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Traditional Medicine Innovation Policy: Between the Protection of Traditional Knowledge, Genetic Resources, and Intellectual Property

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Abstract

This study analyses how innovation in traditional medicine can be strengthened through the convergence of policies on traditional knowledge protection, genetic resources governance, and intellectual property rights to support national independence in drug availability. Using a qualitative normative design, this research examines statutory regulations, international instruments, and institutional practices relevant to traditional medicine, biogenetic conservation, and intellectual property management. The methodological approach includes doctrinal legal analysis, conceptual analysis, and policy evaluation to map regulatory overlaps, gaps, and strategic opportunities for integration. The study finds that Indonesia possesses vast biodiversity and rich traditional medicinal knowledge that remain underutilised in pharmaceutical innovation. Regulatory frameworks governing traditional knowledge, genetic resource access, and intellectual property work in parallel but lack harmony, resulting in problems related to standardisation, benefit-sharing, research authorisation, and commercialisation. Findings also indicate that strengthening scientific validation, through standardised extraction, preclinical and clinical testing, and quality assurance, significantly increases the potential of traditional medicines to advance into standardised herbal medicines and phytopharmaceuticals. The study concludes that policy convergence is essential to ensure equitable protection of traditional knowledge, sustainable use of genetic resources, and effective commercialisation of research outputs. An integrated framework is required to support national drug independence, enhance bioeconomic value creation, and promote fair benefit distribution for indigenous and local communities.

INTRODUCTION

Indonesia is known as a mega-biodiversity country, with the second-largest biodiversity in the world after Brazil. Approximately 30,466 vascular plant species are recorded in Indonesia, representing 8.7% of the total vascular plant species worldwide (Sun et al., 2024). This vast biodiversity includes tens of thousands of plant species, many of which have medicinal properties. There are 38,000 plant species in Indonesia's tropical forests, 9,600 of which have been identified as having medicinal properties, and only 200 species are used as raw materials for traditional medicines (Muhaimin, 2022) . The Indonesian archipelago is home to the world's second-largest biodiversity and is inhabited by more than 300 ethnic groups, with a total population of over 270 million (Rani et al., 2023). Each ethnic group has unique traditional knowledge and practices related to medicinal plants or ethnobotany and the use of medicinal plants (Susanti & Zuhud, 2019). The biodiversity of medicinal plants and the traditional knowledge and practices of indigenous or local communities hold potential for the development or innovation of traditional medicines into modern medicinal inventions with more effective, practical, and efficient production and use. Therefore, comprehensive policies are needed to enhance the self-reliance, availability, accessibility, and competitiveness of traditional medicines while also benefiting the well-being of indigenous or local communities that possess traditional knowledge.

In Javanese and Madurese communities, traditional medicine is commonly known as *jamu*, with Serat Kawruh and Serat Centhini as key written sources documenting thousands of ingredients and their uses. Sundanese people and several Indigenous communities in Sumatra also rely on hundreds of medicinal plant species, as recorded in various ethnobotanical surveys. In Kalimantan, Bali, West Nusa Tenggara, and Sulawesi, herbal remedies and medicinal oils remain widely practised, including knowledge preserved in manuscripts such as lontaraq pabbura. In Maluku and Papua, hundreds to thousands of medicinal plants continue to be used for varied health purposes, ranging from treating common ailments to supporting vitality and providing sedative effects.

In the international order of recognition of protection for traditional knowledge and the rights of its guardian communities, particularly in Article 8 J of the Convention on Biological Diversity (CBD), 1992, every knowledge, innovation and practice of indigenous peoples and local communities embody traditional lifestyles that are relevant to the conservation and sustainable use of biodiversity. The provisions of this Article are further regulated in the international agreement Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from The Utilization to the Convention on Biological Diversity 2010, stating that every promotion and wider application is with the consent and involvement of holders of such knowledge, innovation, and practice, and encourages fair sharing of benefits

arising from the utilisation of their knowledge, innovation, and practice (Rohaini, 2015). Indonesia has ratified both international treaties through Law No. 5 of 1994 concerning the Ratification of the United Nations Convention on Biological Diversity and Law No. 11 of 2013 concerning the Ratification of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization.

Furthermore, the World Intellectual Property Organization (WIPO) made efforts to protect intellectual property rights by establishing the Intergovernmental Treaty on Genetic Resources, Traditional Knowledge, and Folklore (GRTKF) in 2000. It was not until May 2024 that the Treaty on Intellectual Property, Genetic Resources Associated Traditional Knowledge, was finally approved, establishing international disclosure requirements for new patent applications involving genetic resources and/or related traditional knowledge. This treaty addresses only norms governing the use of traditional knowledge in patent-oriented inventions.

The World Health Organization (WHO) recognises that most member states of the WHO's state that 40 to 90 per cent of their populations now use traditional medicine. Traditional medicine (TM) is an important component of the global healthcare system, given its long history and deep integration into the cultural practices of diverse communities, encompassing a variety of health practices, knowledge, and beliefs originating from diverse cultures (Che et al., 2023). The WHO-Global Traditional Medicine Strategy 2025–2034 sets out the vision and mission of integrating safe, effective, and evidence-based traditional complementary integrated medicine (TCIM) into the national health systems of WHO member states. The Global Traditional Medicine 2025-2034 guideline principles recognise the rights of Indigenous Peoples to maintain their health practices and access to all social and health services without discrimination. They also have the right to maintain, control, protect, and develop their intellectual property related to traditional knowledge, and to protect it from misuse and unauthorised use (WHO, 2025). WHO policies, which will later become guidelines for WHO member states to develop legal policies on the protection, utilisation, and development of traditional medicines, should be aligned with regulations governing the protection of genetic resources, traditional knowledge, and intellectual property.

Traditional knowledge, including the traditional medicinal knowledge of indigenous peoples, is an important element of their intellectual and cultural heritage. It reflects their social and historical identity, which contributes significantly to future welfare and sustainable development (Hirwade & Hirwade, 2012). Traditional medicine has significant economic potential, particularly in biotechnology, pharmaceuticals, and agriculture. Recognition of this value has prompted efforts to protect traditional knowledge, ensuring that indigenous peoples can gain economic benefits from it (Kuppuswamy, 2020). Traditional knowledge can be utilised for

community economic development and community welfare improvement through product development based on traditional knowledge (Dilixiati & Song, 2023).

The economic potential is evident in the level of consumption and public trust in traditional medicine, which is stronger than in chemical drugs. This is evident in the data on traditional medicines that have been granted a Marketing Authorisation Number (NIE) which remains valid to date. At a closer look, in terms of the frequency of consumption, chemical medicines accounted for 15,937, traditional medicines 24,956, and health supplements 6,950. Even during the COVID-19 pandemic, 79% of the population consumed traditional medicine to boost their immune systems (Badan Kebijakan Kementerian Kesehatan, 2022). However, the economic potential of international medicine is evident in the chemical, pharmaceutical, and traditional medicine sectors, which contribute 5.9% of GDP, equivalent to Rp395.1 trillion (Khaira Ummah Junaedi Putri, 2025). In Brunei, 72.2% of participants used home remedies for COVID-19, with cloves, lemon, and honey as the most commonly used types (Zaim, Idris, & Abdul Rahman, 2024). In Malaysia, 51.4% of respondents turned to herbal medicine due to its availability and reasonable cost (Chander, Tan, & Zaman, 2025). In India, 66.9% of respondents used complementary and alternative medicine (CAM) for COVID-19 prophylaxis (Agrawal et al., 2023). Similarly, in China, 57.9% of respondents used traditional Chinese medicine (TCM) to prevent the virus or treat illness caused by it (Lu et al., 2021).

This economic potential has led to the misuse and commercialisation of traditional knowledge by third parties without proper consent or profit sharing. This issue has become a major concern, calling for stronger protection mechanisms (Thathong, 2014). The unauthorised use of traditional knowledge and genetic resources by companies, often referred to as biopiracy, necessitates an explicit legal framework to prevent exploitation and ensure fair compensation for knowledge holders. Biopiracy cases in Indonesia include the case of Shiseido, a Japanese corporation, which has patented traditional knowledge related to herbs and medicines, including *kayu rapet* (*Parameria laevigata*), *kemukus* (*Piper cubeba*), *beluntas* (*Pluchea indica*) and others, all of which fall into the category of anti-ageing ingredients. In 2012, the Indonesian Institute of Sciences (LIPI) reported a case of theft of biological resources for research purposes by foreign researchers posing as tourists. The results of the theft of *Megalara garuda* wasp samples from Southeast Sulawesi were published in international scientific journals without the involvement of Indonesian researchers, and the wasps from this research were priced at up to Rp500 million per specimen on the market. The number of biopiracy cases in Indonesia is increasing, many of which have gone unreported because researchers in universities and research institutions, local communities, and even government officials are unaware that what is happening before their eyes is categorised as *biopiracy*.

The protection of traditional knowledge, including traditional medicinal knowledge, through intellectual property regimes plays an important role in preventing third parties from misusing such knowledge. However, protection through intellectual property regimes is not accessible to most holders of traditional knowledge, and such regimes do not necessarily guarantee the preservation or protection of such knowledge. These concerns call for consideration of various approaches, particularly at the policy-making level, to achieve a balance between protecting indigenous/local communities through intellectual property rights regimes and ensuring cultural preservation and access to knowledge (Andanda, 2012). In addition, the protection of traditional knowledge is closely related to the rights of indigenous peoples, including their rights to self-determination, cultural preservation, and fair benefit-sharing. Integrating human rights dimensions into the protection of traditional knowledge is essential to ensure that the interests of indigenous peoples are respected and upheld (Chaturvedi, 2023).

Policies that support the existence of traditional medicine knowledge are explicitly outlined in Law concerning Conservation of Living Natural Resources and Ecosystems (KSDAHE) No. 32 of 2024, which aims to ensure the preservation of ecological processes, genetic diversity, species, and ecosystems that support the availability of raw materials for traditional medicines. The 2016 Patent Law and its 2024 Amendment, the 2017 Cultural Promotion Law, and the 2022 Government Regulation on Communal Intellectual Property are policies aimed at protecting knowledge from unfair use and exploitation (Roisah et al., 2025).

In addition, traditional medicinal knowledge also plays an important role in the development of new drugs or drug inventions, as it provides information about plants or natural compounds that have been used traditionally for treatment, which can then set the basis for scientific research to discover new drugs (Yuan, Ma, Ye, & Piao, 2016). Traditional medicine also assists in identifying active compounds, determining chemical structures, and developing more effective drug formulations. Traditional medicinal plants often contain active chemical compounds that can be isolated and studied for their therapeutic effects. For example, HPLC analysis of herbal formulations can identify and measure phytochemicals (Selvakumar & Valliammai, 2016). The traditional knowledge of indigenous/local communities in Indonesia regarding medicinal plants is vital to the development of modern pharmaceutical drugs. Plants such as *Muntingia calabura*, *Curcuma longa*, *Phyllanthus urinaria*, *Abelmoschus esculentus*, *Pogostemon cablin*, and several others have been studied for their bioactive compounds and therapeutic potential. Several pharmacological drugs that use natural product prototypes, including aspirin, atropine, ephedrine, digoxin, morphine, quinine, reserpine, and tubocurarine, were initially discovered through studies of traditional medicine and indigenous knowledge (Anwarul Hassan Gilani & Atta-ur-Rahman, 2005).

With growing consumer interest in more natural and herbal-based medicines, developing an innovative traditional medicine sector could offer ample opportunities for Indonesia's pharmaceutical industry. The government and pharmaceutical companies can take advantage of this trend by developing traditional medicine products that preserve the value of local wisdom and traditional medicinal knowledge while meeting strict scientific and regulatory standards for safer, more effective health solutions. In this regard, this paper aims to discuss the synergy of traditional medicine innovation policies, between traditional knowledge protection policies, biological resource protection, and intellectual property rights.

METHODS

This paper is based on doctrinal research (Al-Fatih, S., 2023) drawing on various sources of literature, including theories and concepts on the protection of traditional knowledge, conservation of genetic resources, drug patents, and the development and innovation of traditional medicines. Legislative studies were also used, particularly those governing the Patent Law, the Law concerning the Advancement of Culture, the Law concerning the Conservation of Biological Natural Resources and Ecosystems, and the Law concerning the Science and Technology System. These data were useful for examining the correlation and integration between these legal policies. In addition, international legal instruments on the protection of traditional knowledge and the utilisation of resources, such as the CBD, the Nagoya Protocol, the Treaty of IPGRTK, and the WHO Strategy, were also used to examine the extent to which these instruments are implemented in traditional medicine development policies in the context of protecting traditional knowledge, genetic resources, and patents. The collected data were verified through interviews with relevant stakeholders, including the National Agency of Drug and Food Control (BPOM) and the Directorate of Intellectual Property of the Indonesian Ministry of Law. The interviews helped verify secondary legal materials and explore policies in both institutions. All data, both secondary legal materials and interview results, were then integrated and analysed, and conclusions were drawn based on the research questions.

RESULTS AND DISCUSSION

Protection of Traditional Medicinal Knowledge: Intellectual Property Rights, Culture, and Biological Resources Law

The emergence of the back-to-nature movement at the end of the 20th century, as a reaction to the negative impacts of modernisation that have caused widespread environmental damage, has continued to grow in global society in the 21st century. Society has become more environmentally conscious, with a growing demand for health products made from natural ingredients, the development of environmentally friendly technologies, discoveries based on genetic resources, and a need for ethnic goods and products, among others. For global pharmaceutical companies or

Multinational Corporations (MNCs), this condition triggers the production of medicinal products based on biological resources taken from tropical countries that have abundant biological resources (mega diversity). However, global pharmaceutical companies have obtained genetic resources, including the traditional knowledge related to genetic resources, legally (through utilisation agreements and Access and Benefit-Sharing)(Waimer, Torres-Londoño, Stekly, Wahrenburg, & Steinhoff, 2018) and illegally (without authorisation and appropriate compensation)(Lai, Robinson, Stirrup, & Tualima, 2019).

The development of traditional knowledge has always required the interaction and adaptation of communities with their environment (Menon et al., 2023) to gain a better understanding of natural resource use, agricultural practices, and ecosystem management (Turner et al., 2022). This knowledge often stems from practical experience and experimentation conducted by communities over long periods of time (Kumari et al., 2021). It takes the form of information, wisdom, traditions, and practices that, evolving over time, have long been upheld and adhered to by indigenous peoples or specific local communities (Saxena & Rao, 2023). Culture is sustained by attitudes, beliefs, principles, behavioural conventions, and social practices derived from historical experience. Traditional knowledge is not static; rather, it continues to evolve and adapt to social and environmental changes, thereby enabling indigenous communities to remain responsive to new challenges.

Traditional knowledge refers to Article 8(j) of the Convention on Biological Diversity (CBD), which explains that "Traditional Knowledge is knowledge, innovation, and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity" (Roisah, 2021). The convention shows that traditional knowledge is broad, covering knowledge about plants and animals for medicinal purposes and including food that requires protection in other frameworks, such as patents and biodiversity (K. Roisah, 2021). According to WIPO, there is no consensus on the definition of traditional knowledge, and from the documents resulting from several IGRTKF meetings, traditional knowledge is defined as knowledge, expertise, skills, and practices which are developed, maintained, and passed down from generation to generation within a community, which are often part of its cultural or spiritual identity. Traditional knowledge can be found in various contexts, including agricultural, scientific, technical, ecological, and medicinal knowledge, as well as knowledge related to biodiversity (World Intellectual Property Organization (WIPO), 2011).

According to Indonesia's Cultural Promotion Law No. 5 of 2017, particularly in Article 5 letter e, traditional knowledge refers to all ideas and concepts in society that contain local values, resulting from real experiences of interacting with the environment, developed continuously, and passed on to the next generation. Traditional knowledge includes crafts, clothing, healing methods, herbal medicine,

traditional food and beverages, as well as knowledge and behavioural customs regarding nature and the universe. In Government Regulation No. 56 of 2022 concerning Communal Intellectual Property, traditional knowledge is defined in much the same way.

Traditional knowledge related to genetic resources is very valuable for bioprospecting and biotechnology, as it provides insight into the properties of medicinal plants and other organisms, which potentially contributes to the development of drugs (Oriakhogba, Ndlovu, & Mugabe, 2023). This has attracted the attention of various foreign parties to explore traditional knowledge among various indigenous communities through researchers, academics, or corporate R&D teams. The use of traditional knowledge for the commercial interests of foreign parties raises complex issues. In most cases, industry players exploit traditional knowledge without sharing the benefits of its use with indigenous communities. Such actions are usually justified by industry players on the grounds that traditional knowledge is in the public domain or under communal ownership. In response, indigenous peoples claim that such behaviour is unfair and disrespectful (von Lewinski, 2008), which is not quite surprising. This conflict has also attracted the attention of the international community, which is concerned about finding solutions to protect traditional knowledge through agreements/conventions as outlined in international legal instruments.

In response to the above matter, an international conference was held, resulting in the Convention on Biological Diversity (CBD) to address the issue of biopiracy, particularly regarding the inappropriate exploitation or use of various forms of traditional knowledge or traditional cultural expressions for commercial and monopolistic purposes, which are part of the lives of indigenous/local communities (Masrur et al., 2024). The CBD legal instrument focuses on the conservation and utilisation of genetic resources and traditional knowledge, as well as ensuring Access and Benefit-Sharing (ABS) in the form of the fair and equitable sharing of benefits arising from new products (Mcneely, Rojas, & Martinet, 1995). The main principle of the CBD is that countries have sovereignty over their genetic resources and access to utilise them must be based on prior informed consent (PIC) and mutually agreed terms (MAT) for benefit sharing (Article 15 of the CBD).

ABS arrangements are also regulated under the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), an international agreement that aims to conserve, sustainably use, and fairly and equitably share the benefits arising from the utilisation of plant genetic resources for food and agriculture. This agreement is crucial to enhancing food security by facilitating access to the genetic diversity needed to develop new crop varieties (Frison et al., 2012). This agreement establishes a Multilateral System that facilitates access to plant genetic resources for food and agriculture and ensures the fair and equitable sharing of benefits arising from their

utilisation through Standard Material Transfer Agreements (SMTA) that standardise the terms and conditions for Access and Benefit-Sharing (ABS) (Ho, 2011).

Although the ABS mechanism for the utilisation of genetic resources and traditional knowledge is regulated under the CBD, biopiracy persists in many developing countries. This situation is triggered by the fact that each country may implement ABS differently, and legal certainty at the international level is minimal. For examples, India's ABS Framework has made efforts to align with international obligations, and its framework has been criticised for insufficient protection of Intellectual Properties & Local Communities and for gaps in implementation. (Joshi et al., 2025). In contrast, Brazil's ABS Framework approach emphasises stakeholders, which has evolved into a hybrid institution. (Relly, 2024). However, its implementation has been affected by internal political changes that have shifted the balance between industrial and indigenous interests. To address these issues, CBD member countries initiated the creation of a supplementary agreement to the CBD, specifically related to ABS, resulting in the Nagoya Protocol. This protocol is intended to be a transparent and binding legal framework, requiring parties to regulate ABS procedures and ensure compliance by users of genetic resources of traditional knowledge with the rules of the provider country (Friso et al., 2020), and contribute to the conservation and sustainable use of biological diversity (Flach et al., 2019). The implementation of the provisions in this protocol requires prior informed consent (PIC) from the provider country and mutually agreed terms (MAT) that detail the sharing of benefits, both monetary and non-monetary.

Efforts to protect traditional knowledge through the IG-GRTKF forum established by WIPO in 2000 place greater emphasis on sui generis protection. Sui generis protection by countries requires positive and defensive approaches. The positive approach aims to prevent unauthorised use by parties outside the indigenous/local community that holds the traditional knowledge, both for commercial purposes without compensation and for inappropriate use. The defensive approach, in contrast, is intended to ensure that intellectual property rights over traditional knowledge are not obtained illegally or without authorisation. The positive approach can be taken in the following forms: (1) protection within the framework of intellectual property right principles (intellectual property with sui generis rights specifically provide protection for TCE which aims to prevent unauthorised use and resolve cases where traditional knowledge is used without rights, especially those related to commercial use and degrading use); (2) the same protection through specific intellectual property rights principles or *sui generis* intellectual property rights that can be used as a basis for conducting commercial research and cultural cooperation with third parties, including the design of profit sharing when traditional knowledge is used outside the traditional community environment; (3) the protection using legal provisions outside of intellectual property rights principles, such as human rights law,

environmental law, and laws governing the protection of indigenous peoples; and (4) technical protection provided by creating a database with specific security principles to prevent third parties from taking advantage of and gaining unauthorised access to TCE (Taubman, 2005) .

At the WIPO negotiation forum, discussions are dynamic and even marked by a gap in perception between developed countries as users and developing countries (especially tropical countries) as providers. Developed countries emphasise the importance of strong intellectual property rights protection, including in the context of traditional knowledge. However, this approach cannot effectively protect traditional knowledge due to fundamental differences in the concepts and objectives of intellectual property rights and traditional knowledge (Srivastava & Rana, 2020). Developing countries emphasise the need for a legal framework that protects intellectual property (IP) through mechanisms such as Access and Benefit-Sharing (ABS) and sui generis systems. They argue that the current intellectual property rights system fails to adequately protect intellectual property and often leads to its misuse (Dutfield, 2005).

After two decades of IG-GRTKF WIPO negotiations, an agreement-the Treaty on Intellectual Property, Genetic Resources, and Associated Traditional Knowledge (GRATK Treaty)-was reached at the Diplomatic Conference held by WIPO in Geneva in May 2024. This treaty marks a global breakthrough that specifically requires every patent applicant who utilises genetic resources to disclose the origin of those resources and the identity of the communities that own the associated traditional knowledge (Yu, 2024). This aims to ensure transparency and traceability in the utilisation of genetic resources (Callo-Müller, Ortega Sanabria, & Remigio, 2024). The agreement introduces sanctions for non-compliance, including administrative sanctions and potential patent revocation in cases of fraudulent intent. It sets a new standard for compliance frameworks in intellectual property law (Park, 2025). The agreement is also linked to other international instruments, such as the Convention on Biological Diversity (CBD) and the Nagoya Protocol, which also address Access and Benefit-Sharing (ABS) of genetic resources. The WIPO Treaty can be seen as a compromise between the interests of developed and developing countries, aiming to balance access to genetic resources with the rights of indigenous peoples. Although this agreement introduces important new requirements and sanctions, its actual impact on scientific practices and equity in benefit sharing will depend on effective implementation and compliance by all stakeholders. Further efforts are needed to ensure that the agreement's goals of justice and equity are fully achieved.

Indonesia, as a country with mega diversity in genetic resources (Yulia & Saputra, 2021), has a strong interest in the legal instruments of the 1992 CBD and the Nagoya Protocol. Therefore, Indonesia has declared its willingness to participate by ratifying the provisions of the 1992 CBD in Law No. 5 of 1994 concerning the Ratification of

the United Nations Convention on Biological Diversity and ratified the Nagoya Protocol with the ratification of Law No. 11 of 2013 concerning the Ratification of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization to the Convention on Biological Diversity (Widayanti, Djafar, Hakim, Rivanie, & Ashri, 2022). Explicit recognition of farmers' traditional knowledge is regulated by the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and ratified through Law No. 6 of 2006 concerning the Ratification of the International Treaty on Plant Genetic Resources for Food and Agriculture (Andersen & Winge, 2013). In addition to ratifying these two international legal instruments, Indonesia has a number of positive laws that protect traditional knowledge.

Positive law that regulates traditional knowledge as intellectual property includes Law No. 13 of 2016 concerning Patents, Government Regulation No. 56 of 2022 concerning Communal Intellectual Property, and the Regulation of the Minister of Law and Human Rights No. 13 of 2017 concerning Communal Intellectual Property Data. Traditional knowledge as part of cultural heritage is regulated in Law No. 5 of 2017 concerning the Cultural Promotion, and traditional knowledge related to genetic resources is regulated in Law No. 32 of 2024 concerning the Conservation of Living Natural Resources and Ecosystems (KSDAHE).

Traditional medicine, which is part of traditional knowledge, is outlined in Article 26 of Law No. 13 of 2016, affirming that patent registration for inventions derived from genetic resources and/or traditional knowledge requires the inclusion of a description of the genetic resources and/or traditional knowledge as an effort to prevent recognition by other countries and as an effort to support Access and Benefit-Sharing (ABS). Provisions regarding this disclosure must be clear and honest about the materials used in the invention if the materials are related to and/or derived from genetic resources and/or traditional knowledge in the patent description. Although several steps have been taken, the protection of traditional knowledge under Indonesian Patent Law still faces issues (Yulia & Saputra, 2021) regarding the sources and inventorying of traditional knowledge. Therefore, more specific and effective regulations are needed to ensure fair protection and prevent the exploitation of traditional knowledge for commercial purposes or without rights.

The protection of traditional knowledge is regulated by Government Regulation No. 56 of 2022, which stipulates that traditional knowledge is part of communal intellectual property rights, including moral rights, upheld and/or exercised by the community of origin, that carry economic benefits and are valid indefinitely. The state, as the holder of traditional knowledge rights, has an obligation to conduct an inventory through data recording and integration, protection from any use that breaches the value system upheld by the community of origin of traditional knowledge, preservation through education, literacy, promotion, and utilisation of traditional knowledge that is

beneficial to the community of origin. This is to ensure that traditional knowledge remains and is passed on to the next generation. All parties who utilise traditional knowledge must state the origin of the traditional knowledge of the community of origin. For commercial use, permission must be obtained, and the sharing of benefits must be calculated in accordance with the agreement. Protecting traditional knowledge under communal intellectual property rights ensures its preservation and equitable benefit sharing for indigenous communities (Adhiyatma & Roisah, 2020; NKS Dharmawan et al., 2023).

Traditional knowledge is also recognised as an object of cultural advancement, as regulated in Law No. 5 of 2017. The government, together with the community, is obligated to make efforts to increase cultural resilience and the contribution of Indonesian culture to world civilisation through the protection, development, utilisation, and advancement of culture. This law stipulates that any use or exploitation of traditional knowledge for commercial purposes by large industries and/or foreign parties must be approved by the government and requires prior informed consent (PIC). This law also addresses benefit-sharing and the inclusion of the origin of the object of cultural advancement (Article 37). However, the protection of Traditional Knowledge in this law has been criticised for not fully aligning with the ideals of legal certainty, justice, and benefits, due to the lack of a clear identification process for traditional knowledge managers (Setyawan et al., 2021).

Provisions emphasising the importance of integrating traditional knowledge into conservation efforts are regulated in Law No. 32 of 2024 concerning Amendments to Law No. 5 of 1990 concerning the Conservation of Natural Resources and Ecosystems, which are part of the genetic resources that are preserved and whose ecosystems are protected. Traditional knowledge, as part of local wisdom, is recognised in Law No. 11 of 2019 concerning the Science and Technology System, which states that the application of science and technology respects and appreciates the traditional knowledge and local wisdom held by Indonesian communities (Article 2 and its Elucidation). The National Science and Technology System also recognises, respects, develops, and preserves the diversity of traditional knowledge, local wisdom, living and non-living natural resources, and culture as part of the nation's identity (Sujatmiko, 2021). One requirement for research activities involving biological resources and traditional knowledge by foreign parties and/or funded by foreign parties is proportional sharing of benefits, as agreed upon.

Legal policies regarding the existence of traditional knowledge, as outlined in several laws and regulations, illustrate that the approach to protecting traditional knowledge related to biological resources is hybrid, consisting of defensive and positive elements. The defensive approach in several of these policies places the protection of Traditional Knowledge related to Biological Resources (TKRBR) in an open/inclusive manner or accessible to any party, including foreign parties, to use and

develop traditional knowledge. This policy is intended to prevent claims to exclusive intellectual property rights over traditional knowledge. The emphasis in this policy is more on conservation/preservation so that traditional knowledge is maintained and utilised for the welfare and prosperity of the community. The positive approach in several of these policies is intended to prevent misuse, meaning that the use of TKRBR must respect and recognise the local wisdom value system of the community where traditional knowledge originates. The sustainable and commercial use of traditional knowledge must take into account fair profit-sharing and the requirement to enter into a material transfer agreement when TKRBR is used outside the conservation area or outside Indonesia's territory. The approach to protecting TKRBR is outlined in the following table.

Table 1. Approaches to the Protection of Traditional Knowledge related to Genetic Resources/Biological Resources (TKRBR)

LEGAL POLICY	STATUS OF TKRBR	DEFENSIVE APPROACH	POSITIVE APPROACH
Patent Law 13/2016	Intellectual property/Patents Exclusive ownership	Use of traditional knowledge for patented inventions, obligation to mention the source of TKRBR	Profit-sharing
Government Regulation No. 5/2022, Regulation of the Ministry of Law and Human Rights No. 13 of 2017	Communal intellectual property State rights holders; Moral Rights of the Originating Community	Inclusive access Inventory Obligation to cite the source and respect the value system	Commercial use requires authorisation Profit-sharing
Law No. 5/2017 concerning Cultural Promotion	Objects; of Cultural Promotion	Inclusive access Inventory	Used for large industries and foreign parties, as well as for sacred traditional knowledge; requiring authorisation & initial approval (informed consent) Profit-sharing obligation
Law No. 11 of 2019 concerning the Science and Technology System	National Intellectual Property & Technology System	Recognition and respect for local wisdom and traditional knowledge	Prohibition on the transfer of materials related to TKRBR in research testing; research conducted by foreign parties and/or funded by foreign parties must have authorisation; transfer of TKRBR-related materials to foreign countries must be accompanied by a material transfer agreement (MTA)

Law No. 17 of 2023 concerning Health	Information content related to clinical specimens, biological materials		Transfer of information related to clinical specimens and biological materials to foreign countries must be accompanied by a material transfer agreement (MTA) and fair benefit-sharing
Law No. 32 of 2024 concerning Amendments to Law No. 5 of 1990 concerning Conservation of Living Natural Resources and their Ecosystems	Genetic Resource Ecosystem	Traditional Use	Conservation, Preservation, Rescue Prohibition on leaving the conservation area Prohibition on commercial use Violations: criminal sanctions

Source; Authors, 2026

However, some existing regulations still focus on substantive matters and lack relevant institutional arrangements, a more structured framework for implementation, monitoring, and evaluation, and adequate operational procedures. Regulatory fragmentation and weak coordination between institutions have resulted in the ineffective implementation of ABS. Furthermore, the weakness of the ABS mechanism results in the loss of potential economic benefits for traditional communities and the suboptimal application of the principles of mutually agreed terms (MAT) and prior informed consent (PIC). This leaves indigenous communities with no bargaining power in negotiating matters with external parties. Consequently, economic benefits are primarily enjoyed by corporate actors or researchers, while communities remain resource providers without adequate compensation.

Traditional Medicine Policy: Conservation and Utilisation of Biological Resources and Traditional Knowledge

The global policy recognising traditional medicine as an important part of the global health system has been in place since the late 1960s. The WHO has developed several strategies for traditional medicine, including the "WHO Traditional Medicine Strategy 2002-2005" and the "Traditional Medicine Strategy 2014-2023." These strategies emphasise the importance of regulation, research, and integration of traditional medicine to ensure safety, quality, and effectiveness (Clair, Kirk, Coulter, & Saller, 2023). In principle, WHO policy prioritises ensuring the safety of traditional medicine practices and products. WHO has developed guidelines and technical tools to help countries establish regulatory frameworks that promote the safe use of traditional and complementary medicine (T&CM); WHO emphasises the importance of quality control in the production and use of traditional medicines, including the standardisation of herbal medicines and the implementation of pharmacovigilance

programmes to monitor side effects (Adams, Chung, Dubois, & Rodondi, 2023); WHO supports research and evidence-based approaches to validate the efficacy of traditional medicine practices, which also includes support for research and development of guidelines to support the therapeutic benefits of traditional medicine; WHO encourages the integration of traditional medicine into national health systems. This involves developing national policies, regulatory frameworks, and strategic plans that align traditional medicine with conventional healthcare practices and encourage collaboration between traditional and conventional medicine practitioners to ensure a holistic approach to healthcare (Zhang, Tian, & Chen, 2025).

At the ASEAN level, comprehensive policies have been developed to integrate traditional medicine (TM), including herbal medicine, into their healthcare systems, guided by the World Health Organization (WHO) 2002 strategy on traditional medicine (Akarasereenont et al., 2015). Five key areas have been identified by ASEAN members: (i) integration of traditional medicine (TM) into primary health care, (ii) development of traditional medicine (TM) clinical services, (iii) provision of traditional medicine (TM) education and training, (iv) creation of a plant database, and (v) traditional medicine (TM) research. Each ASEAN country adheres to the same key requirements of quality, safety, and efficacy, but promotes each of the five areas from its own strategy.

National Policy through Law No. 23 of 1992 concerning Health states that traditional medicine is a substance or mixture of substances in the form of plant materials, animal materials, mineral materials, galenic preparations, or mixtures of these materials that have been used for generations for treatment based on experience, and that traditional medicines must meet established standards. Then, the National Health System (SKN) policy through Minister of Health Decree No. 131/Menkes/SK/II/2004 states that the development and improvement of traditional medicine is aimed at obtaining high-quality, safe traditional medicine with proven scientific efficacy that can be widely used, both for self-medication by the community and for use in formal health services.

Furthermore, the main objectives of the National Traditional Medicine Policy, as stipulated in the Decree of the Minister of Health of the Republic of Indonesia No. 381/Menkes/SK/III/2007, include *(i)* Cultivation and conservation of traditional medicine resources, for which there needs to be a continuous supply of traditional medicine raw materials that meet quality standards that can be used for health services and community welfare. The main policy was followed by the issuance of the Regulation of the Minister of Administrative and Bureaucratic Reform (Permenpan) No. 57 of 2012, which sets out the Guidelines for Good Agricultural Practices for Medicinal Crops. These guidelines provide direction for farmers and horticultural businesses to implement good cultivation practices to maintain the quality and sustainability of medicinal plants, ensure that traditional medicines on the market meet

safety and efficacy requirements, and ensure that traditional medicines and traditional medicinal ingredients on the market meet quality requirements. Healthcare facilities and the community can obtain traditional medicines that meet safety and quality requirements and have proven efficacy, at affordable prices; these medicines are used in appropriate amounts, types, dosage forms, doses, indications, and compositions, accompanied by accurate, complete, and non-misleading information. The community is protected from traditional medicines that do not meet requirements, and the development of the traditional medicine industry is an integral part of national economic growth.

The policy on traditional medicine regulation has been reinforced with the enactment of Health Regulation No. 17 of 2023, emphasising the recognition of traditional medicine based not only on empirical evidence but also on scientific evidence. This can be seen, among other things, in the shift in the nomenclature of traditional medicine to natural medicine. The term "traditional medicine" was previously defined as "a substance or mixture of substances in the form of plant materials, animal materials, mineral materials, galenic preparations, or a mixture of these materials that have been used for treatment for generations and can be applied in accordance with the norms that apply in society." Meanwhile, natural medicine is defined as materials, mixtures of materials, or products derived from natural resources in the form of plants, animals, microorganisms, minerals, or other materials from natural resources, or mixtures of these materials that have been used for generations, or have been proven to be efficacious, safe, and of high quality, used for health maintenance, improving health, preventing disease, treating illness, and/or restoring health based on empirical and/or scientific evidence (Article 1 No. 17 of Law No. 17 of 2023 concerning Health). Natural Medicine Ingredients are active ingredients in the form of crude drugs or galenic preparations, as well as additional ingredients used in the manufacture of natural medicine, and are not packaged ready for use by consumers. The change in nomenclature from "traditional medicine" to "natural medicine" reflects a shift in focus from the "traditional" aspect to the "natural" aspect, as in line with increased scientific evidence and standardisation. This step aims to demonstrate the potential of more modern and clinically tested traditional medicines to the wider community, such as in the categories of Standardised Herbal Medicine (OHT) and Phytopharmaceuticals.

Traditional medicine policies play a crucial role in the sustainable management of genetic resources by addressing conservation, equitable use, and the integration of traditional knowledge into modern frameworks. Traditional medicine relies heavily on biological resources, particularly medicinal plants, which are integral to biodiversity conservation. Policies that encourage sustainable harvesting and cultivation practices help preserve these resources for future generations (Bhope & Gondhale-Karpe, 2025). Furthermore, the integration of traditional ecological knowledge, such as

sustainable harvesting and land management practices, has been shown to curb the extinction of medicinal plant species and maintain ecological balance (Sen & Bhakat, 2020). Traditional medicine policies often aim to protect the intellectual property rights of indigenous peoples, ensuring that their knowledge is not exploited without consent or compensation (Chapman, 2008). This encourages the ethical use and conservation of biological resources. Traditional medicine policies are increasingly aligned with global sustainability frameworks, such as the Sustainable Development Goals (SDGs) (Aslam & Kim, 2025), particularly in promoting sustainable health and well-being, environmental conservation, and social equity.

Traditional Medicine Development and Innovation Policy: Convergence of Traditional Knowledge Protection, Biological Resources, and Intellectual Property Rights Policies in the Context of National Medicine Self-Sufficiency

a. Traditional Medicine Development and Innovation Policy

In recent years, the need for more standardised traditional medicines based on scientific research has increased. Indonesia is known as a mega-biodiversity country, with more than 30,000 medicinal plant species, around 1,200 of which are used in traditional medicine**.** In addition, the tradition of consuming herbal medicines and concoctions is deeply rooted in the nation's culture, passed down from generation to generation by communities, customs, or local groups. However, most use of these medicinal plants remains empirical or based on traditional knowledge, rather than on measurable scientific evidence. As a result, medical and global recognition of Indonesian traditional herbal medicine remains limited. Traditional medicines that are not based on scientific standards will face safety, efficacy, and quality issues. The manufacture of traditional medicines without toxicity testing and dosage standards means that the safety of traditional medicines is at high risk of side effects from heavy metal contamination, pesticides, and microbes. Claims of efficacy based on empirical evidence are not sufficient to guarantee clinical effectiveness. Quality, harvesting methods, processing (extraction), and storage cause inconsistent production of traditional medicines. Therefore, standardising traditional medicines based on scientific research is primarily intended to ensure they are recognised as natural medicines that meet pharmaceutical requirements.

Scientific research is urgently needed to advance innovation and scientific development, bridging local wisdom and science. In addition, scientific research has a strategic role in the development and innovation of traditional medicine, as it (i) objectively proves empirical claims through the identification of active compounds, mechanisms of action, and pharmacological testing; (ii) ensures the safety, quality, and dosage of traditional medicines so that they can be widely used in health care facilities; (iii) opens up opportunities for innovation in the traditional medicine manufacturing process in extraction and modern formulation (phytopharmaceuticals) so as to

produce modern traditional medicines with high economic value; (iv) protects and develops traditional knowledge that can potentially obtain intellectual property rights and benefit-sharing for the communities where the traditional knowledge originated; and (iv) ensures the sustainable use of natural medicinal ingredients to preserve biodiversity and the environment.

The policy of innovation and development of traditional medicine based on scientific research is reinforced in Health Law No. 17 of 2023. This legal policy brings a major paradigm shift to the innovation and development of traditional medicine based on scientific research in Indonesia. The law places research, innovation, and development of traditional medicine-renamed natural medicine-as an integral part of the national health system. The legal policy related to this is set out in Article 322, stating that the public is given the widest possible opportunity to research, develop, produce, distribute, improve, and use pharmaceutical preparations and medical devices whose benefits and safety can be accounted for. The 2023 Health Law does not rely solely on empirical evidence, as is common with traditional herbal medicine, but requires scientifically verifiable evidence.

Every production and use of traditional medicine must be accountable for its benefits by supporting claims about its efficacy with empirical or scientific evidence. There are three types of evidence for claims about the efficacy of natural medicines or traditional medicines based on BPOM Regulation No. 30 of 2023: (1) Verification of Traditional Health Use Claims (Traditional Health Use) derived from documented traditional use and knowledge, (2) Proof of Traditional Claims for Treatment (Traditional Treatment) comes from documented traditional medicine; and (3) Proof of Scientifically Established Treatment comes from scientific data, namely mandatory evidence in the form of scientific data through preclinical and/or clinical data and additional evidence.

Scientific data from preclinical trials in accordance with BPOM Regulation No. 20 of 2023 or other internationally recognised guidelines such as the Organization for Economic Co-operation and Development (OECD) Guidelines. Clinical trial data are subject to the BPOM Regulation Guidelines governing the implementation of clinical trials (BPOM Regulation No. 8 of 2024) or to other internationally accepted guidelines, such as the ICH-GCP (International Conference on Harmonisation - Good Clinical Practice) Guidelines.

Every traditional medicine produced and distributed by the above business actors must meet the criteria of safety, efficacy, and quality as mandated under BPOM Regulation No. 25 concerning Criteria and Procedures for the Registration of Natural Medicine and BPOM Regulation No. 29 of 2023 concerning Safety and Quality Requirements for Natural Medicine. These mandatory criteria include (a) using ingredients that meet safety and quality requirements; (b) being manufactured using Good Traditional Manufacturing Practices (CPOTB) based on BPOM Regulation No.

25 of 2021 concerning CPOTB and Regulation No. 21 of 2022 concerning CPOTB in Stages; (c) meeting the requirements of the Indonesian Herbal Pharmacopoeia, official monographs, and/or scientific references or other recognised requirements; and (d) having efficacy that is proven empirically, traditionally, and/or scientifically. Empirical evidence is obtained from classical texts, pharmacopoeias, monographs, and/or scientific references or other recognised requirements. Meanwhile, scientific evidence is supported by preclinical and/or clinical data (safety data in the form of toxicity test results and/or pharmacodynamic data) and/or recognised scientific references.

This policy also regulates safety and quality standards for natural medicinal ingredients and their finished products, aiming to protect public health by preventing the circulation of traditional natural medicines that do not meet safety and quality requirements, which could endanger public health, and to support and facilitate innovation in the field of natural medicines in line with developments in science and technology. This provision also regulates the use of nanoparticle technology in the manufacture of OBA, the use of irradiation as a processing and sterilisation method, new traditional drug preparations such as aerosols, and limits on ethylene glycol, diethylene glycol, and microbial contamination, such as Escherichia coli. This regulation replaces BPOM Regulation No. 32 of 2019 and aims to protect public health and support innovation in natural medicine.

Safety and quality requirements for Natural Medicinal Ingredients that are not regulated in the Indonesian herbal pharmacopoeia or Indonesian medical materials may refer to (i) safety and quality requirements standards for Natural Medicinal Ingredients in the Indonesian pharmacopoeia or pharmacopoeia of other countries; (ii) safety and quality requirements standards for Natural Medicinal Ingredients that are internationally applicable; (iii) scientific references regarding recognised standards for the safety and quality requirements of Natural Medicinal Ingredients; and/or d. scientific data regarding valid standards for the safety and quality requirements of Natural Medicinal Ingredients.

b. Convergence of Policies on the Protection of Traditional Knowledge, Biological Resources, and Intellectual Property Rights

The policy on research, development, and innovation in traditional medicine provides direction for the scientific process aimed at increasing the added value, safety, efficacy, and quality of natural ingredients or traditional knowledge used as medicine. In this case, it is necessary to protect intellectual property rights over the results of research, development, and innovation of traditional medicines, which serves to prevent misuse or bio-piracy (Alamgir, 2017), while simultaneously providing economic benefits for researchers, communities that preserve traditional medicinal knowledge, and industry (Li, 2022). The results of basic research activities, such as the exploration of natural materials and ethnopharmacological knowledge from communities, become documentation of traditional knowledge and genetic resources

(GR) and can be protected as Communal Intellectual Property (CIP) as rights based on the provisions of the Copyright Law and Government Regulations on CIP, as well as Objects of Cultural Promotion based on the Cultural Promotion Law.

The documentation of traditional medicinal knowledge has not yet been integrated, unlike the documentation of Ayurveda through India's Traditional Knowledge Digital Library (TKDL). The documentation of traditional Indonesian medicinal knowledge is still scattered across several ministries, including the National Research and Innovation Agency (BRIN), through the Centre for Medicinal and Natural Materials Research and the Centre for Science, Technology, and Innovation Policy and Management Research. BRIN is responsible for inventorying and documenting the results of natural material research, managing genetic resource and traditional knowledge databases, and integrating with the patent and Access and Benefit-Sharing (ABS) systems (until such systems are in place). The Ministry of Health, through the Directorate of Traditional Health Services, has a database of Indonesian Traditional Medicines, the Indonesian Herbal Pharmacopoeia, and Indonesian Natural Medicine Monographs. The ministry is also developing a Traditional Health Services Information System (SIPT) and supports the empirical documentation of herbal medicine and traditional medicine through the Tawangmangu Centre for Research and Development of Medicinal Plants and Traditional Medicine (B2P2TOOT), which is now under BRIN. The Ministry of Environment and Forestry, through the Centre for Biodiversity Data and Information (PDIKH), manages a database of traditional knowledge related to the utilisation of local flora and fauna. The Directorate General of Intellectual Property (DJKI), through the Ministry of Law and Human Rights, manages the Traditional Knowledge and Traditional Cultural Expressions Database (PTEBT) as a form of defensive publication protection to prevent traditional knowledge from being unfairly patented by other parties. This system also serves as a reference for patent examiners, enabling Indonesian traditional knowledge to be recognised as prior art.

Activities related to the development of traditional medicines, particularly for the production of standardised herbal medicines (OHT) and phytopharmaceuticals, involve processes such as formulation, pre-clinical and clinical trials, and ingredient standardisation, which enable patent protection, provided the requirements for novelty are met. This includes patents for new formulas, processes, or preparations based on the 2016 Patent Law and the 2024 Amendment Law. Traditional medicine formula patents registered with the Directorate General of Intellectual Property Rights until 2025 remained low in number compared to the potential genetic resources and traditional knowledge, which accounted for 1089, while the most traditional medicine formula patents from Indonesia accounted for 809. Meanwhile, the number of registered traditional medicine composition patents from Indonesia was 1,261 (the highest) out of a total of 5,226. There are 24 traditional medicines that have undergone

clinical trials 1 and 2, or phytopharmaceuticals that have been registered, but there are only two patents, and six of the processes have been withdrawn (Direktoral Jenderal Kekayaan Intelektual: Pusat Data Kekayaan Intelektual (Paten), 2025). During the protection period (10 years for simple patents and 20 years for regular patents), patent holders can exploit their patent rights. Under the Patent Law Amendment, drug inventions do not have to produce new compounds or active substances; as long as the drug's formula or composition improves efficacy or has new uses, the invention can be patented. On the one hand, this provision can encourage research activities among MSMEs and novice researchers. On the other hand, it may leave room for exploitation by large pharmaceutical companies to engage in evergreening practices. For the traditional medicine development and innovation industry, commercialisation requires security through trademark protection, industrial design, or trade secrets. In addition, traditional medicine knowledge documentation may obtain geographical indication protection, which describes production originating from the characteristics of traditional medicinal knowledge from a specific geographical community, such as Madura herbal medicine or Red Medicine from Papua.

Research, development, and innovation activities related to traditional medicine that obtain intellectual property rights protection will provide economic incentives for communities that possess traditional medicinal knowledge through benefit-sharing from the commercial use of that knowledge (Ngang & Ageh, 2019). Researchers/research institutions receive royalties and licences when traditional medicine knowledge is developed into standardised herbal medicines or phytopharmaceuticals, or through research contracts with industry for further development. The industry, as the party that utilises the results of research, development, and innovation of traditional medicines that have obtained intellectual property rights protection, will gain economic added value, competitiveness or comparative advantage, and market loyalty.

The institutions responsible for policies on the development and innovation of traditional medicines in relation to the protection of traditional knowledge, genetic resources, and intellectual property rights, are the National Research Agency (BRIN), the Ministry of Health and Food and Drug Control, the Ministry of Environment and Forestry, the Ministry of Agriculture, the Ministry of Law and Culture, the Ministry of Industry, and the Ministry of Villages. BRIN has the authority as the national research organiser and genetic resource manager for research and development, and, therefore, plays the following roles: conducting research on natural materials, medicinal plants, and phytopharmaceuticals; compiling a database of genetic resources and traditional knowledge; managing research licensing based on Access and Benefit-Sharing (ABS) in accordance with the Nagoya Protocol; and promoting the commercialisation of research results through partnerships with industry.

The Ministry of Health is authorised to develop, supervise, and utilise traditional medicines in the national health system, with its roles in developing policies on the scientification of herbal medicines and the Indonesian Traditional Medicine Formulary *(FROTI);* encouraging clinical research on natural medicines to become OHT and phytopharmaceuticals; and integrating the use of traditional medicines into health services. BPOM has the authority to regulate and supervise the safety, quality, and benefits of traditional medicines, OHT, and phytopharmaceuticals, with its roles in establishing guidelines for pre-clinical and clinical trials of traditional medicines, product registration and raw material standardisation, and post-market surveillance.

The Ministry of Law and Human Rights-Directorate General of Intellectual Property (DJKI) has the authority to provide legal protection for intellectual property, including patents, trademarks, geographical indications, and traditional knowledge, and, therefore, is responsible for managing the National Database of Traditional Knowledge and Genetic Resources, rejecting patents derived from traditional knowledge without disclosure of origin, and facilitating the protection of geographical indications and the collective rights of indigenous peoples. The Ministry of Environment and Forestry has the authority to conserve biodiversity and regulate access to genetic resources, including granting permits for the collection of genetic material from forests or conservation areas and implementing the Access and Benefit-Sharing (ABS) mechanism at the ecosystem level.

The Ministry of Agriculture has the authority to develop and standardise medicinal plants and biopharmaceuticals, including promoting Good Agricultural Practices (GAP) and Good Post-Harvest Practices (GPHP); providing superior varieties of medicinal plants; and supporting the upstream supply of traditional medicinal raw materials. The Ministry of Industry has the authority to develop the pharmaceutical industry, especially natural-based phytopharmaceuticals, with its role in encouraging the downstreaming of research results into commercial products and facilitating bio-industrial innovation hubs for the development of natural medicines. The Ministry of Villages, Disadvantaged Regions, and Transmigration (Kemendesa PDTT) has the authority to empower the rural economy based on local potential, with a role in supporting the development of Medicinal and Aromatic Plant Centres (STOA) in villages, especially in villages with biodiversity potential and encouraging the involvement of indigenous peoples/farmers in the medicinal ingredient supply chain.

These normative policies and the division of ministerial roles demonstrate that Indonesia has a comprehensive institutional structure for the development of traditional medicine. However, observations indicate institutional framing, gaps between upstream and downstream policies, and disharmony between regulation and implementation. Institutional fragmentation is characterised by numerous institutions playing roles, yet coordination remains sectoral. This is evident in each ministry

carrying out its mandate separately, without strong policy integration, without a leading sector to provide comprehensive coordination, without duplication of programmes between ministries, and with differing policy priorities. The gap in upstream-downstream policy integration is evident in the gap between research, policy, and industry processes. For example, research conducted by the National Research and Innovation Agency is not always aligned with industry needs, research results are not automatically adopted by the Ministry of Industry of the Republic of Indonesia, and the resulting products are not yet integrated into the services provided by the Ministry of Health of the Republic of Indonesia.

This disharmony in regulation and implementation is also evident in weak coordination across uncorrelated regulatory areas, such as BPOM focusing on product safety and quality, the Ministry of Health of the Republic of Indonesia focusing on health services, and the Ministry of Environment and Forestry focusing on conservation. However, the regulation lacks an integrated mechanism that links all these aspects into a single policy framework. As a result, the regulation operates partially, implementation is asynchronous, and oversight is incomplete. Furthermore, coordination to protect traditional medicinal knowledge and ABS is weak, and procedural regulations governing these mechanisms are absent. This is evident in the fact that the Ministry of Environment and Forestry regulates genetic resources, the Ministry of Law and Human Rights regulates intellectual property rights, and indigenous communities, the holders of this knowledge, are outside the formal coordination system. Consequently, benefit-sharing is suboptimal, indigenous communities are not the primary actors, and the protection of traditional knowledge is merely administrative rather than substantive.

c. Development and Innovation of Traditional Medicines: Convergence of Policies on the Protection of Traditional Knowledge, Biological Resources, and Intellectual Property Rights in the Context of National Drug Self-Sufficiency

Traditional medicine innovation policy concerns the convergence of traditional knowledge protection, genetic resources, and intellectual property in the context of medical independence. This shows how traditional medicine research and development policies align with traditional knowledge and genetic resource protection policies and how they are strengthened through the intellectual property rights system. With this, research results can provide fair economic benefits to the community while promoting national self-sufficiency in medicine. Traditional knowledge protection policies, as shown in Table 1, serve to provide an initial foundation for researchers to identify traditional recipes, medicinal plants, and ethnomedical practices. Traditional knowledge protection policies ensure that research is conducted with the consent of indigenous communities (prior informed consent/PIC), avoids biopiracy, and respects communal rights (Mayastuti & Purwadi, 2025).

Genetic resources are biological resources for traditional medicine research and development, and genetic resource protection policies serve to ensure that research policies are carried out through legal access to biological resources. Access permits are granted through mutual transfer agreements (MTAs), mutual benefit agreements, or mutual agreement terms (MATs), which are legal documents regarding biological resources. This policy prevents the illegal extraction of genetic resources and ensures that research and development provide fairness and benefits to the communities where the genetic resources originate, as well as the sustainable use of genetic resources (Ijinu, Rajasekharan, George, & Pushpangadan, 2023).

Intellectual property rights policies govern traditional knowledge recorded as prior art to prevent it from being unfairly patented by other parties. Intellectual property rights policies encourage and protect researchers in discovering new extraction processes, new formulations, and innovations in herbal technology, ensuring they can obtain patent rights. In addition to its function, intellectual property rights policy protects the results of traditional medicine research and prevents unilateral claims by foreign parties. In addition, intellectual property rights over the results of traditional medicine development can help protect the rights of traditional healers by ensuring fair compensation and benefit-sharing (Willcox et al., 2015).

The convergence of traditional knowledge, genetic resources, and traditional medicine development and innovation policies aims to support national drug self-sufficiency, as convergence policies are expected to promote national pharmaceutical resilience by replacing imported chemical drug ingredients with local natural ingredients and establishing biodiversity-based drug supply chains, reinforcing the National Health System by making the strengthening of national phytopharmaceuticals part of the National Formulary, and providing traditional medicines as evidence-based treatment alternatives.

In addition, convergence also promotes the sovereignty of raw material resources by (i) ensuring the sustainable use of protected local medicinal plants and preventing the loss of germplasm due to foreign exploitation; (ii) promoting innovation based on local wisdom by encouraging the development of pharmaceutical and phytopharmaceutical products derived from scientifically verified traditional knowledge and increasing local economic value; and (iii) maintaining the security and sustainability of supply by strengthening the ABS system to ensure equitable benefit-sharing for local communities, thereby maintaining the sustainability of medicinal plant cultivation and reducing dependence on imported pharmaceutical raw materials.

The convergence of traditional knowledge, genetic resources, and traditional medicine development and innovation policies can be analysed from the perspective of bioeconomic theory. Bioeconomic theory is an economic approach that focuses on the sustainable use of biological resources to support production, distribution, and consumption. This concept integrates biological processes with economics to create a

more environmentally friendly and efficient model. The bioeconomy encompasses various sectors such as agriculture, fisheries, forestry, and biotechnology, with the primary goal of optimising the interaction between biological and economic processes to generate social, economic, and environmental benefits (Clark, 2018; Merritt & Vilchis-Flores, 2025). The convergence of traditional knowledge, genetic resources, and the development and innovation of Indonesian policies is in line with the application of the bioeconomy theory, which refers to an economic system that utilises renewable biological resources, such as food crops, forests, and microorganisms, to produce a variety of products and services (Aguilar, Twardowski, & Wohlgemuth, 2019). Bioeconomy drives innovation through the integration of the value chain of biotechnology stakeholders, from the cultivation of medicinal plants and harvesting, through pharmacological evaluation and processing with quality and efficacy control, to intellectual property rights protection, and finally to the marketing and distribution of the final product through effective marketing strategies and distribution networks. An effective distribution network is crucial for reaching a broader market (Vieira, Leal, & Calado, 2020). This can lead to the development of innovative circular business models and enhance production efficiency, economic value, and the competitiveness of traditional medicines.

CONCLUSION

Although Indonesia has issued various policies to encourage the development and innovation of traditional medicine, key challenges remain in standardisation, regulatory clarity, funding, research infrastructure, academia-industry collaboration, and public perception. Standardisation is particularly challenging, given that herbal products require consistent standards for raw materials, extraction, formulation, and clinical testing. Furthermore, manufacturers are required to develop and validate product-specific quality assessment methods, while ingredient variability across sources makes it difficult to ensure safety, efficacy, consistency, and uniformity, particularly for traditional herbal products. Regulatory implementation is also challenging; its framework is complex and often interpreted differently, creating confusion for traditional medicine industry players and researchers. Regulations on the protection of traditional knowledge lack clear operational mechanisms (e.g., benefit-sharing and requirements for foreign research), and regulations on the transfer of genetic material and commercial use require clearer approvals, monitoring, and sanctions to prevent exploitation that harms the community that holds the knowledge.

In Indonesia, the policy for developing traditional medicine innovation is linked to the protection of traditional knowledge, genetic resources, and intellectual property. The main problem lies not in the absence of regulations, but in policy incoherence in the development of traditional medicine and in governance failure, stemming from an absence of integrated policy design, weak intersectoral integration, and ineffective institutional coordination. A bioeconomic approach is needed because it treats

traditional knowledge, genetic resources, and innovation as a unified value system oriented not only towards economic growth but also towards sustainability and distributional justice. Therefore, the policy for traditional medicine innovation and intellectual property rights protection in Indonesia must be reconstructed from a sectoral approach to an integrative, adaptive, and community-based approach.

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REFERENCES

Adams, J., Chung, V., Dubois, J., & Rodondi, P. Y. (2023). The Significance of Traditional and Complementary Medicine to Self-Care. *Journal of Integrative and Complementary Medicine*. https://doi.org/10.1089/jicm.2023.0004

Adhikari, P. P., & Paul, S. B. (2018). History of Indian traditional medicine: A medical inheritance. *Asian Journal of Pharmaceutical and Clinical Research*, *11*(1), 421–426. https://doi.org/10.22159/ajpcr.2018.v11i1.21893

Adhiyatma, M. T., & Roisah, K. (2020). Legal Protection for Traditional Medicine Knowledge of Paliasa Leaves in Traditional Community of South Sulawesi Through Intellectual Property Regime. Law Reform: Jurnal Pembaharuan Hukum, 16(2), 290–306. https://doi.org/10.14710/lr.v16i2.33782

Agrawal, A., Sharma, A., Mathur, M., Sharma, A., Modi, G., & Patel, T. (2023). Perspective toward complementary and alternative medicines in the prevention of COVID-19 infection. *Indian Journal of Community Medicine*, *48*(3), 401–406. https://doi.org/10.4103/ijcm.ijcm_282_22

Aguilar, A., Twardowski, T., & Wohlgemuth, R. (2019). Bioeconomy for Sustainable Development. *Biotechnology Journal*. https://doi.org/10.1002/biot.201800638

Akarasereenont, P., Datiles, M. J. R., Lumlerdkij, N., Yaakob, H., Prieto, J. M., & Heinrich, M. (2015). A south-east asian perspective on ethnopharmacology. In *Ethnopharmacology* (pp. 317–331). Wiley. https://doi.org/10.1002/9781118930717.ch27

Alamgir, A. N. M. (2017). Intellectual property (IP) and intellectual property right (IPR), traditional knowledge (TK) and protection of traditional medical

knowledge (TMK). In *Progress in Drug Research* (Vol. 73, pp. 515–528). Birkhauser Verlag AG. https://doi.org/10.1007/978-3-319-63862-1_12

Al-Fatih, S. (2023). Perkembangan metode penelitian hukum di Indonesia. UMMPress.

Andanda, P. (2012). Striking a balance between intellectual property protection of traditional knowledge, cultural preservation and access to knowledge. *Journal of Intellectual Property Rights*, *17*(6), 547–558. https://doi.org/10.2139/ssrn.2718887

Andersen, R., & Winge, T. (2013). *Realising Farmers' Rights to Crop Genetic Resources: Success Stories and Best Practices.* Taylor and Francis. https://doi.org/10.4324/9780203078907

Anwarul Hassan Gilani & Atta-ur-Rahman. (2005). Trends in ethnopharmacology. *Journal of Ethnopharmacology*, *100*(1–2), 43–49. https://doi.org/10.1016/j.jep.2005.06.001

Aslam, M. S., & Kim, Y. J. (2025). Bridging traditional Chinese medicine and sustainable development in Malaysia. *Discover Sustainability*, *7*(1), 117. https://doi.org/10.1007/s43621-025-02467-0

Aston Philander, L. (2011). An ethnobotany of Western Cape Rasta bush medicine. *Journal of Ethnopharmacology*, *138*(2), 578–594. https://doi.org/10.1016/j.jep.2011.10.004

Badan Kebijakan Kementerian Kesehatan. (2022). Fitofarmaka menjadi unggulan produk dalam negeri. Retrieved from https://www.badankebijakan.kemkes.go.id/fitofarmaka-menjadi-unggulan-produk-dalam-negeri/

Bhope, S., & Gondhale-Karpe, P. (2025). Supply Chain Management of Herbal Medicines. In S. Kulkarni, A. K. Haghi, O. M. Bagade, & B. Kumar (Eds), *Ecotoxicity and Herbal Health: A Symbiotic Approach* (pp. 383–410). Boca Raton: Apple Academic Press. https://doi.org/10.1201/9781779640437-12

Callo-Müller, M. V., Ortega Sanabria, D. F., & Remigio, A. M. (2024). The WIPO Treaty on Intellectual Property, Genetic Resources and Associated Traditional Knowledge: Situating a Landmark Development in International Intellectual Property Governance. *GRUR International*, *73*(12), 1128–1136. Scopus. https://doi.org/10.1093/grurint/ikae140

Chander, A. R. R., Tan, T. G., & Zaman, R. (2025). Herbal medicine and non-hospital utilisation in Malaysia during the COVID-19 pandemic. *Discover Public Health*, *22*, 107. https://doi.org/10.1186/s12982-025-00498-6

Chapman, T. (2008). The role, use of and requirement for traditional ecological knowledge in bioprospecting and bio banking biodiversity conservation schemes. *Environmental and Planning Law Journal*, *25*, 196–217.

Chaturvedi, S. (2023). Repatriation of traditional knowledge through the lens of international legal instruments. In *Crop Sustainability and Intellectual Property Rights*

(pp. 293–311). Apple Academic Press. https://doi.org/10.1201/9781003383024-15

Che, C. T., George, V., Ijinu, T. P., Pushpangadan, P., & Andrae-Marobela, K. (2023). Traditional medicine. In *Pharmacognosy: Fundamentals, applications, and strategies* (2nd ed., pp. 11–28). Academic Press. https://doi.org/10.1016/B978-0-443-18657-8.00031-3

Clair, S., Kirk, R., Coulter, I. D., & Saller, R. (2023). A Pragmatic Historical Assessment Tool. *Complementary Medicine Research*, *30*(4), 340–353. https://doi.org/10.1159/000531021

Clark, C. W. (2018). Bioeconomics. In *The New Palgrave Dictionary of Economics* (pp. 951–953). London: Palgrave Macmillan UK. https://doi.org/10.1057/978-1-349-95189-5_602

De Santana, B. F., Voeks, R. A., & Funch, L. S. (2016). Ethnomedicinal survey of a maroon community in Brazil's Atlantic tropical forest. *Journal of Ethnopharmacology*, *181*, 37–49. https://doi.org/10.1016/j.jep.2016.01.014

Dharmawan, N. K. S., Kasih, D. P. D., Samsithawrati, P. A., Dwijayanthi, P. T., Salain, M. S. P. D., Mahaswari, M., … Moisa, R. V. (2023). Quo Vadis Traditional Cultural Expressions Protection: Threats from Personal Intellectual Property and Artificial Intelligence. *Law Reform: Jurnal Pembaharuan Hukum*, 19(2), 321–343. https://doi.org/10.14710/lr.v19i2.58639

Dilixiati, D., & Song, X. (2023). Benefit-sharing model of traditional knowledge based on substantive fairness in China. *Queen Mary Journal of Intellectual Property*, *13*(1), 75–96. https://doi.org/10.4337/qmjip.2023.01.04

Direktoral Jenderal Kekayaan Intelektual: Pusat Data Kekayaan Intelektual (Paten). (2025). Retrieved from https://pdki-indonesia.dgip.go.id/detail/e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855

Dutfield, G. (2005). Legal and economic aspects of traditional knowledge. In *International Public Goods and Transfer of Technology Under a Globalized Intellectual Property Regime*. https://doi.org/10.1017/CBO9780511494529.025

Flach, J., Ribeiro, C. dos S., van der Waal, M. B., van der Waal, R. X., Claassen, E., & van de Burgwal, L. H. M. (2019). The Nagoya Protocol on Access to Genetic Resources and Benefit Sharing: Best practices for users of Lactic Acid Bacteria. *PharmaNutrition*, *9*.

Friso, F., Mendive, F., Soffiato, M., Bombardelli, V., Hesketh, A., & Heinrich, M. (2020). Implementation of Nagoya Protocol on access and benefit-sharing in Peru: Implications for researchers. *Journal of Ethnopharmacology*, *259*.

Frison, C., López, F., & Esquinas-Alcázar, J. T. (Eds.). (2012). *Plant genetic resources and food security: Stakeholder perspectives on the International Treaty on Plant Genetic Resources for Food and Agriculture*. London: Earthscan.

Hirwade, M., & Hirwade, A. (2012). Traditional knowledge protection: An Indian prospective. *DESIDOC Journal of Library and Information Technology*, *32*(3), 240–248. https://doi.org/10.14429/djlit.32.3.2381

Ho, C. M. (2011). *Access to medicine in the global economy: International agreements on patents and related rights*. New York: Oxford University Press.

Ijinu, T. P., Rajasekharan, S., George, V., & Pushpangadan, P. (2023). Access and Benefit Sharing in Indigenous Knowledge Stewardship and Sustainable Development. In *Biodiversity Conservation Through Access and Benefit Sharing (ABS): Himalayas and Indian Sub-Continent* (pp. 163–185). Springer International Publishing. https://doi.org/10.1007/978-3-031-16186-5_8

Jana, D., Guchhait, K. C., Ballav, S., Panda, A. K., & Ghosh, C. (2021). Traditional herbal medicine practiced in plateau-fringe and Rarh districts of West Bengal, India. In *Evidence-Based Validation of Traditional Medicines: A Comprehensive Approach* (pp. 1019–1089). Springer Singapore. https://doi.org/10.1007/978-981-15-8127-4_48

Joshi, E., Patodi, E., & Broome, A. P. (2025). India's access and benefit-sharing framework: Critical assessment of legal protection for traditional knowledge holders and local communities. *Journal of Intellectual Property Rights*, *30*(1), 45–58.

Khaira Ummah Junaedi Putri. (2025). Data industri farmasi Indonesia: Panduan lengkap. Retrieved from https://id.techinasia.com/data-industri-farmasi-indonesia-panduan-lengkap

Kumar, H. K. S., Mishra, P., Banerjee, M., Acharyya, S., & Behera, B. (2025). A historical perspective on botanical remedies for neurodegenerative disorders. In *Natural Solutions for Neurodegenerative Disorders: Exploring Botanical Remedies*. Nova Science Publishers, Inc.

Kumari, P., Singh, R., & Yadav, A. K. (2021). Traditional knowledge: Documentation, protection and sustainable utilization. *Journal of Traditional and Complementary Medicine*, *11*(4), 305–312. https://doi.org/10.1016/j.jtcme.2021.03.001

Kuppuswamy, C. (2020). The ethics of intellectual property rights: The impact of traditional knowledge and health on international intellectual property law. In *Asian Medicine*. Brill Academic Publishers. https://doi.org/10.1163/157342109X568847

Lai, J. C., Robinson, D. F., Stirrup, T., & Tualima, H. Y. (2019). Māori knowledge under the microscope: Appropriation and patenting of mātauranga Māori and related resources. *Journal of World Intellectual Property*, *22*(3–4), 205–233. https://doi.org/10.1111/jwip.12125

Li, H. (2022). Enlightenment of European and American drug non-patent protection mechanism on protection of traditional Chinese medicine innovation and improved varieties. *Chinese Traditional and Herbal Drugs*, *53*(19), 6306–6312. https://doi.org/10.7501/j.issn.0253-2670.2022.19.035

Liu, K., Liu, Y., Tang, Q., Niu, Z., & Luo, Y. (2019). Intellectual property rights and access to medicine in the traditional Chinese medicine legal system: From a Chinese perspective. *Medicine and Law*, *38*(3), 443–460.

Lu, C.-L., Zheng, R.-X., Xue, X., Zhang, X.-W., Liu, X.-H., Jin, X.-Y., … Liu, J.-P. (2021). Traditional Chinese medicine for COVID-19 pandemic and emerging challenges: An online cross-sectional survey in China. *Complementary and Alternative Medicine for the COVID-19 Pandemic: Current Evidence and Emerging Challenges*, *10*, 100798. https://doi.org/10.1016/j.imr.2021.100798

Masrur, D. R., Yulia, Y., Zainol, Z. A., & Akpoviri, F. I. (2024). Biopiracy and the Regulatory Framework for Material Transfer Agreements in Indonesia. Law Reform: Jurnal Pembaharuan Hukum, 20(1), 76–105. https://doi.org/10.14710/lr.v20i1.57001

Mayastuti, A., & Purwadi, H. (2025). *Protection of Indonesia's biodiversity against biopiracy through adoption of Traditional Knowledge Digital Library*. Presented at the IOP Conference Series: Earth and Environmental Science. https://doi.org/10.1088/1755-1315/1438/1/012066

Mcneely, J. A., Rojas, M., & Martinet, C. (1995). The Convention on Biological Diversity: Promise and Frustration. *The Journal of Environment & Development*, *4*(2), 33–53.

Menon, R., Sharma, P., & Kumar, S. (2023). Traditional ecological knowledge: Adaptation, resilience and protection of indigenous communities. *Environmental Sustainability*, *6*(2), 215–228. https://doi.org/10.1007/s42398-023-00270-z

Merritt, H., & Vilchis-Flores, J. C. (2025). Exploring Public Perceptions of the Bioeconomy in the Global South: A Public Policy Approach. In M. C. Ogwu, S. C. Izah, H. Merritt, R. D. Wise, & A. Jintrawet (Eds), *Sustainable Bioeconomy Development in the Global South: Volume I Status and Perspectives* (pp. 401–423). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-96-0640-5_15

Muhaimin. (2022, June 25). Pengembangan obat berbasis bahan alam memerlukan tahapan yang panjang. Retrieved from Ceramah Virtual Dewan Guru Besar Universitas Padjadjaran website: https://www.unpad.ac.id/2022/06/penemuan-obat-berbasis-bahan-alam-memerlukan-tahapan-yang-panjang/

Ngang, C. C., & Ageh, P. A. (2019). Intellectual property protection of African traditional medicine within the legal framework of the right to development. *African Journal of International and Comparative Law*, *27*(3), 426–445. https://doi.org/10.3366/ajicl.2019.0282

Oriakhogba, D. O., Ndlovu, L., & Mugabe, J. C. (2023). Constitutional and international legal framework for the protection of genetic resources and

associated traditional knowledge: A South African perspective. *International Journal of Intellectual Property Management*, *1*(1). https://doi.org/10.1504/ijipm.2023.10062841

Park, T. J. (2025). Innovative provisions for compliance in the recent WIPO treaty. *Trends in Biotechnology*. https://doi.org/10.1016/j.tibtech.2025.06.021

Rani, D. M., Wongso, H., Purwoko, R. Y., Winarto, N. B., Shalas, A. F., Triatmoko, B., … Nugraha, A. S. (2023). Anti-cancer bioprospecting on medicinal plants from Indonesia: A review. *Phytochemistry*, *216*, 113881. https://doi.org/10.1016/j.phytochem.2023.113881

Relly, E. (2024). Genetic resources governance in Brazil: Stakeholder inclusion and the evolving role of CGen. *Journal of World Intellectual Property*, *27*(1), 88–109. https://doi.org/10.1111/jwip.12289

Rohaini. (2015). Perlindungan hukum terhadap pengetahuan tradisional berbasis sumber daya genetik (Studi tentang pemanfaatan bagi hasil dalam Konvensi Keanekaragaman Hayati). *Fiat Justisia: Jurnal Ilmu Hukum*, *9*(4), 1–22. https://doi.org/10.25041/fiatjustisia.v9no4.609

Roisah, K. (2021). *Perlindungan ekspresi budaya tradisional: Perspektif hukum internasional dan nasional*. Semarang: Yoga Pratama.

Roisah, K., Rahayu, R., Al Asy'arie, Moh. A. H., Mitskaya, E., & Wahyudi, B. F. H. (2025). Empowering Cultural Communities in Protecting Traditional Expressions: Legal Challenges in the Digital Age. Diponegoro Law Review, 10(2), 134–156. Retrieved from https://ejournal.undip.ac.id/index.php/dlr/article/view/73534

Saxena, A., & Rao, V. R. (2023). Traditional knowledge systems: Evolution, transmission and protection. *Indian Journal of Traditional Knowledge*, *22*(3), 471–482.

Selvakumar, S., & Valliammai, R. (2016). High performance liquid chromatographic (HPLC) analysis of a herbal formulation ACTP. *International Journal of ChemTech Research*, *9*(1), 175–178.

Sen, U. K., & Bhakat, R. K. (2020). Role of Traditional Ethnobotanical Knowledge: Culture and Indigenous Institutions in Medicinal Plant Conservation. In A. Akash, N. Navneet, & B. Bhandari (Eds), *Ethnomedicinal Plant Use and Practice in Traditional Medicine* (pp. 58–80). IGI Global Scientific Publishing. https://doi.org/10.4018/978-1-7998-1320-0.ch004

Setyawan, A. D., Setyaningsih, R., & Murti, W. B. (2021). Perlindungan hukum pengetahuan tradisional sebagai objek pemajuan kebudayaan di Indonesia. *Jurnal Hukum & Pembangunan*, *51*(2), 367–390.

Srivastava, C., & Rana, M. (2020). Easily accessible treasure susceptible to misappropriation: A discourse on traditional knowledge. *Journal of Intellectual Property Rights*, *25*(5), 155–161. https://doi.org/10.56042/jipr.v25i5.32810

Sujatmiko, B. (2021). Pengetahuan tradisional dan kearifan lokal dalam sistem nasional ilmu pengetahuan dan teknologi Indonesia. *Jurnal Penelitian Hukum De Jure*, *21*(3), 357–374. https://doi.org/10.30641/dejure.2021.V21.357-374

Sun, J., Liu, B., Rustiami, H., Xiao, H., Shen, X., & Ma, K. (2024). Mapping Asia plants: Plant diversity and a checklist of vascular plants in Indonesia. *Plants*, *13*(16), 2281. https://doi.org/10.3390/plants13162281

Surya, R., Romulo, A., Nurkolis, F., & Kumalawati, D. A. (2024). Compositions and health benefits of different types of jamu, traditional medicinal drinks popular in Indonesia. In *Reference Series in Phytochemistry* (Vol. 2024, pp. 1–33). Springer Science and Business Media B.V. https://doi.org/10.1007/978-3-031-04195-2_123-1

Susanti, R., & Zuhud, E. A. M. (2019). Traditional ecological knowledge and biodiversity conservation: The medicinal plants of the Dayak Krayan people in Kayan Mentarang National Park, Indonesia. *Biodiversitas*, *20*(9), 2764–2779. https://doi.org/10.13057/biodiv/d200943

Taubman, A. (2005). Saving the Village: Conserving Jurisprudential Diversity in the International Protection of Traditional Knowledge. In K. E. Maskus & J. H. Reichman (Eds), *International Public Goods and Transfer of Technology Under a Globalized Intellectual Property Regime* (pp. 521–564). Cambridge: Cambridge University Press. Cambridge Core. https://doi.org/10.1017/CBO9780511494529.026

Thathong, S. (2014). Lost in fragmentation: The traditional knowledge debate revisited. *Asian Journal of International Law*, *4*(2), 359–389. https://doi.org/10.1017/S2044251313000350

Torri, M. C. (2012). The emergence of traditional Indonesian herbal medicine (jamu) for cosmetic use: New avenues for the revitalisation of Javanese health and cosmetic traditions through gender entrepreneurship? *International Journal of Entrepreneurship and Small Business*, *16*(1), 48–59. https://doi.org/10.1504/IJESB.2012.046916

Turner, N. J., Cuerrier, A., & Joseph, L. (2022). Well grounded: Indigenous peoples' knowledge, ethnobiology and sustainability. *Journal of Ethnobiology*, *42*(2), 115–145. https://doi.org/10.2993/0278-0771-42.2.115

Vieira, H., Leal, M. C., & Calado, R. (2020). Fifty Shades of Blue: How Blue Biotechnology is Shaping the Bioeconomy. *Trends in Biotechnology*. https://doi.org/10.1016/j.tibtech.2020.03.011

von Lewinski, S. (Ed.). (2008). *Indigenous Heritage and Intellectual Property: Genetic Resources, Traditional Knowledge and Folklore* (2nd edn). Netherlands: Kluwer Law International.

Waimer, F., Torres-Londoño, P., Stekly, G., Wahrenburg, F., & Steinhoff, B. (2018). Implementation of the Nagoya Protocol: Recommendations of the German

Medicines Manufacturers Association (BAH) for a Good Practice Guide regarding Regulation (EU) No 511/2014 of 16 Apr 2014. *Pharmazeutische Industrie*, *80*(12), 1662–1667.

Widayanti, T. F., Djafar, E. M., Hakim, M. Z., Rivanie, S. S., & Ashri, M. (2022). *Legal protection concerning marine environment and coastal areas in Indonesia based on the convention on biological diversity (CBD)*. *1119*. https://doi.org/10.1088/1755-1315/1119/1/012006

Willcox, M., Diallo, D., Sanogo, R., Giani, S., Graz, B., Falquet, J., & Bodeker, G. (2015). Intellectual property rights, benefit-sharing and development of improved traditional medicines: A new approach. *Journal of Ethnopharmacology*, *176*, 281–285. https://doi.org/10.1016/j.jep.2015.10.041

World Health Organization. (2025). *WHO Traditional Medicine Strategy 2025–2034*. Geneva: World Health Organization.

World Intellectual Property Organization (WIPO). (2011). *The Protection of Traditional Cultural Expressions: Draft Articles* [WIPO/GRTKF/IC/19/4]. Geneva. Retrieved from https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_19/wipo_grtkf_ic_19_4.pdf

Yu, P. K. (2024). WIPO Negotiations on Intellectual Property, Genetic Resources and Associated Traditional Knowledge. *Akron Law Review*, *3*(2), 10829–10836.

Yuan, H., Ma, Q., Ye, L., & Piao, G. (2016). The traditional medicine and modern medicine from natural products. *Molecules*, *21*(5), 559. https://doi.org/10.3390/molecules21050559

Yulia, Y., & Saputra, J. (2021). An Investigation of Biodiversity and Genetic Resources: The Importance of Legal Protection in Indonesia. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 2511–2512.

Zaim, S. N. N., Idris, D. R., & Abdul Rahman, H. (2024). COVID-19 home remedy consumption and perceived effectiveness among adult population in Brunei Darussalam: A PLS-SEM approach. *BMC Complementary Medicine and Therapies*, *24*(1). https://doi.org/10.1186/s12906-024-04374-9

Zhang, Y., Tian, X., & Chen, Z. (2025). Policy research on role of traditional medicine in emergency health system construction. *BMC Complementary Medicine and Therapies*, *25*, 4. https://doi.org/10.1186/s12906-024-04743-4