

Traditional Ecological Knowledge of the Jah Hut Community, Kuala Krau, Temerloh and Their Use of Forest Resources

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Received: 22 February 2025 | Accepted: 10 June 2025 | Published: 30 June 2025

DOI: <https://doi.org/10.55057/ajress.2025.7.5.47>

Abstract: *This paper investigates the sustainable living methods and traditional knowledge of the Jah Hut community in Kuala Krau, Temerloh. One of the indigenous Orang Asli subgroups in Peninsular Malaysia, the Jah Hut people have a tight interaction with their surroundings using subsistence agriculture, forest resource use, and traditional handicrafts. Using a qualitative ethnographic method, the data were gathered from field observations and semi-structured interviews with three main informants: a bamboo harvester, a rattan weaver, and a village leader. Results show that bamboo and rattan crafts, especially lidi sticks used in food preparation, reflect both cultural legacy and significant revenue sources. Reflecting the dedication of the community to food security and environmental sustainability, traditional farming methods, including rice growing and empeng (pounded rice) preservation, are shown. The neighborhood, however, struggles constantly with things like restricted access to markets, healthcare, and formal education. Health issues related to long-standing cultural traditions like betel nut chewing also add to the complexity of development initiatives. While preserving the Jah Hut's cultural legacy, the research emphasises the need to support indigenous livelihoods employing inclusive policies, sustainable agricultural initiatives, and better healthcare access.*

Keywords: Jah Hut, orang asli, local knowledge, local wisdom, indigenous knowledge

1. Introduction

Traditional Ecological Knowledge (TEK) is broadly defined as a cumulative body of knowledge, practices, and beliefs evolving by adaptive processes and handed down through generations by cultural transmission (Berkes, 2012). As eloquently phrased by Inglis (1993), “TEK represents experience acquired over thousands of years of direct human contact with the environment (p.1)”. Rooted in long-term interactions with the land, TEK is dynamic and adaptive, guiding how indigenous peoples understand, manage, and sustain their natural surroundings. This knowledge extends beyond mere survival techniques. It encompasses spiritual values, cultural norms, and ethical responsibilities toward the environment.

In indigenous societies, TEK forms the foundation for sustainable living. It is intricately woven into daily activities such as farming, food preservation, herbal medicine and craftsmanship.

This perspective is echoed by Sumarwati (2022) who highlights that TEK involves “knowledge, practice, and beliefs based on food issues maintenance, such as the origin of food, farming and harvesting procedures, pests’ control, harvest management, and disaster management (p. 2)”. These forms of knowledge are vital not only for ensuring daily survival and food self-sufficiency but also for maintaining the community’s cultural identity and adaptive strategies in the face of ecological and socio-economic changes.

In Malaysia, the *Orang Asli*, indigenous peoples of Peninsular Malaysia, embody these principles in their daily lives. Among them, the Jah Hut community of Kuala Krau, Temerloh, is known for its enduring connection to the forest and environment. Chin (2024) noted that many *Orang Asli* still live in forest regions and follow conventional ways of life strongly shaped by the environment and the habits of their ancestors. Ng et al. (2018) said that *Orang Asli* usually “linked with various agroforestry practices including home gardening, forest garden, shifting cultivation, gathering and trading of forest products including non-timber forest products (NFTPs), fishing and hunting activities to maintain subsistence-based livelihood (p.542)”. These practices are more than just economic activities. They are live examples of a knowledge system that connects cultural heritage with environmental stewardship.

This study explores the *Orang Asli* Jah Hut community's traditional practices and sustainable living methods in Kuala Krau, Temerloh. The research involved a day-long ethnographic fieldwork visit, where direct observation and interviews with three community members provided insight into their agricultural practices, craftsmanship, and daily lifestyle. This study attempts to answer the following research questions: 1. *What are the traditional economic activities practiced by the Jah Hut community in Kuala Krau, Temerloh?* 2. *How do the Jah Hut people sustain their agriculture and food preservation practice?* And 3. *What are the key health and socio-economic challenges faced by the Jah Hut people today?*

The findings contribute to a broader understanding of how indigenous knowledge and sustainable traditions continue to shape the community’s economic and social structures.

2. Literature Review

2.1 The History of Orang Asli Jah Hut

Malaysia is a country defined by its rich tapestry of ethnicities, cultures, and religions. Among its diverse population are the *Orang Asli*, the indigenous people of Peninsular Malaysia, who comprise various ethnic subgroups, each with its distinct languages, traditions, and ways of life. As aptly put by Shah et al., (2020), “Orang Asli refers to original or primitive peoples composed of 18 sub-ethnic groups generally classified under Negrito, Senoi, and Proto-Malay for official purposes (p.3)”. Despite their deep historical roots in the region, the *Orang Asli* remain a small minority, numbering approximately 210,000 and accounting for less than 1% of the country’s total population (Wallace et al., 2022). They are broadly categorised into three main groups: the Negrito, Senoi, and Proto Malay, each with unique cultural practices and deep connection to their natural environments (Jabatan Kemajuan Orang Asli, 2022). Table 1 shows the distribution of these groupings in detail.

Table 1: Distribution of Peninsular Malaysia's Three Principal Aborigine Groups

Ethnics	Senoi	Proto-Malay	Negrito
Number	113910	86784	6083
Percentage	55.09	41.97	2.94

Sources: Census Data of Orang Asli community as of 31 December 2020 as cited in Shaari et al., 2024

The *Orang Asli* population in Malaysia lags other ethnic groups in numerous areas (Shaari et al, 2024). The majority live in wooded areas and depend on the environment for a living, adhering to traditional lives heavily impacted by their natural surroundings and ancestral customs. One of the subgroups is the The *Orang Asli* Jah Hut, who primarily reside in the forested areas of Temerloh and Jerantut, Pahang. The Jah Hut people historically engaged in various agricultural and economic activities, including rubber tapping, hill rice cultivation, and poultry farming (The Austronesians: Historical and Comparative Perspectives, 2006). Additionally, wood carving is a significant practice within the community, serving not only as a source of income but also as an extension of their spiritual beliefs (Sani & Arif, 2021). Despite living in forested areas, the Jah Hut have never been completely isolated, maintaining trade relationships with neighboring communities for centuries.

The language spoken by the Jah Hut people is known as "Bahasa Jah Hut," which belongs to the Mon-Khmer branch of the Austroasiatic language family (Diffloth, 1976). In their language, 'Jah' means 'people,' while 'Hut' means 'different,' as understood by the community members. Over time, the Jah Hut language has absorbed many Malay words into its vocabulary (Baharom et al., 2023). Various dialects of the language include those spoken in Kerdau, Krau, Ketiar Krau (Terengganu), Kuala Tembeling, Pulau Guai, Ulu Ceres (Cheres), and Ulu Tembeling.

According to recent statistics, approximately 6,383 Jah Hut individuals live in Temerloh and Jerantut district (sukrr et al., 2025). In Temerloh, there are nine Jah Hut villages, including Kampung Kuala Terboi, Kampung Paya Pelong, Kampung Paya Mengkuang, Kampung Penderas, Kampung Paya Mendo, Kampung Seboi, Kampung Pasu, Kampung Pian, and Kampung Paya Rekoh (Sani, 2016).

2.2 Traditional Economic Activities of the Jah Hut Community

In the past, the Jah Hut people collected rattan and resin from the jungle to sell to outsiders. They also historically practiced subsistence-based economic activities for example, hunting, fishing, foraging and swidden agriculture. At the same time, they have a deep reliance on the surrounding forests for medical herbs, wild fruits and materials for handcrafts (Nicholas et al., 2020).

In more recent years, with increased interaction with the outside world and state-led government, some Jah Hut individuals have engaged in small-scale rubber tapping, wage labour, and craft selling, especially woodcarving and rattan products (Lin, 2005, Sani & Arif, 2021). The carving tradition, particularly the spirit sculptures or '*semangat*' figures, remains both a cultural and economic practice, often sold to outsiders and tourists (Werner, 1997). Today, while the spiritual significance may have waned for some, the practice continues to thrive as an economic and aesthetic pursuit (Sukri et al., 2022). The 'new' tradition is shared by "only two of the indigenous peoples out of eighteen groups of people living in peninsula Malaysia (Arus et al., 2016, p. 266)" as the majority do not engage in the creation of figurative sculptures or masks. The two groups are Jah Hut and Mah Meri. The evolution of this carving

tradition reflects both cultural adaptation and resilience in the face of socio-economic transformation.

Along with sculpture activities, agriculture is also a vital component of the Jah Hut community's livelihood.

Indigenous knowledge (TEK) is especially relevant in these practices as skills and techniques are taught through hands-on experience (Adnan et al., 2020). The Jah Hut's ability to carve wood and weave serves as a source of economic survival but also indicates their holistic grasp of natural resources, spirituality, and ecology. For example, their skill in locating appropriate types of wood, ensuring the preservation of biodiversity in forests, and the use of natural dyes in weaving illustrates their complex relationship with nature.

Natural materials that are readily available are also used ingeniously by the Jah Hut. Women's work includes weaving as well as making rattan products (Sukri et al., 2022). Their adaptability and creativity is demonstrated in the skills of surgery and the conversion of raw materials into and of cultural products of art (Mustafa, 2013). The economic resources available to them subsistence farming has been supplemented by the increased economic demand for their carvings and woven crafts (Sani, 2016).

2.3 Sustainable Agriculture and Food Security

The Jah Hut community still practices farming as a crucial means of both subsistence and economy. Farming skills have been accumulated over time within the community, and farming activities are directly correlated to weather patterns and seasonal changes (Lin, 2005). The Jah Hut cultivates rice, tapioca, bananas, chilies, ready-to-use herbal, and other plants using rudimentary techniques. While slash-and-burn agriculture enables them to clear land and preserve soil, modernity and land restriction policies have made this practice increasingly difficult.

Adopting new practices associated with sustainable agriculture has several constraints. One of the most important issues can be recognized as the limited accessibility of modern equipment, such as harvesting tools or irrigation systems, that have the potential to increase productivity and crop yields. Unlike these other types of farming, the Jah Hut are small-scale farmers and thus do not have access to modern machinery. Manual labour and rudimentary tools restrict their capability further below the subsistence level (Roddin et al., 2014). In addition, poor infrastructure and transportation systems limit accessibility to bigger markets where crops can be sold at competitive prices, resulting in a reliance on middlemen who purchase crops at lower than desirable prices (Dong et al., 2022).

Albeit facing challenges, the Jah Hut maintains robust food security systems through the seasonal farming calendar and communal food storage systems (Aishah & Ibrahim, 2024). Instead of selling their entire harvest, they process a portion of it into shelf-stable foods, which can be consumed during off-seasons (Idros et al., 2024). This approach guarantees the availability of food throughout the year, notably in periods when fresh supplies are limited.

2.4 Health Issues and Socioeconomic Problems

As far as the Jah Hut community goes, inadequate access to modern healthcare facilities continues to remain a concern. The cultural habit of chewing betel nuts (pinang) has led to many community members suffering from dental issues, especially discoloration. As much as chewing on betel nut is significant to Jah Hut culture, some researchers claim it poses long-

term health risks like oral complications and other diseases (Khairunjauhari et al, 2023). With proper birding education, accessible health improvement programs, and other healthcare services, these concerns could be alleviated.

The socioeconomic mobility of the Jah Hut community is significantly influenced by educational attainment (Mohd Salim et al., 2024). Amir (2019) noted that parents are sending their children to school because, even though they follow ancient traditions, there is a glaring need to adapt to the changes and acquire knowledge. On the contrary, Kamaruddin (2018) remarked that out of the 3200 Orang Asli pupils in peninsular Malaysia, only 2062 were retained in school till the end of Secondary Five. He pointed out that there was a marked difference between the enrolment figures of Orang Asli pupils in primary and secondary schools, suggesting that a significant number of pupils did not intend to continue their education beyond primary schooling. At the same time, Salim et al. (2020) claim that both formal and non-formal education centre around the positive construction of an individual who is shaped to be a whole person capable of contributing and giving back to society.

3. Research Methodology

3.1 Research Design

As the ethnographic approach is appropriate for exploring the culture of a community, sustainable living practices and existing knowledge systems of the Jah Hut community were investigated using qualitative ethnographic methods. Such an approach enables the capture of rich data as it accounts for complex socio-cultural factors in indigenous societies. By residing in that environment and interacting with the relevant subjects, the researcher intended to appreciate as fully as possible the practices, ideologies, and knowledge of elders and children, which are intertwined as an everyday phenomenon. Ethnography captures multi-faceted behavioural and attitudinal information through prolonged participation in daily activities, rendering them meaningful and enabling insights to be drawn from the perspectives of the subjects.

3.2 Data Collection Methods

The primary data for this study was obtained during a field trip to Kuala Krau in the Temerloh district using direct field observation and semi-structured interviews. This site was chosen because it is one of the noted settlements of the Jah Hut people. Even though there was only one day set aside for fieldwork in the Jah Hut community due to logistical challenges, careful planning and purposive sampling of informants in a pre- and post-data collection framework were used to enhance the richness of the data collected. Table 1 below explains the three key community members who were interviewed during the visit.

Table 1: Key Community Members Interviewed

Informant	Role/Occupation	Key Contributions
Alwi and Safwan	Bamboo harvesters	Described daily techniques in sourcing, preparing, and utilizing bamboo. Discussed economic aspects and environmental conservation practices.
Rahmah	Rattan weaver and rice farmer	Shared insights into ethnobotany and traditional agriculture. Explained the cyclic rhythm of rice cultivation and the decline of craft traditions. Highlighted the balance between livelihood and cultural identity.

Tok Empat	Village leader	Provided a holistic overview of community dynamics including development, intergenerational challenges, land issues, and social services.
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Note. Table 1 adapted for ethnographic reporting. Pseudonyms are used where appropriate to maintain confidentiality.

All ethnographic data were documented as meticulous field notes, along with relevant photographs taken of significant and distinctive features and practices. Such records enabled the analysis of the specific spatial relations, tools, and sociometrical interactions within the community. The informal conversational structure of the interviews prepared participants while leaving room for their unique viewpoints and experiences to shape the discussion. Interview items focused on sustainable resource management, traditional ecological wisdom, and community responses to current social and environmental issues posed to them.

3.3 Ethical Considerations

Ethical principles were upheld in all steps of the research. Informed consent was secured prior to data collection, with all participants fully briefed on the objective, methodologies, and potential outcomes of the study. The researcher made it clear that participation was voluntary, and respondents were free to skip questions or withdraw completely at any time. In relation to other ethical considerations, cultural respect and sensitivity were at the forefront, which involved respecting local customs, taboos, and ways of communicating. Anonymity and confidentiality were maintained, along with the use of pseudonyms where necessary. Efforts were made to ensure minimal disruption for the community members with regard to their daily routines, as well as to ensure that the community is represented accurately and respectfully in the narrative. The researcher acknowledges the significance of positionality and reflexivity when doing research involving indigenous people and intentionally interprets and presents the data in a manner that reflects the Jah Hut community's realities and values.

4. Findings

4.1 RQ1: Traditional Economic Activities

Utilisation of Bamboo and Rattan

The Jah Hut community still relies heavily on Bamboo harvesting in economic activities. *Alwi and Safwan*, for instance, consider it more than a resource-gathering endeavour because it also provides value addition that helps them sustain a living. They focus on gathering, preparing, and processing bamboo into *lidi* sticks, which have constant market demand. These *lidi* sticks are made through a labour-intensive process and are sold to Malays, especially in the market of *Pekan Temerloh*. *Ramadhan* is one of the peak months for this trade as the sticks are vital for the vendors who attend the bazaars. This activity shows an excellent example of how indigenous resource wisdom can be matched with local market needs. The entire process from bamboo collection to production of marketable items is sustainable, eco-friendly.

The activity is shown in Picture 1:



Picture 1: Alwi prepares the *lidi* sticks to be sold to Malay vendors.

Alwi clarified:

“For stirring the fire, we sell grated coconut sticks to the Malay vendors. It helps them cook ayam percik and during Ramadan, demand for the dish surges. The good part is that selling semi-finished pieces does not entail tree trimming, which makes it environmentally friendly. It is an easy way to earn extra money.”

Alwi's comments bring out the environmentally conscious traditions that lie within the community's ecosystem, utilizing the resources as well as the sustainability concerns deeply rooted within the community's use of resources. While the name of the *lidi* sticks is associated with the palm leaves, there is also a degree of bamboo, which demonstrates some level of adaptation of materials. The *ayam percik*, which is arguably the most popular dish in Malaysia, is made by marinating pieces of chicken in coconut, turmeric, lemongrass, and sprinkling local spices. Marinade-infused flavours deliver the best taste when the chicken is securely held by sticks as it is grilled directly over the open flames to be maximally aromatic, ensuring even cooking. *Ayam percik* is particularly loved, especially during the eating periods in Ramadan when stalls pop up and community gatherings happen. Thus demand for *lidi* sticks does not decrease at any time during this season.

For the Jah Hut community, this trade not only allows them to earn a steady stream of supplemental income but also permits them to participate meaningfully in Malaysia's festive culinary culture, strengthening the bond between traditional craftsmanship and modern urban consumption. In the same way, the practice of rattan weaving remains an important source of income and a cultural heirloom within the community, especially for people such as Rahmah, who is celebrated for her artistry. She expertly creates functional pieces such as *nyiru*, *gadang*, and *ibong*. The *nyiru* and *gadang* serve agricultural functions, particularly for winnowing rice and drying grains during post-harvest processing. The *ibong*, on the other hand, is a multipurpose carrying basket useful in farming for the movement of harvested crops or daily necessities over long distances. These handcrafted items are not only utilized within the community but also traded to external buyers, illustrating the adaptability of traditional crafts in response to socio-economic and market changes. The blending of tradition and economics illustrates the strength of indigenous knowledge systems.

Examples of *nyiru*, *gadang*, and *ibong* are presented in Picture 2 below:



Picture 2: Rahmah holds Nyiru on her left side, Gadang on her right, and carries Ibong on her back.

Rahmah narrated,

“When I am going out to work, I usually bring along my *nyiru*, *gadang*, and *ibong*. Both the *nyiru* and *gadang* serve the same purpose of separating rice or dried agricultural products. The *ibong*, on the other hand, is a carrier. It serves the purpose of a bag for us, and we carry items on our backs.”

From her explanation, it is apparent that these rattan products have a certain daily necessity that is practical and indispensable. More than instruments, they provide a means of sustenance and a form of livelihood and community belonging. As she continues to depend on these items for her agricultural and home responsibilities, their relevance for contemporary society is also validated. Each tool not only adds to its story as a tool and by the process known as creation, provides a story to the tool that is passed down through generations, embodying practical wisdom and ancient culture.

Rahmah reiterated this very point when she said:

“We learn to weave from our mothers and grandmothers. We use rattan and bamboo to make baskets, mats, and even other decorative pieces. The patterns we weave have meaning. They tell stories about our people and our land. We also use natural dyes from plants. We know which leaves or roots will give us the right colours. It is knowledge passed down through generations.”

This quote illustrates how deeply rooted and cultural the practice of weaving is and how it transcends generations. According to Rahmah, rattan weaving is not just an economic activity; it is a form of cultural identity. In this sense, weaving connects a person to their roots and ancestral wisdom. After learning from her mother, she now teaches daughters and daughters-in-law from different families, helping with the sustainability of this art in the face of modernization. The meticulous weaving process starts with going into the forest to gather the right rattan, cleaning it, treating it, softening it, and making it easier to weave. After all of that, there is still the painstakingly slow work of crafting each piece, be it meant for use or display.

The extraction of dyes from leaves, roots, and barks illustrates further a natural and eco-friendly approach. Every mat or basket has a design that narrates a story about the Jah Hut worldview, which could be about nature or family. For Rahmah, these handicrafts have reasons beyond functionality and financial income as they embody cultural pride and heritage, endurance, and plastic-free living. With the prevalence of plastic and synthetic options, her work stands as a vital example of preserving indigenous knowledge and craftsmanship.

4.2 RQ2: Agricultural Practices and Food Preservation

The Cultivation of Rice and the Preservation of Empeng

The rice farming, the backbone of the Jah Hut people's agriculture, follows a long-standing cyclic seasonal calendar. One of the community members who engages in farming activities, *Rahmah*, mentions that the rice planting season starts in September and goes until January. During this duration, favourable climatic conditions ensure the rice crops fully mature. February marks the harvesting period which is undertaken during fully matured plant stages. It is done in a completely traditional manner which is characteristic of the Jah Hut people's way of life. Their focus is not on selling, but in achieving food sufficiency and self-reliance.

Rahmah elaborated,

"We begin sowing in September and harvest in February. We practice seasonal rice farming and sell the empeng rice for preserving food for our family. We always have enough to eat."

Instead of marketing the rice to derive profit, the community focuses on transforming the rice into *empeng*, which helps them avoid the costs and hassle of purchasing food later. The traditional methodology behind making *empeng*—primarily parboiling, drying, and sun-drying—allows for simple preservation of food. This technique is not only efficient but also inexpensive and demonstrates the practices of indigenous people. This ensures that even during periods of scarcity or times when farming is not feasible due to weather, land conditions, or other challenges, there is a dependable food source. It represents subsistence agriculture focused on food sustainability rather than financial benefits. These captures sustaining a balanced ecosystem where the production and preservation of food follows the natural seasons while rooted in cultural wisdom.

In addition to rice farming, the Jah Hut community forages and gathers wild fruits, edible plants, and medicinal herbs from the forest. This gathering practice sustains and enhances their nutritional diversity, providing additional nutritional and medicinal resources beyond what cultivated crops offer. This practice serves as a vital form of dietary diversification that strengthens food security. Moreover, these products give supplementary income, especially during off-farming seasons, helping sustain household requirements. As an illustration of this practice, during fruiting seasons, the community collects wild durian and *petai* (stinky beans), and other wild foods for personal use and to sell at local markets. These endeavours support and sustain household requirements.

Nonetheless, this age-old approach to procuring food and living in the forest is increasingly under strain. Deforestation coupled with large-scale and commercially driven agriculture systems severely limits available foraging spaces. In addition, these ventures tend to oversaturate the market with similar fruits and products, which further diminishes the Jah Hut communities' ability to make a living. Compounding these factors, the community continues to demonstrate resourcefulness to adapt and maintain their way of life, underscoring the persistent strength of their environmental knowledge. Their capability to balance between cultivation and foraging reflects the depth of ecological understanding that fosters cultural resilience essential for sustaining indigenous food systems.

4.3 RQ3: Health and Socioeconomic Challenges

Health Practices and Observations

The Jah Hut community's health issues arise from a combination of culture and access restrictions. One of the most significant cultural practices affecting health is chewing betel nut

(pinang), which has great social and ritual significance. While betel nut chewing is culturally relevant, it poses the risk of causing oral health issues and discoloration of teeth. Knowledge regarding these health impacts is low, highlighting the need for tailored outreach programs that fit cultural frameworks. These communities still face problems related to healthcare access and nutrition. Subsistence agriculture and gathering have the potential to mitigate food shortages, but seasonal shifts result in sparser periods of nutrition. The elderly and young children are particularly susceptible. Medical assistance is geographically distant, and coupled with low income, greatly constrains access. There are some mobile health services, but these are inconsistent in providing comprehensive coverage.

Education Barriers and Indigenous Knowledge Transmission

Due to low income, many children from the Jah Hut community face significant barriers to education. Some children, such as Tok Empat's daughter, can attend Sekolah Menengah Sains Sultan Haji Ahmad Shah (SEMSAS), but many other children pursue traditional roles centred on forest-based livelihoods.

Tok Empat underscored the importance of safeguarding indigenous ecological wisdom, saying, *"Our wisdom teaches us to read the forest. We know which plants heal, which trees are strong, and how to take only what we need. But the younger ones are moving away from this knowledge. We must teach them before it's gone."* While supporting his daughter's education, he is equally stern about cultural sustainability: *"She's at SEMSAS, and we're proud. But I keep reminding her of who we are and our connection to the forest, our ways."*

SEMSAS, located at Km 12 Jalan Gambang, Kuantan, Pahang, is one of the Fully Residential Schools (Sekolah Berasrama Penuh) in Malaysia.

5. Discussion

The study emphasizes the Jah Hut community's engagement with traditional ecological knowledge (TEK) as they navigate education, health, and economic challenges. This reflects previous research while contributing to the understanding of how TEK acts as a sustaining anchor in modernizing societies. Shah et al. (2020) emphasise that Traditional Ecological Knowledge (TEK) and informal learning are crucial for indigenous communities to stay connected with their culture amid modern-day challenges. Adnan et al. (2021) support the argument by highlighting that non-formal education is important for the continued development of Orang Asli youth because it acts as an enhancement to formal constituents of schooling while safeguarding indigenous identity.

5.1 The Use of Traditional Knowledge in Resource Management

Jah Hut subsistence livelihoods revolve around forests, where they engage in vine weaving, bamboo harvesting, and sustainable timber collection for carvings. These activities illustrate ecological skills acquired through cultural heritages and align with Sani and Arif (2021), who highlight the importance of indigenous crafts for culture and economy. Daily life also reflects several environmental mindfulness routines, such as the production of *lidi* sticks (Mustafa, 2013) and forest-derived dyes (Adnan et al., 2020). These traditions, however, are constrained by market access obstacles. As Roddin et al. (2014) note, underdeveloped infrastructure serves as a hurdle to commerce for indigenous goods. Expanding market access through cooperative models and digital advertisement can aid the Jah Hut in marketing their forest-based products and strengthen forest-based economies.

5.2 Forest-related Agricultural Activities and Food Traditions

The Jah Hut are still dependent on primitive agriculture and the gathering of wild food, such as cultivating upland rice. The making of *empeng*, or preserved pounded rice, demonstrates the rationing of food to balance seasonal food scarcity, as stated by Idros et al. (2024). Such knowledge of seasonal cycles and local plants is made possible by adaptive food strategies as described in Lin (2005). Productivity is hindered by restrictions on ancestral land and a lack of farming tools. Dong et al. (2022) reported similar challenges among Orang Asli communities. To improve food security while maintaining ecological preservation, these issues necessitate support programs that combine modern sustainable farming technologies alongside traditional techniques.

5.3 Ecological Health Practices

Health-related practices in Jah Hut communities directly stem from their knowledge of specific forest regions. Only traditional herbal remedies are employed to alleviate slight discomfort. Alongside these, modern health risks stemming from the habit of betel chewing, leading to potential oral problems, coexist. Access to contemporary healthcare is still limited, in line with Wallace et al. (2022). Future interventions should respect and build upon the community's ecological health practices. Integrating traditional healing through culturally informed programs with community leaders, such as Tok Empat promotes better healthcare integration. As noted by Salim et al. (2020), any educational or health-based initiative in indigenous communities must be deeply embedded in the cultural context to be effective.

5.4 Knowledge Transmission and Education Barriers

Many educational accomplishments aside, a multitude of Jah Hut youths persist in dropping out, solely attributed to financial reasons. This validates the case presented by Amir (2019) and Kamaruddin (2018), who associate low income with school discontinuation. More crucially, formal education systems seldom include TEK, resulting in the further erosion of these invaluable forms of knowledge. Yusuf et al. (2024), Mohd Salim et al. (2020) and Salim et al. (2020) suggest a blend of formal and informal types of education. Preserving cultural identity while broadening horizons, such as through the awarding of scholarships, could be significantly aided via a blended model of education where forest knowledge is documented, taught, and appreciated.

6. Conclusions and Recommendations

To foster and sustain traditional ecological knowledge within the Jah Hut community, a comprehensive approach is essential. Focusing on the marketing of forest-based products at the cooperative and online levels for better visibility and revenue generation through e-commerce falls under economic support. Health education needs to incorporate traditional aspects of health while tackling problematic behaviours, such as betel nut chewing. Community-based health promotion blends traditional care with modern approaches, which can help drive the change needed. Funding for education should be accessible to indigenous students, as well as community learning centres that teach forest knowledge, under equitable education policy frameworks. This helps maintain a connection to roots while nurturing those who can lead as future champions. Farming programs should incorporate traditional sustainable practices with modern techniques. Training in agriculture should come with respect for ecological traditions to enhance yield and climate resilience. Further research is needed to explore the effects of incorporating traditional ecological knowledge (TEK) into formal systems on indigenous identity and adaptation. Company-wide comparisons among Orang Asli communities would

enhance understanding of diverse approaches to forest-based sustainable development in Malaysia.

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