies of this nature emphasize customer satisfaction as a means of loyalty and retention. Therefore, it is crucial for any small, medium, or large company to closely monitor customer expectations regarding a specific category of products and respond accordingly or even exceed them.

The primary role of marketing techniques is to promote the company's products and services on a large scale. These techniques aim at developing the market concept and enhancing the brand recognition among customers. It is important to note that when consumers trust a brand, threats decrease, ensuring sustainability.

In addition to this primary objective, the promotion or marketing strategies of a company also manage to achieve the following goals:

- **Meeting the needs and desires of consumers**

Marketing services have the ability to easily identify what customers want from a particular product or service, which is extremely beneficial for a company. In this way, organizations can adapt their products to satisfy each customer individually.

- **Enhancing the company's reputation**

As more and more customers become fans of the products you offer, your company can enjoy an outstanding level of popularity. Only through communication with customers and well-thought-out marketing methods can you bring your business out of anonymity.

- **Expanding the market**

Marketing techniques use mass communication means to ensure that the company's message reaches as many people as possible. This way, there is a high chance that the company's audience will grow over time, depending on the quality of the promotion.

- **Economic growth**

Marketing strategies in sales generate demand, which encourages the production and distribution processes. Consequently, industrial growth leads to an increase in income levels.

Thus, marketing techniques play an essential role in the smooth operation of a company. Without proper product promotion, achieving success for a company is nearly impossible.

7.2. The Chosen Techniques to Be Used

Social Media - LinkedIn

Social networks are used by almost everyone today. Here, one can find images and various events from people's lives, as well as marketing messages designed to attract customers. Note that some businesses have been built solely through social media. It is crucial to be as original and authentic as possible, capturing people's attention through visually appealing materials or well-written texts. Image holds great importance on these channels. Therefore, it is necessary to make an effort to present products in the best light and create a impactful message to prompt the audience to click on your website without much hesitation.

Video Tutorials

The world has shifted away from television and towards the Internet, where things are constantly evolving. Today, it is not enough to create a good news story or a unique advertisement; you must ensure to attract customers through all possible sources. Therefore, one of the communication techniques in marketing involves creating video tutorials that spark consumer interest. Keep in mind that, currently, YouTube serves as a different type of search engine alongside conventional ones, so consider creating interesting videos to upload on this platform. It is crucial to teach people something, as that is the key to gaining the desired visibility.

Blog
Not everyone knows how to write beautifully and captivatingly, but if you are not skilled in this area, don't worry, as there are many people willing to lend a hand. Therefore, if your business does not have a blog, you should create one right away. Why? People search the internet for all sorts of things, from the most mundane information to those requiring extensive research. It is proven that when a person finds what interests them on a blog page, they come back for more to gather valuable data. Thus, it is crucial for your blog to present valuable ideas to build a loyal audience. Invest in this type of service marketing strategy as it is among the most powerful promotion strategies.

Regular Posting
It is not enough to create a video tutorial or a funny post on Instagram or Facebook once a month; you must be consistent in your posts to attract attention, keep the audience informed, and build a transparent relationship with them. It is essential to have someone specialized in social media behind these posts, with extensive knowledge in the field, to ensure that the messages or photos uploaded have an impact on the audience. Hire someone to handle social media pages daily and respond to customer questions genuinely. This matters greatly and brings people closer to the company.

SEO (Search Engine Optimization)
SEO can be intimidating, especially when you don't know much about it. It is recommended to make an effort to optimize your website correctly so that your business knows no limits. Learn to achieve results both in the short and long term using tricks that manage to display your website on the top positions in Google results. If you do not have the time to delve into this subject, seek someone knowledgeable, as it is a quite vast and complicated field that requires dedicating a lot of time just to grasp the basics.

Email Marketing
As you already know, if you want profits to be proud of, it is crucial to establish a strong connection with customers. To achieve this, you can use the company's email address to send various offers, promotions, and valuable information to loyal consumers.

People appreciate being informed in advance about store discounts or the loyalty customer discounts that the company provides. It is crucial to offer certain bonuses to customers who consistently choose your brand, as this is the only way to generate the sales the company needs to operate smoothly.

7.3. Marketing Mix

The marketing mix can be defined as the set of tools used to achieve marketing objectives.

The definition seems quite simple, but you must consider that marketing is one of the most complex fields, and you need to take into account many factors; otherwise, failure is just around the corner and can catch you by surprise.

Especially those involved in operational marketing, which is the final part of the marketing strategy development process, know how challenging it is to optimize all resources to achieve tangible results, to make the brand known, or to sell a particular product or service.

To achieve all or at least some of the objectives set in the analytical phase, the marketing expert uses a set of tools considered to influence the choices of real or potential consumers.

One of the most well-known definitions/classifications of the marketing mix is proposed by McCarthy, based on the so-called 4 Ps of marketing, which are:

- **Product**: includes not only the product itself with all its features but also the auxiliary services offered to the customer (customer support, training, etc.).
- **Price**: in addition to the price or, in some cases, tariffs or price lists, you should also include discount policies, gifts or premium vouchers, payment terms, credit granting, and so on.
- **Place** (store or distribution point): is a crucial point for the structure of distribution channels and inventory policies.
- **Promotion**: this fourth P of the marketing mix includes all the strategies designed to promote the product and methods of advertising, promotion, participation in exhibitions, event organization, web marketing, and so on.

8. Risk analysis

This risk analysis provides a foundation for anticipating and mitigating potential challenges that may arise during the development and implementation of the MUSHNOMICS Platform. Regular reassessment and proactive risk management are essential components of ensuring the project's long-term success.

1. Technical Risks:

- Algorithm Accuracy: The effectiveness of the Machine Learning models in the Mushroom Growing section depends on accurate algorithms. Any inaccuracies may impact yield estimation and mushroom detection.
- Data Security: Handling user data and information about waste sources requires robust security measures to prevent data breaches.

2. Operational Risks:

- Dependency on External Partners: Relying on external partners for feedstock information and collaborative efforts in waste valorification may pose risks if partnerships fail or are inconsistent.
- Supply Chain Disruption: Reliance on specific suppliers for components of the MUSHNOMICS Platform could lead to operational disruptions if the supply chain is disrupted.

3. Regulatory and Compliance Risks:

- Environmental Regulations: Changes in waste management regulations or unforeseen environmental policies could impact the legality and feasibility of certain waste valorification practices.

- Data Privacy Compliance: Adherence to evolving data privacy regulations is crucial. Non-compliance could result in legal and reputational risks.

4. Market and Adoption Risks:

- User Adoption: The success of the platform depends on user adoption. If users do not find the platform user-friendly or beneficial, adoption rates may be lower than anticipated.
- Competitive Landscape: Emerging competitors or shifts in the market dynamics could impact the platform's market share.

5. Sustainability Risks:

- Ecological Impact: The platform's success in waste valorification relies on sustainable cultivation practices. Any negative environmental impacts or unsustainable practices may harm the platform's reputation.
- Cyclical Process Challenges: The cyclical nature of the proposed process, from waste to compost, may face challenges in maintaining the balance and efficiency of the circular system.

6. Financial Risks:

- Budget Constraints: Unexpected increases in development or marketing costs could strain financial resources.
- Revenue Generation: If revenue streams (e.g., product sales, subscriptions, workshop fees) underperform, the platform may face financial challenges.

7. External Factors:

- Global Events: External events such as economic downturns, pandemics, or natural disasters could impact the project timeline, funding, or user engagement.
- Public Perception: Negative public perception of urban agriculture or sustainable practices may affect the platform's acceptance.

Mitigation Strategies:

- **Regular Algorithm Audits**: Periodic audits of the Machine Learning algorithms to ensure accuracy and relevance.
- **Diversification of Partnerships**: Engage with multiple partners to mitigate risks associated with dependency on a single source.
- **Continuous Regulatory Monitoring**: Stay informed about regulatory changes and proactively adapt the platform to comply with evolving standards.
- **User Feedback Loop**: Establish a robust feedback loop to address user concerns and improve the platform based on user input.
- **Diversified Revenue Streams**: Develop multiple revenue streams to reduce dependency on a single source and enhance financial resilience.
- **Environmental Impact Assessment**: Conduct regular assessments of the platform's ecological impact and adjust practices accordingly.

- **Scenario Planning**: Develop contingency plans for various scenarios, including changes in market dynamics and unexpected external events.

9. Conclusions

The comprehensive analysis and strategic planning for the MUSHNOMICS results reveal a promising venture at the intersection of sustainable agriculture, urban farming, and waste valorization. The business canvas provides a structured framework, outlining key components from customer segments to revenue streams. The marketing plan articulates a roadmap for customer acquisition and engagement, while the market analysis identifies target demographics, competitive landscapes, and future opportunities.

The MUSHNOMICS results, with its innovative approach to mushroom cultivation, not only addresses the rising demand for sustainable food sources but also contributes to the broader circular economy movement. The platform's incorporation of an AI algorithm, coupled with user-friendly features, positions it as a cutting-edge solution for mushroom enthusiasts, eco-conscious consumers, and educational institutions.

However, our journey is not without challenges. The risk analysis underscores potential pitfalls related to technology, operations, compliance, and market dynamics. Mitigation strategies have been devised to navigate these challenges effectively, emphasizing the importance of continuous monitoring, adaptation, and resilience.

As we embark on the implementation of the MUSHNOMICS results, the insights gathered from the analyses serve as a compass for strategic decision-making. The market analysis illuminates avenues for growth, global expansion, and collaborative partnerships. The marketing plan delineates pathways for effective user outreach and engagement, fostering a community around sustainable urban agriculture.

In conclusion, the MUSHNOMICS results emerges as a visionary project with the potential to redefine sustainable urban agriculture practices. Its success hinges on our ability to navigate challenges, adapt to market dynamics, and foster meaningful collaborations. With a firm foundation established through the business canvas, marketing plan, market analysis, and risk analysis, we embark on a journey toward a greener, more sustainable future.

Together, we cultivate not just mushrooms, but a thriving ecosystem where waste becomes nourishment, and innovation leads to sustainable abundance.