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A REVIEW OF THE FUTURE OF AGROMEDICINE IN INDONESIA: ECONOMIC IMPACT AND BUSINESS DEVELOPMENT INSIGHT

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ABSTRACT

Indonesia's medicinal plant industry significantly contributes to economic development, particularly through small and medium-sized enterprises (SMEs), which play a key role in product diversification and commercialization. However, despite the increasing global demand for natural health products, the industry faces multiple challenges, including regulatory complexities, inconsistent quality assurance, and sustainability concerns. The lack of standardized Good Manufacturing Practices (GMP), limited clinical validation, and environmental risks due to overharvesting pose further barriers to growth. This review provides a comprehensive analysis of Indonesia's evolving medicinal plant industry, emphasizing its economic potential and business development opportunities amid persistent challenges. Indonesia's rich biodiversity, which encompasses a vast array of medicinal plants, highlights the critical need for sustainable agricultural practices to ensure the conservation and responsible utilization of these valuable resources. The primary objective of this review is to examine the economic impact, business prospects and key challenges shaping the growth of Indonesia's medicinal plant industry. It explores the current state of the sector, identifying the fundamental drivers of its expansion while addressing the barriers that impede progress. Specifically, the review investigates the interplay between Indonesia's biodiversity, indigenous knowledge and modern technological advancements in fostering product innovation and enhancing market competitiveness. Additionally, this review evaluates the contributions of small and medium-sized enterprises (SMEs) and the influence of regulatory frameworks in shaping industry sustainability. Finally, this review underscores the necessity of integrating economic growth with environmental conservation and scientific research to strengthen Indonesia's position in the global herbal medicine market. Moreover, stakeholder collaboration, including government agencies, research institutions and industry players are important in ensuring a sustainable and competitive medicinal plant sector. Addressing regulatory, quality control and sustainability issues will be crucial in securing Indonesia's future in the international herbal medicine industry. By addressing these challenges through a multidisciplinary approach, Indonesia can leverage its natural and cultural assets to enhance the sustainability and competitiveness of its medicinal plant industry.

Key words: Agromedicine, Business, Economy, Herbal medicine, Indonesia, Sustainable practices, Biodiversity conservation

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INTRODUCTION

Indonesia, with its extensive and varied collection of islands, serves as evidence of the remarkable biodiversity that exists in the world. This nation is widely recognized for its abundant rainforests, expansive mangroves and vast marine ecosystems, all of which foster a diverse array of living forms. Indonesia possesses valuable medicinal plants, which are an essential part of the country's biodiversity [1]. These plants provide not only aesthetic value and contribute to ecological equilibrium but also serve as the foundation for ancient medicinal practices that have been carefully cultivated and passed down through generations. Indonesia possesses an exceptionally diversified flora, harbouring numerous plant species that flourish over its vast archipelago [2]. Additionally, medicinal plants are particularly significant due to their crucial significance in traditional medicine and healthcare. Indonesian societies have extensively investigated and employed these natural resources for thousands of years, effectively treating a diverse array of maladies and disorders [3]. The understanding of these plants and their applications is evidence of the profound relationship between the Indonesian population and their surroundings, a link that has facilitated the endurance and success of several communities throughout the nation's past.

The extensive collection of therapeutic plants holds great cultural and physiological value, as well as significant commercial potential. Given the expanding global demand for natural and alternative health products, Indonesian medicinal plants have the capacity to make a substantial impact in both local and international markets. The cultivation, harvesting and processing of these plants can generate crucial revenue for rural communities, thereby promoting economic development and sustainability [4]. The increasing global demand for natural treatments and the heightened focus on biodiversity conservation present Indonesia with a distinctive chance to advance in medicinal plant research, production and commerce. Medicinal plants are intricately woven into Indonesia's culture and economy, functioning as an essential component of traditional medicine and an expanding sector within the national economy. They are vital to the sustenance of millions, particularly in rural regions, where they provide crucial economic opportunities, fostering growth and alleviating poverty. The export capacity of these plants, encompassing raw materials and processed goods such as essential oils and herbal extracts, enables Indonesia to penetrate the burgeoning worldwide market for natural health products, thereby augmenting its economic growth.

Traditionally, medicinal plants have been the backbone of Indonesian healthcare, particularly in remote and rural areas where access to modern medical facilities may be limited. The knowledge of these plants and their uses is a rich cultural heritage, passed down through generations among healers, midwives and elders

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[5]. The traditional medicine system, known as "Jamu" in Java and Bali, showcases Indonesia's rich biodiversity and the ingenuity of its people, offering a holistic approach that includes physical, spiritual and environmental well-being. Beyond tradition, medicinal plants are increasingly recognized for their role in modern healthcare, with ongoing research validating their therapeutic properties. This integration into contemporary medicine highlights the potential for innovative treatments and emphasizes the need to preserve Indonesia's medicinal plant knowledge and biodiversity for future generations.

The primary purpose of this review is to offer a comprehensive analysis of the medicinal plant industry in Indonesia, focusing on its economic impacts, business opportunities and the challenges that lie ahead. This exploration aims to shed light on the current state of the industry, identifying the key factors that contribute to its success as well as the obstacles that hinder its growth. Finally, the review will delve into the challenges faced by the medicinal plant industry in Indonesia. These challenges may include issues related to biodiversity conservation, sustainable harvesting practices, climate change impacts, regulatory hurdles, and the need for research and development to validate traditional knowledge with scientific evidence. Addressing these challenges is essential for ensuring the long-term viability of the medicinal plant industry, safeguarding Indonesia's biodiversity, and maintaining the cultural heritage associated with traditional medicine practices.

MATERIALS AND METHODS

The methodology was structured to ensure a thorough analysis of available literature, data and case studies relevant to the topic. A literature search was conducted on Scopus, Web of Science and Google Scholar to collect quantitative and qualitative data from peer-reviewed articles, government reports and case studies published from 2000 to 2023, ensuring the inclusion of recent and relevant studies. Quantitative data included market trends, economic impact, trade volumes and production statistics, while qualitative data covered policy analyses, ethnobotanical studies, expert interviews and business models. Regulatory reports examined legal frameworks, conservation efforts and GMP implementation, and case studies highlighted successful enterprises, SME challenges and business model comparisons. To improve reliability and credibility, only studies from esteemed sources and high-impact journals were incorporated, while governmental and non-governmental publications were evaluated based on their relevance and methodological rigor.The inclusion criteria emphasized studies published during the last twenty years to guarantee the utilization of current and scientifically proven knowledge. The data's validity was substantiated by cross-examining findings from various sources and using meta-analyses and systematic reviews when accessible. Furthermore, primary case studies on business models

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and economic implications were assessed by comparative analysis methodologies to guarantee consistency in conclusions. Keywords and search terms including "medicinal plants in Indonesia," "economic impact of medicinal plants," "business models in traditional medicine," and "sustainability of medicinal plant trade" were employed to obtain pertinent studies. This multi-source methodology improves the reliability and validity of the review outcomes by reducing biases and providing a comprehensive viewpoint on the subject.

RESULTS AND DISCUSSION

Historical Use and Trade of Medicinal Plants in Indonesia

The historical use and trade of medicinal plants in Indonesia is a rich and multifaceted narrative that dates back centuries, deeply rooted in the archipelago's cultural and social fabric. Indonesia's strategic position along ancient trade routes, notably the Spice Route, has played a pivotal role in shaping the history and development of its medicinal plant trade. This section of the literature review explores the historical context of medicinal plant use and trade in Indonesia, highlighting key periods, practices and impacts [6]. Long before European powers set foot in the archipelago, indigenous communities across what is now known as Indonesia had developed a profound knowledge of local flora for medicinal purposes. Each island and ethnic group had its own set of practices and beliefs regarding the use of plants for healing, which was often intertwined with spiritual and ritualistic elements. The knowledge of these plants was passed down orally through generations, with healers and traditional medicine practitioners playing a crucial role in their communities.

The arrival of traders from India, China, the Middle East and later Europe, marked the beginning of a significant period in the history of medicinal plants in Indonesia. The Spice Islands (Maluku Islands) became particularly famous for their rich resources, including cloves and nutmeg, which, while not exclusively medicinal, underscored the global demand for the archipelago's botanical wealth. European colonization, especially by the Dutch, intensified the exploitation and trade of these and other medicinal plants, integrating them into global trade networks. The Dutch East India Company (VOC) played a key role in monopolizing the spice trade, including medicinal plants, for over two centuries [7].

During the colonial period, the Dutch established botanical gardens and research institutions in Indonesia, such as the Bogor Botanical Gardens, to study and catalog the archipelago's vast plant resources. These efforts contributed significantly to the scientific understanding and classification of medicinal plants. However, they also facilitated the extraction and exportation of these resources, often overlooking the traditional knowledge and rights of local communities.

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Following Indonesia's independence, there was a renewed interest in traditional medicine (Jamu) and the country's medicinal plants [8]. The government and various non-governmental organizations have made efforts to document traditional knowledge, promote the use of medicinal plants in healthcare, and explore sustainable trade practices. Modern research has also focused on validating the medicinal properties of these plants through scientific methods, aiming to integrate traditional medicine with modern healthcare systems.

The utilization of medicinal plants is regulated by the Indonesia Ministry of Health, which encourages the population to use these plants as traditional medicines for the purpose of maintaining health and preventing diseases [9]. The government implemented the National Health System (NHS) by issuing the Decree of the Minister of Health of the Republic of Indonesia No. 374/Menkes/SK/V/2009. This decree specifically governs the advancement and enhancement of medicinal plants for use as traditional medicines. The purpose was to acquire traditional medicines that possess superior quality, are safe, have measurable characteristics that have been scientifically verified, and are commonly utilized, both for self-administration by the community and within formal healthcare facilities [10]. The Minister of Agriculture of Indonesia issued Decree No. 141/Kpts/HK.150/M/2/2019, which identified 65 distinct categories of medicinal plant commodities. These categories encompass 14 varieties of rhizome plants and 51 varieties of non-rhizome plants. According to Horticultural Statistics from the Central Statistics Agency (CSA), 14 key therapeutic plants have been officially documented. Figure 1 presents a visual representation of these 14 documented therapeutic plants, highlighting their botanical classification and economic significance in Indonesia's herbal medicine industry. These include *Zingiber officinale, Acorus calamus, Alpinia galanga, Morinda citrifolia, Curcuma longa, Phaleria macrocarpa, Andrographis paniculata, Curcuma aeruginosa, Aloe vera, Ammomum cardamomum, Kaempferia galanga, Zingiber zerumbet, Strobilcumathes crispus* and *Boesenbergia rotunda,* respectively [11].

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Figure 1: 14 documented therapeutic plants based on CSA Horticultural Statistics

Economic Impact

Market Analysis

The medicinal plant sector in Indonesia, particularly in Central Java, has a strong comparative advantage and competitiveness in the global market [12]. This is further supported by the country's rich resources and traditional medicinal systems [13]. The industrialization of medicinal plants in Indonesia presents an opportunity for economic development and increased Gross Domestic Product (GDP) (Table 1)

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[14]. However, there are challenges such as market inefficiency and benefit distribution and the need for sustainable development [15]. Despite these challenges, the potential for growth in the medicinal plant sector in Indonesia is significant, especially in regions like Java and Kalimantan [16].

Innovation in Product Development

Innovation in the development of medicinal plant products is crucial for enhancing the economic value and marketability of Indonesia's botanical resources. Advancements in processing technologies, such as cold extraction, lyophilization and encapsulation, have significantly improved the efficacy, stability and shelf life of plant-based medicinal products. These technological innovations enable the preservation of the bioactive compounds responsible for the therapeutic properties of medicinal plants. Furthermore, product diversification and value addition, such as the development of herbal supplements, cosmeceuticals, and functional foods, open new market opportunities and cater to the growing consumer demand for natural health products. The integration of traditional knowledge with modern scientific research and development is key to innovating product offerings, ensuring their safety, efficacy and quality, thereby strengthening Indonesia's position in the global market for medicinal plant products [17].

Moreover, in Indonesia, traditional herbal medicine plays a significant role in healthcare and is categorized into three main types: Jamu, Obat Herbal Terstandar (OHT) and Fitofarmaka. Jamu is the most widely used and culturally significant traditional herbal formulation, while OHT consists of standardized herbal medicines that meet safety and efficacy requirements but lack full clinical validation. Fitofarmaka represents the highest category, requiring clinical trials and certification, similar to conventional pharmaceutical drugs. Figure 2 presents the classification of herbal medicines in Indonesia, illustrating the category logo of Jamu, OHT and Fitofarmaka available in the market. The preparation and use of Jamu are deeply rooted in Indonesian culture, with recipes and methods being passed down through generations. Jamu is widely consumed for its health benefits and is available in various forms, including powders, pills and drinks [18]. On the other hand, Obat Herbal Terstandar (OHT) and Fitofarmaka represent a more standardized approach to herbal medicine in Indonesia [19]. Obat Herbal Terstandar refers to standardized herbal medicines that have been tested for their safety and efficacy, but not to the extent of clinical trials. These products must meet specific quality standards set by the Indonesian government to ensure their consistency and reliability. Fitofarmaka takes this a step further by requiring clinical evidence of safety and efficacy, making it the highest standard for herbal medicine in Indonesia. Fitofarmaka products are rigorously tested, similar to conventional pharmaceutical drugs, and must be approved by the Indonesian Food and Drug Authority [19].

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The data in Table 2 illustrates the distribution of herbal medicine products in Indonesia by 2023. The largest category is Jamu, with 24,447 products, reflecting its deep cultural roots and widespread use as traditional herbal medicine. Obat Herbal Terstandar (OHT) follows with 236 products, representing standardized herbal medicines that meet safety and efficacy requirements. Lastly, Fitofarmaka consists of only 64 products, indicating a smaller, yet scientifically validated category subjected to clinical testing. This distribution highlights the dominance of Jamu while showcasing a gradual shift towards standardized and clinically tested herbal medicines. This categorization reflects Indonesia's effort to integrate traditional herbal practices with modern scientific standards, ensuring that herbal medicines are safe, effective and of high quality for consumers.

Figure 2: Herbal medicine logo in Indonesia

Entrepreneurship Opportunities

The medicinal plant sector in Indonesia presents numerous entrepreneurship opportunities for small and medium enterprises (SMEs), driven by the global resurgence in demand for natural and traditional remedies [20]. Small and medium enterprises play a crucial role in the value chain, from cultivation and harvesting to processing and marketing. By leveraging Indonesia's rich biodiversity and traditional knowledge, entrepreneurs can develop niche products tailored to specific health and wellness trends. Furthermore, partnerships with local communities and farmers for sustainable sourcing practices can enhance the social and environmental credentials of SMEs, making their products more appealing to eco-conscious consumers. Access to funding, capacity building in terms of business and technical skills, and market access are essential for nurturing entrepreneurship in this sector [21].

Government and non-governmental organizations can support SMEs through training programs, grants, and facilitating connections with larger national and international markets. Additionally, fostering an ecosystem that encourages innovation and collaboration among researchers, entrepreneurs, and the government can accelerate the development of new products and services, contributing significantly to the economic growth and sustainability of the medicinal plant industry in Indonesia. By focusing on sustainable cultivation, innovation in

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product development, and fostering entrepreneurship, Indonesia can harness the full potential of its medicinal plant sector for economic growth and sustainability. This approach not only benefits the economy but also ensures the conservation of biodiversity and the well-being of future generations.

All herbal products in Indonesia must be registered for distribution, with over 10,000 products currently approved, including 32 standard herbal medicines and 5 phytopharmaceuticals. The growth of the medicinal plant sector is evident through the increased development of value-added products. Medicinal plants are widely utilized by individuals and entities such as the Pharmaceutical Industry (PI), Traditional Medicine Industry (TMI), and Small Traditional Medicine Businesses (STMB). Java holds the highest concentration of these industries despite their uneven distribution across the country.

The Indonesian herbal medicine industry is categorized into three major industry groups: UKOT (Small Traditional Medicine Businesses), UMOT (Medium Traditional Medicine Businesses), and IOT (Traditional Medicine Industry). These categories play a critical role in the development, production and distribution of herbal medicine across Indonesia. Figure 3 illustrates the distribution of herbal medicine industries in Indonesia as of 2023, highlighting the dominance of UKOT with 627 registered businesses, followed by UMOT with 272 entities, and IOT with 144 entities. This classification reflects the prevalence of small-scale traditional medicine businesses, which form the backbone of Indonesia's herbal industry. The uneven distribution of these businesses across the country underscores the need for policy interventions to support industry expansion and standardization.

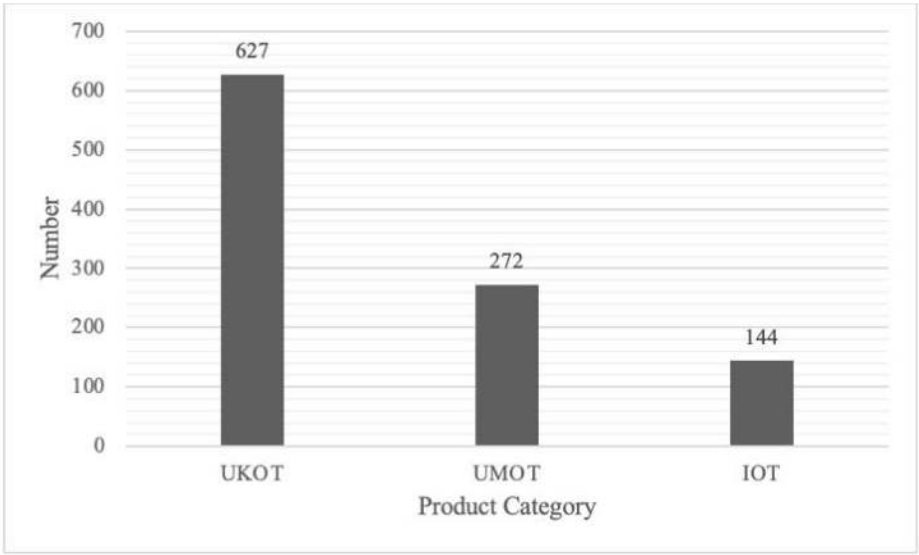

Figure 3: Number of herbal medicine industries in Indonesia by 2023

Challenges

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The country's rich biodiversity includes numerous species of flora with proven therapeutic properties, making it a significant contributor to both local and international healthcare sectors [23]. However, this valuable resource faces challenges that stem from the growing global demand for natural health products. These challenges include ensuring sustainable harvesting practices, protecting biodiversity, upholding intellectual property rights, and achieving equitable benefit-sharing among all stakeholders [24]. The trade of medicinal plants in Indonesia is at a crossroads where economic development opportunities need to be balanced with environmental and ethical considerations. The demand for herbal medicines and natural health products has surged globally, driven by an increasing preference for natural over synthetic remedies [25]. This demand presents Indonesia with a lucrative economic opportunity but also poses risks to its environmental health and cultural heritage. Unsustainable harvesting practices can lead to the depletion of valuable plant species, some of which may already be at risk of extinction. The loss of these plants not only impacts biodiversity but also the ecological balance, which can have far-reaching consequences for the environment and future generations.

To address these challenges, stakeholders, including the government, local communities, and international organizations, are promoting sustainable trade practices through stricter regulations, sustainable agriculture techniques and community-based conservation projects. These efforts help prevent overharvesting and preserve biodiversity. Additionally, intellectual property rights and equitable benefit-sharing are crucial to protect indigenous knowledge. These communities, as traditional custodians, should be fairly acknowledged and compensated. Frameworks for benefit-sharing ensure that economic gains from medicinal plants are shared equitably, encouraging conservation efforts and safeguarding traditional knowledge [26]. While Indonesia is a key player in the global herbal medicine market, it faces significant issues with biodiversity conservation, intellectual property rights, and equitable benefit-sharing. Balancing economic growth with cultural heritage preservation requires collaboration among stakeholders. Sustainable trade practices, respect for indigenous knowledge, and fair benefit-sharing will enable Indonesia to strengthen its role in the international market while conserving its natural resources for future generations.

Current Trends in Indonesia's Medicinal Plant Industry

Indonesia's medicinal plant industry is undergoing significant growth and transformation, driven by market expansion, technological advancements, and supportive policies. The increasing consumer preference for natural remedies, combined with government-backed initiatives, has positioned the sector for substantial development in both domestic and international markets.

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The global shift towards natural health products has significantly influenced Indonesia's medicinal plant industry. Consumers are increasingly seeking herbal medicines as alternatives to synthetic pharmaceuticals, driven by concerns over side effects, drug resistance and chemical additives [27]. The global herbal medicine market is projected to grow at an annual rate of 6-8%, with Asia-Pacific countries, including Indonesia, playing a key role in supply and innovation [28]. Exports of Indonesian medicinal plants, including Curcuma longa (turmeric), Zingiber officinale (ginger), and Andrographis paniculata (king of bitters), have increased due to rising international demand [29].

The Indonesian government has been actively incorporating traditional herbal medicine into the national healthcare system. The Ministry of Health introduced Regulation No. 003 of 2010, which encourages the use of Jamu, Obat Herbal Terstandar (OHT), and Fitofarmaka within primary healthcare services. Fitofarmaka, classified as clinically tested herbal medicines, are increasingly being promoted as safe and effective treatments for chronic diseases such as diabetes, hypertension and arthritis [9]. This policy shift aims to strengthen the scientific validation and standardization of herbal products, aligning them with global pharmaceutical standards.

The rise of online marketplaces and direct-to-consumer sales platforms has transformed the distribution landscape of Indonesian herbal products. Companies such as PT Sidomuncul have expanded their digital marketing strategies, leveraging platforms like Shopee, Tokopedia and Bukalapak to reach broader consumer bases [30]. The Indonesian government, through the Ministry of Cooperatives and SMEs, has also introduced digital training programs to help small and medium enterprises (SMEs) adopt e-commerce models. Studies indicate that digital sales of traditional herbal medicine in Indonesia have grown by over 40% in the past five years, reflecting the industry's increasing reliance on online distribution channels [31].

Proposed Solutions and Policy Measurement

To ensure the sustainable development of Indonesia's medicinal plant industry, a comprehensive approach involving regulatory reforms, industry collaboration and scientific innovation is necessary. The Indonesian Food and Drug Authority (known as BPOM) and the Ministry of Health should simplify licensing procedures to facilitate the commercialization of herbal medicines, reduce bureaucratic delays, and provide tax incentives for companies that comply with Good Manufacturing Practices (GMP). Strengthening international trade agreements will further support export growth and market expansion.

Ensuring quality control and standardization is critical for global market acceptance.

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Collaboration between the pharmaceutical and herbal industry with research institutions is essential in developing a national herbal pharmacopeia, promoting Good Agricultural and Collection Practices (GACP), and enhancing laboratory testing to verify bioactive compounds. Alongside quality, sustainability remains a pressing issue. The government must regulate harvesting practices to prevent overexploitation and incentivize community-based conservation programs that promote agroforestry and biodiversity protection.

Small and medium-sized enterprises (SMEs) play a crucial role in the medicinal plant sector, yet they face challenges in funding and market penetration. Government-backed initiatives should offer low-interest loans, training on branding and marketing strategies, and support for digital sales platforms to facilitate direct-to-consumer sales and reduce reliance on traditional retail. Meanwhile, scientific research and innovation are vital for improving product credibility. Universities and pharmaceutical companies should expand clinical trials, encourage public-private research partnerships, and develop nano-formulation technologies to enhance the bioavailability and effectiveness of herbal extracts. By addressing these key challenges through policy reforms, industry collaboration and scientific advancement, Indonesia can strengthen its position in the global herbal medicine market, ensuring long-term sustainability and economic growth.

Case Studies: Successful Business Models in Indonesia's Herbal Medicine Industry

Perseroan Terbuka (PT) Mustika Ratu Tbk

Perseroan Terbuka Mustika Ratu Tbk stands as a prominent figure in the Indonesian market, having established itself as a pioneer in the production of herbal and natural cosmetics, alongside health drinks that draw inspiration from traditional Indonesian recipes. Since its inception in 1975, the company has effectively tapped into the vast wealth of Indonesia's medicinal plants, creating an extensive array of products that appeal to consumers both within the country and across the globe [32]. The company's ascent can be attributed to a couple of key success factors. Firstly, Mustika Ratu's commitment to innovation and product quality is evident in its continuous investment in research and development [33]. This dedication ensures that their offerings not only meet but exceed national and international standards, securing a competitive edge. Additionally, the brand's deep-rooted heritage and cultural authenticity play a crucial role. By infusing products with Indonesia's rich tradition of herbal medicine, Mustika Ratu delivers solutions that are not only effective but are also imbued with cultural significance, enhancing consumer connection and appeal.

Furthermore, the company has skillfully navigated the global marketplace through

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strategic marketing efforts and obtaining international certifications, allowing it to introduce Indonesian herbal products to a worldwide audience. However, Mustika Ratu faces its share of challenges. Regulatory compliance poses a significant hurdle as the company must adhere to the intricate regulatory framework governing herbal products in various markets. Moreover, maintaining a sustainable supply chain is paramount, especially in light of surging demand and environmental concerns, to ensure a consistent provision of high-quality medicinal plants. These challenges notwithstanding, PT Mustika Ratu Tbk's journey reflects a blend of tradition and modernity, showcasing Indonesia's herbal heritage on the global stage.

Perseroan Terbatas (PT) Jamu Jago

Perseroan Terbatas Jamu Jago, established in 1918, illustrates a remarkable evolution from a humble home-based operation to becoming a key figure in Indonesia's traditional medicine sector [34]. This transformation is deeply rooted in the company's unwavering commitment to the preservation of jamu, Indonesia's ancestral herbal medicine, alongside the adoption of modern manufacturing methodologies. This blend of tradition and innovation has positioned PT Jamu Jago at the forefront of the industry, catering to a growing demand for natural health solutions. The foundation of PT Jamu Jago's success lies in several critical areas. Primarily, the company's dedication to adhering to traditional jamu recipes has enabled it to maintain a strong and authentic brand identity. This authenticity is particularly appealing to consumers who value natural and traditional health remedies. Additionally, PT Jamu Jago has embraced modernization, particularly in its production processes, integrating advanced technology and strict quality control protocols. This not only ensures the safety and efficacy of its products but also aligns with the expectations of today's health-conscious consumers [35]. Moreover, PT Jamu Jago has strategically expanded its market reach. By diversifying its product portfolio and establishing effective distribution networks, the company has not only solidified its presence in Indonesia but also ventured into other Asian markets [36]. This expansion underscores the company's ability to adapt and thrive in a competitive landscape.

These case studies of PT Mustika Ratu Tbk and PT Jamu Jago not only highlight the potential for growth within Indonesia's medicinal plant sector but also underscore the importance of blending traditional knowledge with modern business practices. By navigating challenges related to sustainability, regulatory compliance, and global market penetration, these companies exemplify how the sector can continue to evolve and make a significant impact on the global health and wellness industry. Their journeys suggest that with the right blend of tradition, innovation and strategic market adaptation, Indonesian medicinal plant businesses can

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sustain their growth and enhance their competitiveness on the international stage.

CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

This review examined the multifaceted aspects of Indonesia's medicinal plant industry, highlighting its significant potential for economic growth and sustainable development. The key findings underscore the importance of sustainable cultivation practices, innovation in product development, and the expansion of entrepreneurship opportunities as pivotal drivers for the industry. These elements are crucial for ensuring the long-term viability of medicinal plants, enhancing their economic value, and leveraging Indonesia's rich biodiversity for global health benefits. However, the industry faces challenges, including regulatory hurdles, quality control, standardization issues, and the urgent need for conservation of medicinal plants and their habitats. Addressing these challenges is essential for the sector's sustainability and for maintaining Indonesia's position as a key player in the global market for medicinal plants. Furthermore, to achieve sustainable growth and competitiveness, several strategic actions are essential. The government should streamline regulations, enforce GMP standards, and legally protect traditional medicinal knowledge. Universities and pharmaceutical industries must invest in R&D, focusing on clinical trials to validate herbal medicine efficacy. SMEs and farmers need financial aid, technical training, and better market access. The industry should embrace digital transformation and global trade to expand markets. Lastly, sustainability efforts, including responsible harvesting, biodiversity conservation, and agroforestry programs, are crucial to preserving medicinal plant resources for the future.

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Disclosure Statement

The authors declare that they have no conflicts of interest to disclose.

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Table 1: Indonesia's Share of GDP from the Manufacturing and Agricultural Sectors for Five Years

SECTOR	GDP Share (%)				
	2019	2020	2021	2022	2023
Manufacturing	12.71	13.70	19.29	18.34	20
Agriculture Sector (Including Medicinal Plants)	19.71	19.88	14.27	12.4	13.57

Table 2: Number of Herbal Medicine Products by 2023

Product Category	Number of products
Fitofarmaka	64
Jamu	24447
Obat Herbal Terstandar	236

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