

A REVIEW ON THE APPLICATION OF SUSTAINABLE MODERN HIVES AMONG STINGLESS BEEKEEPER IN MALAYSIA

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Article history

Received date : 1-3-2022
Revised date : 2-3-2022
Accepted date : 25-6-2022
Published date : 1-8-2022

To cite this document:

Langkan, F. J., Sumin, V., Ag Damit, H., Awang Besar, N., & Wasli, M. E. (2022). A Review on The Application of Sustainable Modern Hives Among Stingless Beekeeper in Malaysia. *International Journal of Accounting, Finance and Business (IJAFB)*, 7(41), 383 - 389.

Abstract: *Sustainable practices are one way to address the growing environmental problem. The application of Sustainable modern hives plays a significant role in Malaysia's socio-economic development and environmental conservation. In conventional practices, the colony was obtained from the bee logs hunting activities or natural hives by cutting down trees, which disturb the natural habitat. The lack of awareness has led to designing a new phase of modern hives with sustainable characteristics to conserve the natural habitat ecosystem. These days, the alternative modern hives proved to be the solution for developing a sustainable stingless beekeeping industry in Malaysia and one of the strategies to increase the revenue in stingless beekeeping business by using multiplication of stingless bees' colony method. Thus, this study aimed to compile the transition process of hives design used by stingless beekeeping in Malaysia. Nowadays, both conventional and modern designs of hives are used locally. The review results revealed the transition from conventional to sustainable modern hives approaches used by the stingless beekeeper and comply with the standard of My GAP A.M. in stingless bee farm activity.*

Keywords: *Sustainable, Modern, Hives, Stingless Beekeeper, Malaysia.*

Introduction

Stingless bee farming plays a major role in the socio-economic development and environmental conservation in Malaysia. It is a source of food, raw materials for various industries, medicine, and an additional source of income. It is estimated that the industry can generate millions of ringgits in revenue yearly from the sales of bee products and by-products. It is an important income-generating activity with high potential in improving the income of stingless beekeepers in particular. According to the Deputy Minister of Agriculture and Agro-based Industry, Datuk Anthony Nogeh Gumbek, the stingless bees sector contributed more than MYR4 billion to the national forestry industry in 2017 (The Star, 2017). In the United States of America (USA), the pollination services of honeybees were estimated to worth more than USD200 billion yearly, of which the value of the services is much higher than the production of honey (Ismail et al., 2018). In the tropical and subtropical parts of the world, stingless bees are considered important pollinators of the native flora. They have been found to contribute to the pollination of many crops and wild plants (Chidi & Odo, 2017). This conducive plant reproduction is an important source of food production for both humans and animals. Bee pollination has been proven to be a natural activity in conserving the rainforest (Ismail, 2016; Biesmeijer et al., 2006). In conventional practices, the bee colony was obtained from the activities of bee logs hunting or natural hives by cutting down the trees, which disturbed the natural habitat. Moreover, cutting down the trees when hunting bee logs in their natural habitats will consequently reduce the native pollinators, which has implications for forest recovery or restoration (Chidi & Odo, 2017). Albert Einstein stated, "If the bee is extinct from the surface of the earth, man would have no more than four years left to live." The statement implies that bees play a major role in the pollination process, which is crucial in maintaining a balanced ecosystem to sustain human life.

The application of log hives in hive preparation will also affect the social aspect (human surroundings). Lack of information, awareness, and knowledge about colony multiplication and the use of modern hive will cause the stingless beekeeper to face a limited source of colonies. Besides hunting for a log hive in their native habitat, the tendency of the people to steal hives from other stingless beekeepers will also increase due to the increasing demand of stingless bee honey. Stolen beehives are another serious problem faced by stingless beekeepers (Man et al., 2019). The current market price in Malaysia for the stingless bee colony could reach MYR500 to MYR1,000, while stingless bee honey current price is MYR85 per 150 grams (Jailani et al., 2019; Kumara et al., 2016; Rattanawanee & Duangphakdee, 2019). Therefore, the application of modern hive in stingless beekeeping is vital for a sustainable stingless beekeeping industry in Malaysia. The previous study by Chidi and Odo (2017) suggested using modern splitting hive methods on the compartmented hive for small-scale farmers. Thus, there is a need to educate the rural community on the importance of stingless bees in the pollination process for a balanced ecosystem to prevent them from cutting down trees when hunting for the bees in their natural habitats. Musa et al. (2019) proposed that the extension agriculture and the relevant agricultural research institutions, such as MARDI and DOA, should improve their services further, especially in disseminating knowledge to ensure that the beekeepers understand the advantage of using new technology. The effectiveness and success of using modern hives could attract non-adopters to use the method.

This study focuses on establishing a review to sustainable modern hives approaches by looking at the sustainable characteristics of the existing hives based on the standard of My GAP A.M. in stingless bee farm activity as introduced by Department of Agriculture Malaysia since 2002.

Contribution of The Study

The stingless beekeeping project could be considered one of the potentially high-impact agriculture projects in Malaysia (Basrawi et al., 2017). According to M. M. Ismail et al. (2018), stingless beekeepers could earn an average of RM 5000 per month with zero tax. Another survey also indicated that 36% and 29% of stingless beekeepers generated an additional income of RM 833 and RM 1666, respectively (Mustafa et al., 2018). Bee products and by-products are emerging industries and getting popular among consumers because of the medicinal properties and superfood characteristics. Thus, encouraging the involvement of stingless beekeeping during the infancy stage of the industry is imperative. One of the strategies for increasing the revenue in stingless beekeeping business is the multiplication of the stingless bees' colony. The process of colony multiplication requires the beekeeper to prepare several hives. Hives are traditionally created by cutting log portions from a tree to obtain wild colonies of stingless bees, which are then transferred to the bee farm (Musa et al., 2019). Nowadays, modern hives are made from recycled materials, such as bottles and PVC, which are the most popular used by beekeepers. Modern hives play an essential role in establishing sustainable stingless beekeeping since more colonies are required to increase the production of honey, and their valuable by-products; the additional bee colonies could be sold to other beekeepers as well (Jaffé et al., 2015). However, the current application of modern hives in the stingless beekeeping industry is still low in Malaysia. As stated in the statistic of the stingless beekeeper that obtained Malaysian Good Agricultural Practices (Tribus Apini dan Tribus Meliponini) or known as MyGAP A.M in the year 2021, only 101 over 717 stingless beekeepers registered under the Department of Agriculture in Malaysia. Thus, this study will compile the hive design previously and currently used stingless beekeepers in Malaysia. Sustainable modern hives features will give a benefit to human, environment and ecology as indicated in the sustainable development goals (SDG) 1 (no poverty), 2 (No hunger) and 13 (issues on climate change; sustainable modern hive will give a positive impact on ecology, ecosystem, human surroundings). A balanced ecosystem was found to reduce or delay the global warming effect (Ramirez et al., 2015). Colony multiplication by increasing the number of hives will increase the source of income of stingless beekeeping (SDG 1).

Review on the application of Sustainable Modern hives among Stingless Beekeeper in Malaysia

A) Conventional Method

Traditionally, hives are prepared by cutting log sections from a tree (Musa et al., 2019) to obtain the wild colonies of stingless bees, and later transferred to the bee farm. This is a non-sustainable practice is encouraging the demolition and deforestation of the forest; hence, the prohibition from searching and hunting for the log hives for stingless bees (Jailani et al., 2019; Sommeijer, 1999). According to the Department of Agriculture Malaysia (DOA), there are around 700 active stingless beekeepers in Malaysia (Berita Harian, 2019). At least 30 hives are needed to start a stingless beekeeping project in order to obtain a significant income. If all the 700 stingless beekeepers started with 30 log hives taken from the forest, approximately 21,000 trees would be cut down, which is equivalent to 100 hectares of forest being chopped down. Therefore, multiplication of the colony, using other resources is a preferable alternative to ensure the sustainability of the surrounding environment.

B) The Transition Towards Sustainable Modern Hive Design Approaches In Stingless Bee Industry In Malaysia

Technology is influential in transforming the nature of a business and industrial sector; the agriculture sector is no exception. In recent years, the Malaysian government has given due attention to stingless beekeeping through the Ministry of Agriculture (MOA) because of its high potential. Isah et al. (2019) asserted that there would be a significant improvement if beekeepers adopt the right technology, and it could provide a sustainable outcome for the country's economy. Modern hive application in stingless beekeeping is considered one of the technology implementations that will be highly beneficial to the stingless beekeeping industry. The artificial hive box or a modern hive is a human-made structure, created as a new house for the stingless bees' colony that will be transferred from their original log hive (Man et al., 2019). In Malaysia, the stingless Beekeeper actively to implement sustainable practices in hive design since the certification of Malaysian Good Agricultural Practices (Tribus Apini dan Tribus Meliponini) or known as MyGAP A.M (2002). The global market for value-added products is expanding as increasing the consumer's healthy lifestyle has led to more significant product differentiation and added value opportunities. Thus, MyGAP AM certification produces quality production of stingless bee honey that is safe to eat, preserving the environment and benefitting the consumer. From the producer's perspective, productivity increases, farmworker safety, and welfare are ensured, stingless bees-based products are well-known and compete in domestic and international markets.

The purpose of MYGAP AM is to guide the beekeepers of the stingless bees to "adopt an environmentally friendly concept, safeguarding the welfare and safety of workers to produce quality, safe and edible products." The number of stingless beekeepers who obtained MyGAP AM until June 2021 is about 101. Six main elements need to be fulfilled by the stingless beekeeper to obtain MyGAP A.M certification. These include i) traceability of the post-harvest of stingless bee honey production, ii) Recordkeeping and auditing, iii) Site/location selection, iv) Management of Apiary/ Meliponari, v) Standard compliance, and vi) Legal requirements. As stated in Apiary and Meliponary, one of the elements is the hive. According to MyGAP A.M (2002), hives must be made of materials that do not risk contamination to stingless bees, honey production, and the environment. The hive is also not placed directly on the ground. In terms of design, the hive needs to be considered the welfare of stingless bees.

C) Sustainable Modern Hive Design

There are several models of boxes: horizontal or vertical, with various sizes depending on the species' arrangement of brood and food pots (Rattanawanee & Duangphakdee, 2019). Some of the modern hives has been patented, and it was successfully utilized in stingless beekeeping (Jailani et al., 2019). For example, the MUSTAFA-Hive, designed by Dr. Mohd Zulkifli Mustafa from Universiti Sains Malaysia, successfully upholds the daughter colony survival, shown by the gradual increase of the queen cell's number and the height of brood layer after the colony transfer (Jailani et al., 2019). Therefore, it is believed that the adoption of this innovative technology in upholding the stingless beekeeping industry serves as a holistic approach that will benefit the country's socio-economy, species survival, and long-term ecological preservation, which supported Mustafa et al. (2018). As showed in the Table the transition of the hive design from conventional to modern and sustainable design approaches. Several studies found that modern hives significantly increase the production of honey, easy to inspect and harvest, transportable, high potential for queen rearing, high colony survival rate, long-lasting, and environmentally safe (Barbiéri et al., 2019; Fikadu & Tilaye, 2017; Isah et al.,

2019; Jailani et al., 2019; Man et al., 2019; McMenamain et al., 2017; Musa et al., 2019; Sommeijer, 1999).

Table 1: Review of The hive transition From Conventional To SUSTIANBALE MODERN Hive.

No	Review of The Hive Transition From Conventional To Sustainable Modern Hive			
	<i>Authors</i>	<i>year</i>	<i>Characteristics of Hives Design</i>	<i>Sustainable element</i>
1	Sommeijer	1999	UTOB hive- two chambers in one wooden hive (brood chamber and honey chamber)	Efficient harvesting and minimum damaged on brood layer
2	Fikadu et. al	2017	Modern Hive Design	High yield, better honey quality, ease of inspection, and ease of product harvesting
3	McMenamin et al	2017	The impact of hive type on the behavior	Langstroth hives to be the most attractive to migrating swarms
4	Luqman et al.	2018	Mustafa Hive- Air-jacket thermoregulation system	Stimulate production and growth, easy to inspect and harvest
5	Jailani et al	2019	The colony transfer strategy from log to hive	The colony transfers and splitting strategies proves to maintain survival of the daughter colony, which was indicated by the gradual increase of height of brood layer and number of queen cell
6	Barbiéri et al	2019	hive model with visibility characteristics interior of the hive.	Facilitating ecological and behavioral studies and environmental education
7	Rahman et al.	2019	Zen Hachi hive- simple and small modern hive	Eco friendly
8	Man et al	2019	Hive design with IOT technology. Equipped with with Global Positioning System (GPS) tracking and temperature and humidity sensor anytime and anywhere.	Tracking and monitoring the number of beehives As well as to monitor a good quality of honey production and temperature

D) Future Direction of the potential of sustainable modern hive usage among the stingless beeKEEPER in Malaysia.

The beekeeping industry in Malaysia has great potential to be explored from many perspectives. One of the crucial elements by implementing the multiplication of stingless bees' colony method. Sustainable modern hives that produce high quantity and quality of honey production, inspection and harvesting process become more manageable, mobile, high potential for queen rearing, high colony survival rate, long-lasting and environmentally safe.

Conclusion

In line with the government initiative of the National Kelulut Industry Development Plan 2020-2030, this study provides significant findings that make the stingless beekeeping industry a new source of stable and sustainable income. This study can also assist the government agencies in identifying adequate supports and incentives to give exposure to the stingless beekeepers to use 4.0 technology in stingless bee farming particularly in the selection process of sustainable modern hive design to produce competitive entrepreneurs in the national and global market in line with the Agricultural Revolution 4.0.

Acknowledgment

The authors would like to express their deepest gratitude to the Research Grant of SDG@BORNEO 2020, for the technical and financial support for this study.

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