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Leveraging Juncao Technology to Enhance Food Security & Sustainable Agricultural Development in Fiji: Mushroom Farming

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Abstract

After working with team members from four countries, we finally decided to promote sustainable development in Fiji by growing edible fungi such as mushrooms in Fiji through Juncao (fungi grass) technology. From the project background reasons, feasibility study, risk assessment, the current application of AI technology, project impact and other aspects, this paper has carried on a more in-depth elaboration of the plan.

Keywords: Juncao (fungi grass) Technology, Fiji, Sustainable Development, Case Competition

1.0 Introduction

Located in the central region of the South Pacific Ocean, the Fiji Islands are an archipelago that is widely recognized for its untouched natural beauty, welcoming demeanor, and rich cultural heritage. Fiji, a destination including more than 300 islands, is characterized by its tropical environment featuring exquisite white sandy beaches contrasted against turquoise oceans, as well as vast emerald-green mountains that extend to the horizon. In addition to its awe-inspiring natural beauty, Fiji offers a unique blend of traditional practices and contemporary influences, resulting in a diverse range of cultural encounters that captivate individuals from many parts of the world.

2.0 Literature Review

This business plan aims to elaborate on the feasibility and implementation plan of applying mycorrhizal technology in Fiji, and combine it with the application of AI technology to improve agricultural efficiency, promote sustainable agricultural development, and increase farmers' income. As a new type of agricultural technology, mushroom grass technology has multiple advantages such as improving land use efficiency, promoting sustainable agricultural development, and increasing farmers' income. By introducing fungi and grass varieties suitable for Fiji's climate and soil conditions, combined with the application of AI technology, new development opportunities will be brought to Fiji's agriculture.

As a tropical island country, Fiji's agricultural development has always been limited by natural environment and resources. In recent years, with the intensification of global

climate change and resource scarcity, Fiji's agriculture has faced enormous challenges. The introduction of mycorrhizal technology has provided new possibilities for the agricultural development of Fiji. Fungus grass, as a perennial herbaceous plant, has the characteristics of strong adaptability, fast growth speed, and high crude protein content. It can be used for cultivating edible and medicinal mushrooms, making feed, improving land use efficiency, and so on. Meanwhile, with the continuous development of AI technology, its application in the agricultural field is also becoming increasingly widespread. The application of AI technology can help us better understand and analyze the processes and laws of agricultural production, improve production efficiency and management level.

3.0 Project Objectives

1. Introduce fungal and grass varieties suitable for Fiji's climate and soil conditions for large-scale cultivation.
2. Cultivate edible mushrooms and medicinal mushrooms using mushroom grass technology to expand agricultural income sources.
3. Produce feed with high crude protein content and high yield to meet the needs of animal husbandry.
4. Through the application of mushroom and grass technology, improve land use efficiency and promote sustainable agricultural development.
5. Increase farmers' income, alleviate resource pressure, and address the challenge of climate change.
6. Utilize AI technology for agricultural production management, disease prevention and control, yield prediction, and other applications to improve agricultural production efficiency and management level.

4.0 Implementation Plan

4.1 Implementation strategy

Developing a comprehensive action plan for implementing Fungal Grass Technology in Fiji involves several key steps starting with Conducting a comprehensive Market Research and Feasibility Study involves delving into Fiji's agricultural landscape. This entails a detailed examination of existing practices, challenges, and opportunities within the agricultural sector. The objective is to pinpoint potential markets for fungal grass technology products and evaluate their demand through a thorough analysis. The second step would be establishing strategic alliances with local farmers, agricultural cooperatives, research institutions, and government agencies to cultivate a collaborative approach. By engaging in partnerships with international organizations and experts specializing in fungal grass technology it helps with enhancing the knowledge and capabilities of the project.

Commencing a limited-scale pilot initiative will assess the efficacy of fungal grass technology under Fiji's distinctive environmental conditions. During this trial phase, there will be a close monitoring and gathering of the data on parameters such as soil health, crop yield, and economic impact to evaluate the technology's performance. During the course of the pilot program, an inclusive training program will be designed, and tailored for local farmers, providing them education on the advantages and correct application of fungal grass technology. Collaborating with agricultural extension services and educational institutions will aim to widely share this knowledge and ensure its effective dissemination within the community.

Executing a pilot program serves the dual purpose of identifying potential risks and devising effective strategies for their mitigation, encompassing financial, environmental, and regulatory aspects. Simultaneously, robust contingency plans will be implemented to address unforeseen challenges that may arise. Concurrently, the development of a marketing strategy is imperative to promote fungal grass technology products, highlighting their benefits to both consumers and the environment. This strategic approach not only aims to create awareness but also contributes to building a resilient brand that embodies sustainability, quality, and a positive impact on the community. Building upon the insights garnered from the pilot's success, a comprehensive plan will be formulated to scale up the implementation of fungal grass technology across larger areas in Fiji. Additionally, potential replication models for neighboring regions or countries will be considered, fostering the dissemination of successful practices beyond the initial implementation.

Lastly, an investment in essential infrastructure to support the production, processing, and distribution of fungal grass or related products will be necessary to prioritize the scalability to meet the demands of potential growth in the future. This entails establishing robust systems that not only meet current needs but also possess the flexibility and capacity to adapt to an expanding operational scale, ensuring efficiency and sustainability in the long run.

4.2 Use of Artificial Intelligence

A further advancement in mushroom cultivation technology involves the integration of artificial intelligence (AI) and machine learning algorithms to enhance the optimization of growing conditions. Through the examination of data related to factors such as CO2 levels, humidity, and temperature, these algorithms can discern patterns and provide predictions for the optimal conditions conducive to mushroom growth. This enables growers to attain increased yields and superior-quality mushrooms while simultaneously reducing waste and optimizing energy usage. The approach is categorized into three parts, outlined as follows:

1. Implementation of a Smart Monitoring System,
2. Automation of Farm Processes.

The pivotal elements influencing mushroom growth are ambient room temperature and humidity. Monitoring these factors remotely is of utmost importance. A sensor equipped with a microcontroller is placed within the farm to detect temperature and humidity levels. The gathered data is then transmitted to a cloud server. To access real-time data visualization, users can send requests through a smart application to the cloud. The resulting information is promptly displayed on the screen, enabling users connected to the application to monitor the farm's status from any location.

The automated system streamlines the control of the temperature regulator (air cooler), humidifier, and watering sprinkler within the mushroom farm. This system incorporates real-time sensor data from sensing modules and user-input data to automate the operation of these machinery types. To illustrate, for temperature regulation in the mushroom farm, a user establishes the desired temperature setting. The microcontroller then compares this user-defined value with the real-time sensor temperature data, subsequently adjusting the air cooler. Likewise, the integration involves a comparison of user-provided humidity values for corresponding adjustments.

4.3 Risk-Mitigation

Mushrooms represent one of the most delicate and finicky crops to cultivate, demanding specific conditions for optimal growth. Temperature stands out as a pivotal factor influencing mushroom development. While the ideal temperature range varies among species, most mushrooms thrive in temperatures ranging from 65-75 °F. Maintaining a consistent temperature is paramount, as even minor fluctuations can significantly impact both the growth rate and quality of the mushrooms.

A straightforward method for temperature control in mushroom cultivation involves the use of a thermometer or temperature sensor. In situations of elevated temperatures, employing a cooling fan proves effective. This becomes particularly useful when the cultivation environment becomes excessively warm. A cooling fan can swiftly lower the temperature by enhancing air circulation, preventing mushrooms from overheating and sustaining damage.

Conversely, when faced with low temperatures, a viable solution is the utilization of a heating pad or mat. Placed beneath the growing container, these provide a steady source of warmth. Available in various sizes to cover the entire growing area, heating pads, and mats offer adjustable settings to achieve the desired temperature.

Another consideration is the potential challenge of farmers adapting to new technology and crops. This can be addressed through continuous training, knowledge transfer initiatives, and highlighting the diverse benefits, encompassing social, economic, and environmental aspects.

5.0 Future Impact

The prospective impact of introducing Fungal Grass Technology in Fiji holds the promise of significant and diverse benefits, positively influencing various facets of agriculture, economics, the environment, and society.

The realization of these outcomes hinges on the project's success and its alignment with the local context as will enhance soil fertility and nutrient content that may result in increased productivity, offering farmers the potential for improved crop yields and overall agricultural productivity. This, in turn, can contribute to income generation by providing farmers and businesses in the value chain with heightened productivity and expanded market access, leading to increased income.

Furthermore, the implementation of Fungal Grass Technology could contribute to improved food security in local communities. The combination of increased agricultural productivity and diversified crops has the potential to enhance food security, ensuring a more robust and varied local food supply.

The project extends its positive influence into the field of business opportunities, fostering growth in the fungal grass technology industry and opening new avenues for businesses and markets. This expansion can lead to job creation, particularly in the agricultural and agribusiness sectors, thereby contributing to overall economic development.

For Fiji, the project represents an opportunity for continued innovation, ongoing research and development efforts have the potential to drive continuous improvement and innovation in other technologies. This innovation not only benefits Fiji but also contributes to the global knowledge base in agricultural technology.

6.0 Conclusions

Juncao (Fungus) technology originated in China, but it has its world significance and value. The use of fungus technology to grow edible fungi in Fiji, coupled with current innovative technologies such as artificial intelligence, will greatly contribute to the sustainable economic and social development of Fiji.

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Judges and Biographies – *In Alphabetical Order*

Cameron Welsh, Professor and Case Competition Director at the University of Calgary
Cameron Welsh, a Senior Instructor at the Haskayne School of Business, University of Calgary, brings over two decades of dedication to academia and impactful business leadership. His remarkable achievements include numerous Haskayne service and case team coaching awards, notably the Dean's Award for Outstanding Service Leadership for Faculty (2011-2013). Cameron's coaching prowess is reflected in multiple Faculty Advisor of the Year awards at JDC West and consecutive Best Coach honors at the Engineering Commerce Case Competition. In addition to his teaching and coaching roles, he is a respected researcher with publications in esteemed journals and has received accolades, including the Best Paper in Entrepreneurial Theory Award. Cameron, actively engaged in environmental stewardship, serves as Vice President of the Crowsnest Forest Stewardship Society and contributes to Castle Special Places Working Groups. Outside academia, he finds solace in outdoor pursuits like fly fishing, hiking, biking, and photography.

Hélène Tremblay, International Author and Researcher
Helene Tremblay, a world-renowned researcher, author, photographer, and inspirational speaker, has captivated global audiences with her exploration of daily life in 111 countries. Her 15 published books, distributed internationally, offer intimate portraits of diverse families. Engaging over 100,000 participants in conferences spanning continents, Helene excels in bringing audiences into the heart of humanity. As a skilled photographer, her thematic works, exhibited at the United Nations and the Cultural Foundation of Abu Dhabi, capture life's ritualized moments across cultures. Helene Tremblay's impactful legacy celebrates shared human experiences, inspiring strength and spirit in a global context.

Juan Villaescusa, MBA Social Impact Measurement Expert
Mr. Villaescusa obtained his MBA from Corvinus Univeristy of Budapest, Hungary. Today, he is a Credit Risk Associate at Morgan Stanley. Mr. Villaescusa is engaged in sustainability projects around social and environment, providing guidance and consultancy services, as well as, facilitating the delivery of education. He has been a mentor to students living abroad as well as a judge on international case competition projects. Mr. Villaescusa has extensive experience in the analysis of administrative and commercial processes, audit planning, and performance management (LinkedIn: https://www.linkedin.com/in/juan-alberto-villaescusa-prades-54124117a/).

Miklos Kozma, Dr. Professor in Strategy and MBA Director at Corvinus University in Budapest
Miklos Kozma is a distinguished academic and business professional, currently serving as the Full-time MBA Program Director at Corvinus University of Budapest. He earned his MSc in Business Administration from the same institution in 2000 and later completed his PhD in 2012. With a career spanning both academia and corporate advisory roles, Kozma has held various positions at

Corvinus University of Budapest, including Associate Professor and Academic Director of the Central European Case Competition. His international engagement extends to being a Board Member at the European International Business Academy (EIBA) and his leadership role in the AMBA accreditation process. Beyond academia, Kozma has enriched his experience as an advisor and manager at KPMG Advisory Ltd. from 2000 to 2013. His commitment to the field is reflected in numerous accolades, such as coaching teams to victory in prestigious case competitions and receiving awards for talent management and excellence in teaching. Kozma's multi-faceted career showcases his dedication to advancing education, fostering international collaborations, and contributing significantly to the fields of business and organization science.

Paul Nguyen, Program Director at Scotia Bank
Mr. Nguyen graduated from Concordia University, later joing Scotiabank, and achieving a Level 1 CFA candidate. Responsible for delivering performance and improving customer experience, Mr. Nguyen comes with a wealth of experience from the banking sector. Highly motivated and result driven, Mr. Nguyen brings to the case competition many years of experience in FinTech, Project Management, and process Improvement (LinkedIn: https://www.linkedin.com/in/nt-paul-nguyen/).

Raafat Saade, Chair Professor at Beijing Institute of Technology
Dr. Raafat SAADÉ completed his Natural Sciences and Engineering Research Council of Canada award at McGill University, Canada, in 1997. With over 33 years of academic and industry experience, he joined the Beijing Institute of Technology (BIT), Beijing, China, in 2021, at the rank of Chair Professor. Dr. Saadé has extensive consulting experience on international projects from the Canadian International Development Agency, and the International Civil Aviation Organization, where he assumed several advisory roles to senior management, primarily entailing organizational transformation and change. Dr. Saadé founded the International Network of Digital Innovation Research & Education (INDIRE) in 2020, and has recently joined the International Association for Green Aviation as a founding member. He is multi-disciplinary and has sustained active research with many publications in top ranked journals. He is currently Chief Scientist of the BIT Global Aviation Development Academy (GADA), and a member of the Executive Board of the School of Global Governance. Dr. Saadé's current newly established research interests include the International Network for Digital Innovation, Research & Education, Internet of Things in Education, and Aviation Climate Change (LinkedIn: https://www.linkedin.com/feed/).

Rocco Matteo, Retail Executive Expert, President at E3-Consulting
With over 25 years in retail, Rocco Matteo leverages his expertise to propel organizations to peak performance. Specializing in sales growth, operations, and organizational development, he's a catalyst for success and strategy execution. A sought-after speaker at top universities on Business Management and industry trends, Rocco is also a Lead Judge at the John Molson MBA International Case Competition. Personally, and professionally impactful, he's dedicated to coaching and mobilizing the younger generation through mentorship. Rocco's commitment extends to community welfare, organizing regular fundraisers to combat poverty in the city. His energy, passion, and proven success make him a dynamic force in any team.

Samie Ly, Dr. Co-creator of Innovatank, Co-chair at The World Case Committee
Samie Ly, Dr. co-creator of Innovatank and co-chair at The World Case Committee, is an award-winn winning researcher and educator specializing in innovation within the realms of data analytics and project management. With a robust background as a project manager and technology lead in both industry and academia, Samie is also a seasoned professor in analytics (Undergrad to EMBA level). Having participated in over 12 international and national competitions, she brings a wealth of practical experience to her role. Samie holds an MBA with a focus on strategy and competition, complemented by a Ph.D. in Immersive Learning and Technological Processes. Recognized for her teaching innovation and distinguished research, she leads Innovatank, orchestrating hands-on learning experiences for students through the integration of data analytics and collaborative ventures with corporate entities.

Stavros Athanasoulias, Co-creator of Innovatank and Co-chair at the World Case Committee
Stavros Athanasoulias, MBA, is a dynamic entrepreneur, co-creator of Innovatank, and co-chair at the World Case Committee. With diverse education businesses emphasizing sustainability, Stavros, also an experienced coach, serves as partnerships director, connecting industry and students for soft skills recruitment analytics. His leadership bridges academia and business, fostering impactful collaborations for positive change in education and sustainability. Actively engaged in education and coaching programs for newcomers in Canada, he seeks to support their success in the Quebec environment.

About The World Case Committee
The World Case Committee, an Innovatank initiative, blends education and philanthropy to globally elevate talent through the case methodology. Focused on setting a standard in impact learning, it guides partner organizations in hosting international and national events, including case competitions, pitch contests, and hackathons, bridging academia and industry. The committee annually organizes inclusive seminars and events, providing access to impact learning for all. Committed to United Nations Sustainable Development Goals, its pillars include Education for All, Soft Skills Development, Mentorship Empowerment, Inter-generational Achievements, and Impact Learning. WCC fosters connections, skills development, mentorship, and knowledge creation for a better world. https://theworldcase.com/