

# Transmission and Documentation of Orang Asli Indigenous Knowledge in 'Green Technology' for Sustainable Development in Malaysia

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## Abstract

This study aims to preserve and document the corpus of Orang Asli Indigenous Knowledge in 'Green Technology' (IKGT). This knowledge is at risk of being lost due to the impact of colonization, habitat destruction and modernization. Indigenous knowledge of Orang Asli is naturalistic and environmentally friendly which is used to reduce the human impact on the environment as well as to create a sustainable development. Hence, this study was conducted to explore the indigenous knowledge in green technology of Orang Asli and how they transmit this knowledge to preserve their environment. This study adopts a qualitative approach through exploratory study whereby the study was carried out at the Orang Asli settlements located in Peninsular Malaysia. Data sources were obtained from the village headman (Tok Batin) and tribal elders who served as informants using in-depth interview, field observation, and document analysis. The conceptual framework in this study was based on An Integrated Model of Indigenous Economy, Social World and Ecosystems Model. Five aspects; (i) medicine, (ii) food, (iii) handicraft, (iv) music, and (v) forestry were selected to be studied. The interviews were audio-recorded for data analysis, transcribed verbatim and analyzed through Atlas.ti software. The key result of this study reveals that Orang Asli tribes in the designated

area practice IKGT throughout their lives. This study contributed to the body of knowledge in terms of expanding the Orang Asli indigenous knowledge. The finding also shows that Orang Asli conserves natural resources without damaging the biodiversity. The implication of this study is to educate and inculcate awareness among all levels of the community to practice environmental sustainability and in the future to make the environment 'greener'.

**Keywords:** Orang Asli, Indigenous Knowledge, 'Green Technology', Sustainable Development, Peninsular Malaysia

## **Introduction**

The purpose of this study is to explore how Orang Asli use their Indigenous Knowledge of 'Green Technology' (IKGT) and practices to preserve and sustain their environment and use it on a personal, societal and national level to conserve natural resources for present and future generations. This is because urban living generates carbon footprints and other damaging and hazardous effects such as global warming and river pollution that can be seen in the country that needs co-operation and addressed by all levels to protect the earth life's support systems. Eyong et al., (2004) claim that the earth is so polluted that to the point that the specific survival of mankind is threatened as evidenced by silent emergencies such as desertification, deforestation, fast degradation of motherland due to the abusive and improper utilization of fertilizers, polluted rivers, air and soil caused by industrial effluents. There are numerous scientific phenomena which show that the earth's atmosphere has changed throughout history. According to the National Oceanic and Atmospheric Administration (NOAA), it is worth researching on the expanding of worldwide temperature as it is one component of observed global climate change. The rise of the world's surface temperature has brought worldwide concern and is presently comprehended as one of the vital challenge confronted by the human being (Makkar, 2013).

Climate change, global warming and the increasing of the earth's surface temperature will give huge impacts to the nature around the globe and will speed up the process of biodiversity loss. Modern technology poses a serious threat to sustainable development due to their harmful effects on natural resources and the environment (Eyong, 2007). In addition, modern technology destroys the habitats of wildlife. Environmental degradation and the lessening of resources affect everyone in the long term. The implication is that over-exploitation and other forms of biodiversity loss threaten cultural diversity (Turner, Ignace, & Ignace, 2000; Poe, Norman, & Levin, 2014; Sangha et al., 2015; Frid et al., 2016). The life-support systems of the earth can be compared to a boat; any spillage on one part of this boat will influence the whole boat and not just the affected part. The issues such as global warming, ozone depletion, energy wastage, and pollution have alarmed the housing and construction industry to implement sustainable and green solutions (Victoria et al., 2017).

The study conducted by Boyer (2011) emphasizes that the environmental impact of industrialization constitutes a brutal assault on Orang Asli's wellbeing and continues the harms of colonization. As indicated by the United Nation (2007), most of the world's remaining natural resources — minerals, freshwater, potential vitality sources and more are found in indigenous zones. The best way to reduce these damaging effects is to convert the base knowledge base of the indigenous groups and to encourage Orang Asli to sustain, maintain, manage and use their natural resources while strengthening their Indigenous Knowledge (IK). Orang Asli is very unique and distinctive skills and in managing the natural environment and also rich with taboos in their daily life. Indeed, it is well known that Orang Asli preserved and managed their natural resources and the ecosystems surrounding them

for their survival (Hong, 1987). Orang Asli possessed some knowledge transmitting the facts, ethics, wisdom, or lessons, on flora and fauna. While their ancestors had communicated with nature, they had observed and learned the natural carefully on how to manage their resources and deal with severe situations such as climate change (Lim et al., 2017).

Orang Asli believed that the IK and practices of this heritage exist through their ancestors some time ago very closely with the environment. They also believe in the existence of spirits and the supernatural will control their daily lives. In 2016, Lim, Norya & Norshakila emphasized that Orang Asli is forbidden to *takbur* (boast), to damage or pollute the forest environment while in the forest. Otherwise, it might even encounter misfortunes in their daily routines. These taboos will prevent them to destroy and affect the sustainability of the environment. According to Sam & Aminah (2015), the anger of supernatural powers is believed to bring disaster to Orang Asli in the form of floods, drought, disease or death.

Therefore, they try to maximize the use of modern technology to avoid the misfortunes and another bad sign in their daily lives if they violate the rules of nature. Orang Asli IK can be used to describe the knowledge within a given community or society rather than the scientific knowledge that is generally referred as 'modern' knowledge' (Ajibade, 2003) and commonly understood as 'native knowledge' of Orang Asli. Orang Asli IK is farmer friendly, socially accepted, economic, environmentally sound, and suited to the specific local and environmental conditions in other word using green technology. In this context of study contrast with the knowledge of modern science and different from modern or scientific green technology at this modern age.

Orang Asli IKG is a naturalistic and environmental friendly which is used to conserve and reduce the human impact on the environment as well as to create a way of sustainable development. IKG in Orang Asli perspective in this study refers to the equipment, products or traditional system used by them in preserving and conserving Mother Nature resources without damaging and depleting biodiversity and use of harmful substances for future generation. In their perspective, the environment should be cleaner and healthier for all forms of life and habitats and live a green lifestyle without using any harmful substances. Knowledge of green technology and energy need to be learned so that humans can explore the secrets of nature and create tools to control the symptoms of unhealthy environment that match with natural law (Nahadi, Sarimaya, & Rosdianti, 2011).

However, in these modern days of technological advancement, Orang Asli IK is in mortal danger, and it is often forgotten or neglected. The documentation and publication of how Orang Asli utilized 'green technology' are also not well known or very scarce. In 2013, Amir Zal in his study stated that each tribe of Orang Asli has inherited wide-range of IK over their ancestors but most of it has never been documented. Similarly, according to Eyong (2007), none of the national policies has documented or studied Orang Asli IK of how they conserve and use their surrounding for the sustainability of the environment. Farooquee & Nautiyal (1999), also emphasized that most of the voluminous and diversified areas of traditional knowledge and practices are still undocumented. This is due to the widespread external opportunistic interest, causing Orang Asli to be dispossessed from their traditional territories or had their traditional environments degraded by others.

IK often embraces values or meanings that appear undermined or threatened by western-style legal structures (Recht, 2009) and IK possessed by Orang Asli less emphasized. These areas, regarded as hostile and unproductive environs by the mainstream community, are today much sought after for their natural resources, or simply for their exotic locations. This is because external opportunistic interests are widespread, Orang Asli has been

dispossessed from their traditional territories or has experienced their traditional environments being degraded by others. This safeguards Orang Asli's human and development rights at the crossroads of globalization and expanding economic and market forces while preserving cultural diversity.

Thus, this study is needed to examine Orang Asli on how they getting closer to nature and embraced the use of IK of environment-friendly technologies for sustaining growth. It is also to preserve IKG and practices of a number of natural biological resources and how such pieces of knowledge can add value to the overall conservation and sustainable development of natural habitats and ecosystems. In addition, this study aims to explore the IK and wisdom of OA in solving their daily problems by utilizing 'Green Technology (GT)' to conserve and provide invaluable knowledge and aid in making the best use of natural sources that can be utilized by present societies. Specifically, the objectives of this study are;

- i. To clarify the epistemology of Orang Asli IKG on medicine, handicraft, food, music and forestry, and their green practices.
- ii. To examine the IKG and practices used by Orang Asli on medicine, handicraft, food, music and forestry, and their green practices.
- iii. To identify Orang Asli sustain and maintain IKG and their green practices.
- iv. To develop a framework based on Orang Asli IKG on medicine, handicraft, food, music, forestry, and their green practices.

### Research Methodology

The qualitative descriptive case study research design was employed for this study. The researcher employed five themes: (i) medicine, (ii) food, (iii) handicraft, (iv) music and (v) forestry as the guideline for the study. The study areas involved three tribal groups of Orang Asli that conducted were in 4 states; i) Selangor, ii) Perak, iii) Terengganu, and iv) Pahang of Peninsular Malaysia. The case study method of this study involved an in-depth analysis of the selected individuals based on the purpose to understand in-depth and to induce a clearer picture concerning IKG in the perspective of Orang Asli. As emphasized by Renganathan (2011), to work with Orang Asli tribe, we need to carry out qualitative-based research whereby we need to work with the community in their settlement. Thus, this case study is a form of research that aims to collect information and justify what is happening.

The selection of informants for this study incorporates a Tribes-based purposive sample of ten Orang Asli Headman (*Tok Batin*) or tribal elder aged 30 and older. Ten informants were chosen in this study and they ought to be knowledgeable in IKG and so do their ancient practices. The selection of informants using the purposive sampling is based on the idea that researchers wish to explore, learn and perceive so the informants are observed from them to enhance the creditability of the findings. This study involved a semi-structured interview with key informants. Besides, participant observation and document analysis were conducted. Interviews were conducted based on the prepared protocol. The interview protocol is the prime source of case study data. Document analysis method was used to analyze the data. The researcher thoroughly analyzed the documents generated by the organizations that were enclosed in websites, journals, and books. The accessible and suitable literature was employed in the event of the interview queries that were used to collect the data in this study.

The data collected were processed using Atlas-ti software to ease the organization and composition of the process of coding and classification and also the development of the connection between constructs. The recorded audio was verbatim transcribed and the Malay

transcripts were double checked for precision with the records before the interpretation of the data. The transcripts were analyzed using thematic coding approach. According to Boyatzis (1998), thematic analysis is a process for encoding qualitative information that requires an explicit 'code'. The analysis was done by producing theme clusters (i) medicine, (ii) food, (iii) handicraft, (iv) music and (v) forestry. The researcher selected to review the informants' feedback in analyzing these themes. After the themes were analyzed, they were brought along and interpreted in relevance to the purpose of this study.

## **Results and Discussions**

### **The Epistemology of Orang Asli in IKG**

The findings of this study showed the informants had the same thoughts about the nature of IK practiced by them in daily life. Orang Asli community in Peninsular Malaysia has beliefs and practices that they hold on to from their ancestors. Their epistemology in Orang Asli IKG on medicine, handicraft, food, music, forestry and their green practices arises from the interconnections between human world, the spirit, and the inanimate entities. They also possess epistemology in transmitting the facts, ethics, wisdom, or lessons, flora and fauna. These epistemology had been passed down orally, and it was unclear to them how it was constructed. They learn IKG from their ancestors or friends through observing, monitoring and storytelling methods and through colonization and western schooling. As stated by Lim et al., (2017), while their ancestors had communicated with nature, they observed and learned the nature carefully on how to manage their resources and deal with severe situations such as climate change.

Indeed, Orang Asli tribes have their own uniqueness and distinctiveness inherited from their ancestors. These beliefs and practices of Orang Asli people show their epistemology in IKG and green practices have indeed existed since their forefathers. If they violate taboos or customs that are related to nature, they believe they will get ill or be afflicted by natural disaster, illness and death. Therefore, they still maintain this epistemology even though the country has developed. Their environmental friendly or 'Green Technology' epistemology and lifestyle has indirectly helped in ensuring a sustainable of the natural environment in their daily routine. These privileges and valuable epistemology need to be applied today to conserve and reduce to human impact on the environment. However, the present generation of the average orang Asli peoples have been assimilated by external cultures that make them no longer believe in the practices practiced by their tribes.

Thus, it is possible to conclude that the concept of epistemology according to the perspectives of Orang Asli in IKG plays an important role in society where it is the view of the real world especially in the preservation of the environment. It is clear that the epistemology of Orang Asli people is very different from other societies. It is a need for us, particularly at the grassroots, to acknowledge and support Orang Asli Epistemology in IKG and green practices in Malaysia. It is the right time to get back to basic where there is a need to apply and retrieve Orang Asli Epistemology in IKG which is valuable and precious that can be utilized by modern people in minimizing environmental pollution, ozone warming and extinction of nature.

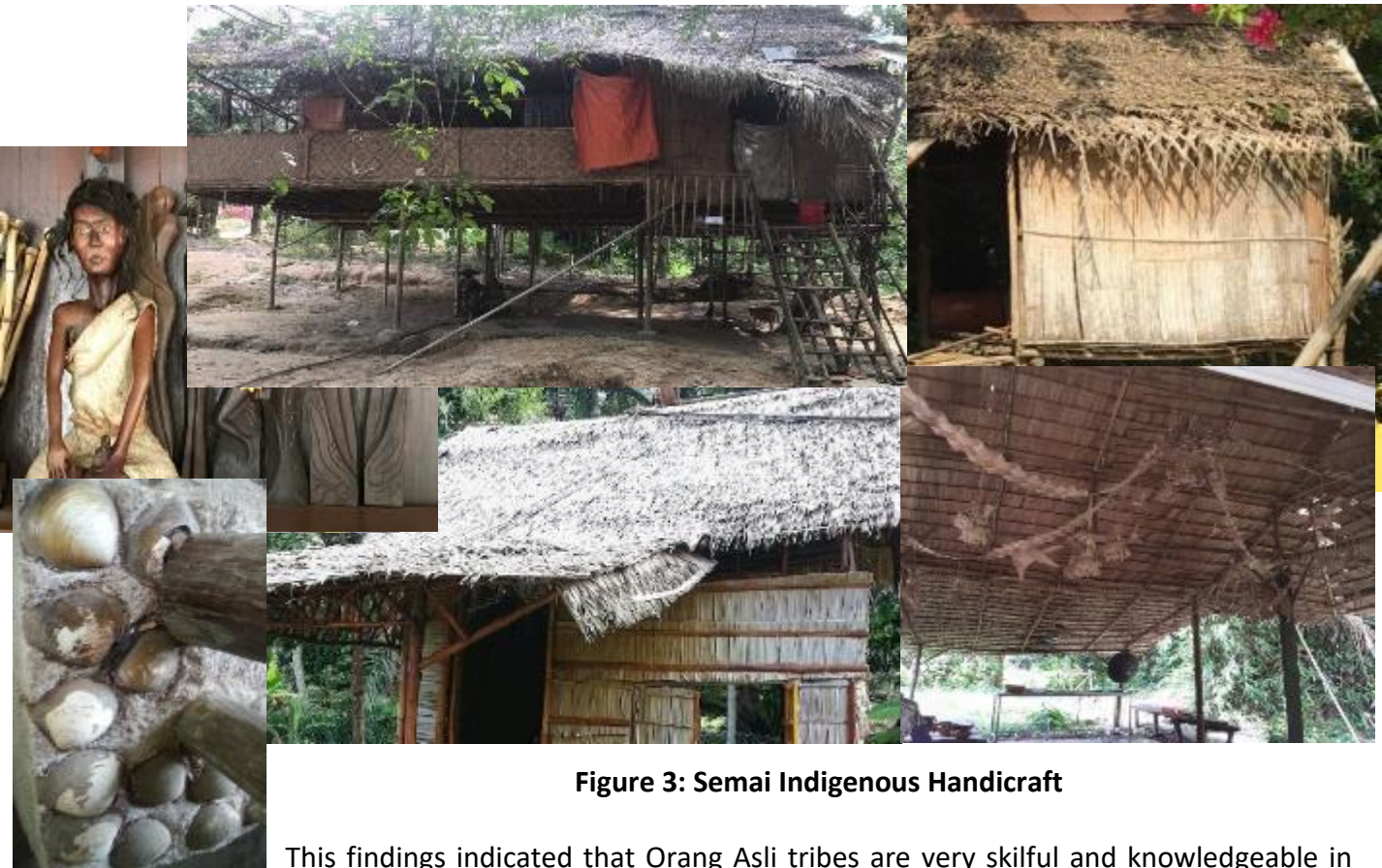


***Orang Asli IKG in Indigenous Handicraft***

There are only twelve types of handicrafts recorded and found from the tribes of i) Semai located at Raub, Pahang, ii) Mah Meri at Pulau Carey and iii) Temuan which is situated at Rawang, Selangor (refer to Figure 1, Figure 2 and Figure 3). Based on the findings of this study, the Mah Meri tribe nominated the indigenous handicraft such as wooden sculptures, shell decorations, jewellery craft, and wall weaving. In Pahang, Semai tribes' lifestyles are directly associated with the forest and they possess their own distinctive thoughts on the forest resources. They used weaved bamboo, rattan or *Nipah* as roof and wall decorations of the house. Meanwhile, the Temuan tribes situated in Selangor also have their own uniqueness and diversities of handicraft that are synonym with the natural environment in terms of conserving the sustainability of the environment.

**Figure 1: Temuan  
Indigenous Handicraft**



**Figure 2: Mah Meri Indigenous Handicraft****Figure 3: Semai Indigenous Handicraft**

This findings indicated that Orang Asli tribes are very skilful and knowledgeable in recognizing the raw materials of their interest in crafting. They managed to preserve a tradition of spiritual woodcarving that is truly world-class in terms of the quality of its craft and artistry. Orang Asli handicrafts are inspired by nature and surroundings which grow wildly and can be collected from the nearby areas of their settlement. Most of the handicraft products which have the elements of environmental sustainability are for personal use. Besides, they also utilized all the available natural resources for various purposes of daily utility. Orang Asli tribes use these natural resources because they can easily get access to it and at the same time, they are maximizing these sources and avoiding the use of modern sources. In their perspectives and myths, every craft has a different story of the spirit world and this shapes their belief and culture.

### ***Orang Asli IKG in Indigenous Medicine***

Based on the finding, Orang Asli tribes utilized and maximized the use of medicinal plants for medicine purpose to heal various health conditions in treating both children and adults as family secret tips. Most of the medicinal plants are used in healing common ailments. The majority of the tribes preferred indigenous healing processes instead of depending on modern medicine provided by the hospitals and rural clinics although they are able to get access to them easily. This is because indigenous medicine practices and healing process are related to their surrounding and spirituality which help to reconnect them to their legacy, land, cultures and the spirits of their ancestors, bringing the true feelings of serenity during their ailment. They believed that their diseases or illness were caused by the acts of spiritual punishment, payback, and breaking the rules of their taboos. This statement supported by

Yew et al., (2017) which stated that Orang Asli tribe are very careful and focused on the practice of taboos in their community.

Table 1:

Medicinal plants used for the treatment of various human ailments by the Orang Asli tribe in Malaysia



Local name	Scientific name	Part used	Methods of use	Recommended uses	Tribe	State
<i>Ketum</i>	Mitragyna Speciosa	Leaves	Boil	Use to treat diarrhea	Semai	Perak
<i>Orkid</i>	Orchidaceae	Leaves water	Drink the water from the leaves	To treat a fever	Semai	Pahang
<i>Tepus</i>	Zingiber Spectabile	Red leafflower	Boiled	To add blood	Semai	Pahang
<i>Pegaga</i>	Centella Asiatica	Leaves	Boil	To relieve pain, fever, headache, and dizziness	Mah Meri	Selangor
<i>Dukung Anak</i>	Phyllanthus Niruri	Leaves	Pounded plants mixed with water, taken orally	To treat diarrhea and stomachache	Mah Meri	Selangor
		Roots	Boiled and infused	To treat jaundice		
<i>Telinga Kera</i>	Tradescantia Albiflora	Leaves	Boiled	To cure kidney diseases	Mah Meri	Selangor
<i>Kendur Urat</i>	Unknown	Leaves	Apply it to body	As coolant to treat hot fever	Mah Meri	Selangor
<i>Durian</i>	Durio	Roots	Boil	To refresh the eye and get rid of thirst	Bateq	Terengganu
<i>Tongkat Ali</i>	Eurycoma Longifolia	Roots	Boil	As the bath water for the kids for rejuvenating the body and get rid of hot flushes	Semaq Beri	Terengganu
<i>Bunga Raya</i>	Hibiscus Rosa-Sinensis	Leaves	Apply the slime from the pounded	As coolant and treating fever	Semaq Beri	Terengganu

hibiscus leaf to patient						
<i>Hempedu Bumi</i>	Andrographis Paniculata	Leaves	Taken orally	To treat diabetes and hypertension	Mah Meri	Selangor
<i>Jemuh Bata Batu</i>	Unknown	Leaves	Boiled	As coolant and treating fever	Semaq Beri	Terengganu
<i>Rebung Muda</i>	Bamboo Shoot	Bamboo shoot	Drink the water from the bamboo shoot	To get rid of thirst	Semai	Pahang
<i>Concengrot</i>	Unknown	Root	Tied the root to the ankle	To cure ankle pain	Semai	Pahang
<i>Buah Dudu</i>	Unknown	Branches	Stew and drink the water	To get rid of toxic in body	Mah Meri	Selangor

Overall, indigenous medicine (table 1) practiced by Orang Asli tribes contributed to the preservation of environmental sustainability which is different from modern medicine. The records of Orang Asli IKG on medicinal plants with worldwide distribution is a potential agent and represent a helpful beginning stage that can fascinate further research on novel chemical compounds and potentially valuable drugs for present-day medicine to treat different types of ailments (Lambin et al., 2018).

### **Orang Asli IKG in Indigenous Food**

In this study, food is understood as Orang Asli indigenous knowledge of 'green technology' where it does not rely on modern technology, barks, poisoners or chemicals in food industries. The findings found that most of the tribes no longer utilize indigenous practices in food consumptions. Based on the findings, on average the informants only told that they had observed and learned about the practices in food consumption by their grandparents during childhood. For orang Asli community they obtain a water supply from plants and natural resources, while for their basic food supply are from animals and plants.

Based on food sources interview data, the food source of Orang Asli community in ancient times were from sources of animals and plants. Informant 1 informed its tribe obtained dishes from animals such as cows, chickens, and birds. However, to eat these animal sources there are taboos for children, such as children cannot eat food like cow or deer. This can cause children to be lazy, but they can eat food sources like chickens and birds. The participants of the study informed that they also found food sources from plants. According to Informant 1, they will plant their own food such as bamboo shoots (Figure 4), fern spikes (Figure 5), and *perah* fruits (Figure 6) to get their food source. He also told how they make these plants as their source of food;

*"...Malays cook perah fruits with eggplants, while Orang Asli keep it dry and then roast it and mash it for cooking oil. Yes. Stored in bamboo. We mash the perah fruit, keep it in the bamboo and at first, we see the oil rising and we take it and keep it again. Just the same. Only that the process of getting the oil is hard and long, drying and roasting then hanged and refined oil.."*

(Informant 1:S/M/39)

In addition to being eaten, the fruits of this plant are processed for other products such as oil from *perah* fruits. Besides *perah* fruits, coconut can also be used as cooking oil as informed by Informant 2;

*"...aaa .. our oil is natural,, here .. cooking oil .. using coconut la .. cook coconut .. make oil.."*

(Informant 2: MM/F/49)



**Figure 3: Bamboo Shoot**



**Figure 4: Fern Spikes**



**Figure 5: Perah Fruits**

The researcher also found that Orang Asli IKG in food does not involve modern technology barks, poisoners or chemicals in food industries. Most of the tribes no longer utilize indigenous practices in food for consumptions due to modernization and development. Back then, they fully utilized the natural resource to survive and managed to live happily without any excuses. According to Bashkar et al., (2015), the traditional food of Orang Asli is based on their traditional wisdom, knowledge, practices, and technologies of the tribes. This IKG can help the plants to grow without using modern technology and can be as a source of protein for healthy living style.

#### ***Orang Asli IKG in Indigenous Forestry***

Based on the analysis of themes obtained through interview data, each study participant believes that indigenous peoples are able to utilize forest products and have their own methods of collecting forest products. The ability to utilize forest produce. Their own method of collecting forest produce enables indigenous people to survive in the forest or suburban area. Based on the data obtained, forest harvesting and collection methods are seen from the aspects of equipment used when collecting forest produce, derive forest produce, products that can be produced from forest produce and the methods used by Orang Asli community in keeping forest produce from plant enemies.

The result of indigenous forestry identified that some Orang Asli tribes in Peninsular Malaysia are still depending on forests resources in their daily life despite present modernization. The tools that they used are also traditional, simple and inexpensive without modern innovation. This is because they realized the incorporation of a harmful substance in modern sources and thus avoided them since their techniques and main ingredients for making 'Green Technology' are more environmentally-friendly.

Furthermore, the findings indicated that Orang Asli tribes are very skilful, knowledgeable in maintaining and keeping the forestry sustainability. In 2017, Gorbar emphasizes that handicraft production has played an important role in many developing countries and highlights that the preservation and promotion of cultural and artistic traditions, as numerous abilities involved in the production of traditional products, have been inherited from era to era. This is because the ancestors have lived the forest for the sake of their survival and for future generations and as well as to utilize their surrounding for the sustainability of the environment.



**Orang Asli IKG in Indigenous Music**

The study found that Orang Asli of these four states no longer practice IKG in music in preserving the surrounding. Most of their music only aims for specific performance only. This is because the succession and practice of music such as musical instruments and dances in the younger generation are increasingly forgotten, this is evidenced by the analysis of interviews by Informant 3;

*"..what is important as the musical instrument and there is nothing else held for the grandchildren of Semaq Beri tribes. If the grandparents dance, their children understand; we need to design new dance.."*

(Informant 3: SB/M/58)

Informant 4 also supports Informant 3's view in which the Semai tribes no longer inherit and practice music, especially traditional music, but they have been using modern singing bands on fun occasions instead of traditional music instruments (Figure 6). Based on Informant 4's experience, the use of music among Semai tribe at one time is usually for entertainment such as festivals.

*"..During festivals, he wants special occasion If he wants it in that way, we do/ or else, do not have..."*

(Informant 4:S/F/42)

According to Informant 4, there is a gathering of residents where the skilful villagers will perform while those who are not skilful will be the spectators. However, for the performance of this traditional music has constraints such as the hall or limited space. The Semai tribe is among those who have the constraints of the hall and the space to gather;

*'..we do not have Thanksgiving party because we do not have a place ... we have a community hall but the area was once a field when we go to the place we were in the field but because the villagers are too much, it becomes home.."*

(Informant 4:S/F/42)



Figure 6: Semai Indigenous Music Instruments

### Sustaining and Maintaining Orang Asli IKG

In order to ensure that IKG does not extinct, the findings from the analysis of interviews show that Temuan tribe and Semai tribe have passed the IKG such as craftsmanship skills to their children. This finding can be seen through interviews with Informant 5 and Informant 1;

*"...kids are taught..."*

(Informant 5: T/M/58)

*"...we teach it to children if there is a program and VIP comes if any, sewang program. That's all for entertainment.."*

(Informant 1:S/M/39)

The findings of this study found that some also learn the IKG from skilled friends before this precious IKG in mortal danger and at risk of being lost, diluted and disappear. As informed by Informant 6 from Semai tribe in Selangor, she gained this knowledge from her friends rather than her parents. Through interviews with her, she stated;

*"... I do not learn this from my mother... from my friend.. we learn together from friends who know more..."*

(Informant 6:S/F/56)

While for Mah Meri tribe, Informant 2 stated that he learned handicraft skills from her mother;

*".. I learn from mom.."*

(Informant 2: MM/F/49)

Through an interview with *Tok Batin* (Informant 3) of the Semaq Beri tribe, all the skills and knowledge he practiced in daily life were obtained from his grandparents previously.

*"... I learn my grandpa and grandma...."*

(Informant 3: SB/M/58)

Plus, the informants on the forest conservation and preservation including ensuring seedlings are still present in the harvesting of forest products and stop the prosecution of the settlers in collecting forest produce. However, the enthusiasm of the settlers to collect forest produce to gain benefit have exceeds those of the Indigenous peoples who only took for specific purposes as the following Informant 7 said;

*"..But now they've been too passionate, cutting for commercial honey, kelulut honey, and once they cut it down, they give up to carving people too.."*

(Informant 7: MM/M/42)

### **Development of Orang Asli IKG Framework**

Figure 7 shows a new framework of orang asli IKG is proposed based on the findings of the research objectives 1, 2 and 3 wherein all the participants of the study on IKG are identified to answer research objective 4. This new framework formed based on the values and it connects Orang Asli IKG, culture, identity as well as the interaction of natural environment. The multidiscipline of five constructs; i) medicine, ii) food, iii) handicraft, iv) music and v) forestry are linked to the preservation of sustainable development practiced by Orang Asli tribes.

These constructs provide the basis for local-level decision-making about many fundamental aspects of day-to-day life and adaptation to environmental or social change. The development of this framework is to contribute to global efforts to map and not only can be used by modern communities as a guide to reduce carbon footprint and others damages evolved, but also for environmentalists, government & NGOs and policy makers who are striving to improve conditions in rural localities. It is also can also be used at all levels; institutions, regional, national, and at local scales who are aspired to launch sustainability programs locally or internationally as practiced by Semai, Mah Meri, Semaq Beri, Temuan and Bateq in their daily routine.

### **Conclusion**

In summary, based on the analysis of the themes obtained through the data, IKG promotes the application of tools, techniques, processes and methods in solving problems especially in conserving natural resources and minimizing the degradation of the environment. At this basic level, green technology is defined as the application of IKG to provide solutions to problems, mostly of mankind. Some forms of IK are expressed through stories, folklores, rituals, songs, and even laws while other forms are often expressed through different means. All tribes in this study have its own uniqueness and distinctiveness that they inherited from

their ancestors. They believed that taboos, the existence of spirits and supernatural will control and give a huge impact in their daily life. Subsequently, they attempted to maximize the use of modern technology to avoid misfortunes and other bad signs in their daily lives if they violate the rules of nature. They did not possess the elaborate technologies that permit them to ignore the nature's own requirements. Thus, they are very cautious and focused on the practice of taboos in their community (Yew et al., 2017). Moreover, they believe that IK and the practice of this heritage exist since the age of their ancestors sometimes ago whereby they were very close to the environment. The close relationship has greatly influenced the way of life and their economic resources (Sam & Aminah, 2015).

It is of utmost importance to ensure the continuity to future generations and sharing the new knowledge towards using the 'GT' known from the Orang Asli tribes for sustainable development. The preservation of this extraordinary knowledge and the importance of biodiversity conservation is therefore fundamental and the strategies of sustainable use should be reinforced and considered for long-term availability of natural resources here and even in the whole country.

Therefore, it is important for us, particularly at the grassroots, to acknowledge and support indigenous knowledge development associated with 'green technology' in Malaysia. The failure to document these knowledge has led significantly to 'language extinction', which results in the loss of environmental knowledge from many traditional cultures. As mentioned by Hood Salleh (2003, p.7), 200 Orang Asli languages in Peninsular Malaysia have dwindled to only 12 at present. He further quoted by saying that "when we endanger the indigenous communities 'culture we are endangering our knowledge of the forests' biodiversity as well." As a colonized nation for 446 years, Malaysia is still considered an infant (48 years old).

Not solely that, now it is the right time go back to basic where there is a necessity to apply IKG and practices used by Orang Asli in their daily life since the days of their ancestors till today. It is additionally necessary to induce a wider view of the tradition and the way Orang Asli IKG has affected modern society. Moreover, Orang Asli IKG is dwindling from the society, and in this case, actions should be taken to preserve the tradition, and something should be done to assist the preservation.

### **Recommendations**

This qualitative research used a descriptive approach which focuses on the limited context and informants can generalized for wider context if improvement via related future researches is conducted. Even though the research is done had already achieved the objectives set, there are still rooms for improvement. The development of Orang Asli IKG framework (refer Figure 7) contribute to global efforts to map and document IKG before it gets lost forever. The development of this framework not only can be used by modern communities as a guide to reducing carbon footprint and others damages evolved but also for environmentalists, government & NGOs, and policymakers who are striving to improve conditions in rural localities.

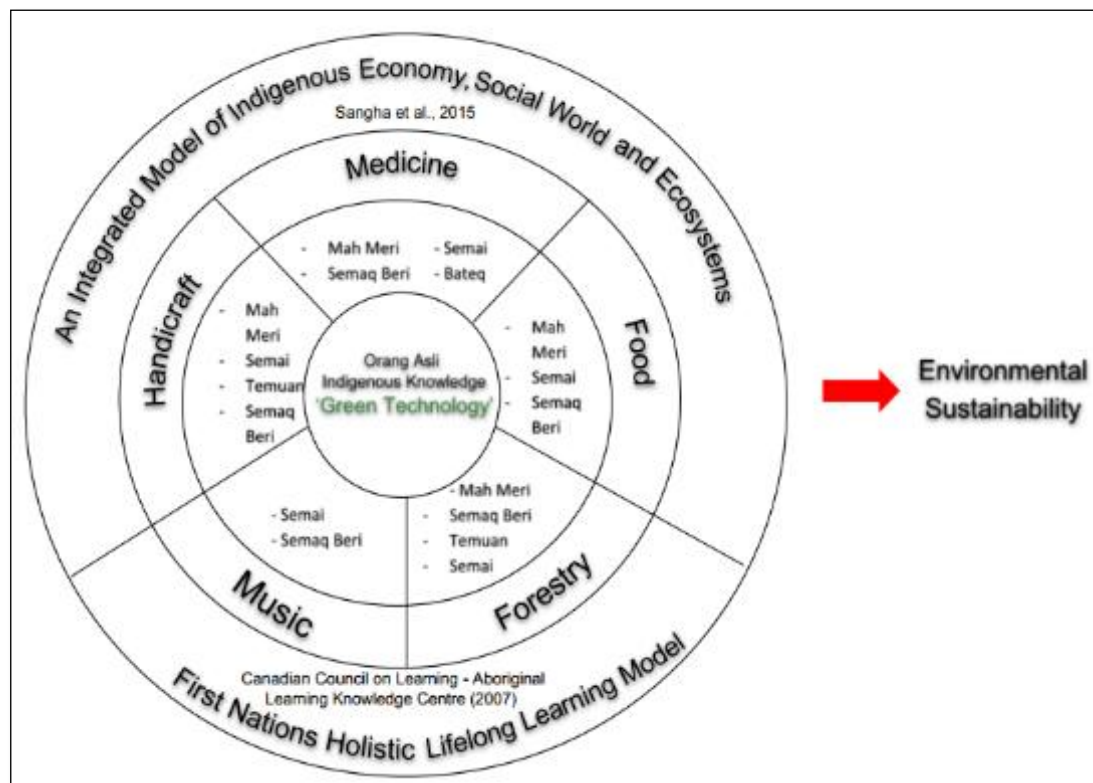
In addition, it is useful for end-users such as teachers or educators to generate learning modules to be used with their pre-service teachers and to enhance awareness, knowledge, and capacity of all levels towards green growth in line with the national policy. Furthermore, Orang Asli IKG can also be used at all levels; institutions, regional, national, and at local scales



who are aspired to launch sustainability programs locally or internationally as well as expanding economic and market forces while preserving cultural diversity.

**Figure 7: Orang Asli IKG Framework**

This study is beneficial because the insight gained is useful in launching various environmental programs. Orang Asli IKG developed can be used and applied to support and contribute to academic knowledge for future studies. It is hoped that the Orang Asli IKG framework can be as a guide towards the national policy of making Malaysia a



greener place as stipulated in 11th Malaysia Plan 2016-2020.

Additionally, the five constructs of IKG for sustainable development need to be taught to young generations for the continued survival on the earth and this will help to conserve and preserve the cultural heritage of Orang Asli tribes of Peninsular Malaysia at large. Therefore, the researcher suggested further studies to be carried out involving more target groups of orang asli tribes throughout Malaysia to increase the reliability and validity of the study results. This can be significant as this research confirmed that orang Asli IKG contributed to the information systems solution in preserving environmental sustainability. It is also would be interesting to identify IKG of the native at Sabah and Sarawak.

In addition to that, research related to the aspect of forestry, music and food should study in a deeper manner. The combination of some other construct models needs to be considered too. Apart from that, the triangulation of qualitative and quantitative approaches is recommended to enhance the research methodology on Orang Asli IKG.

The researcher also suggested studying the level of awareness of Orang Asli with appropriate approaches to attract the interest of the younger generation in learning and inheriting IKG. Orang Asli IKG for sustainable development need to be taught to young generations for the continued survival on the earth and this will help to conserve and preserve

the cultural heritage of Orang Asli tribes of Peninsular Malaysia at large. This is because these tribes are known as the preserver of this culturally-rich important craftsmanship that reflects their beliefs and views of the world which was inherited from their forefathers and have been developed indigenously over a long period.

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