

## Development Strategy and Existing Qualities of Honeybee in Beekeepers Group Badung Regency-Bali

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## Abstract

The cultivation of local honeybees is one of the new alternative jobs for the local community in Badung Regency, Bali to survive their life during Covid-19. This research aims to identify and determine of development strategy and to evaluate the quality existing of honeybees. The total sample was used 50 respondents consisting of 22 members of beekeepers of the "Sarining Trigona Pertiwi" group, 4 samples from local government, 4 from related institution government, and 20 local people. The SWOT method is used to formulate appropriate strategies and IE matrix is to analyze the condition of the honeybee-tourism strategy. The results of the analysis showed that internal factors have a total value of 3.20, with the highest factor being strategic partners in product innovation development. External factor analysis has a total value of 2.88 with the highest factor being increasingly diverse product diversification. Based on the IE matrix, tourism in quadrant IV shows the potential development of honeybees in Badung Regency, Bali is in a position to grow and develop with the appropriate intensive and integrated strategy. Based on the SWOT matrix were obtained strategies to conduct socialization of the cultivation program, having a research program regularly, developing products based on consumer demand, collaborating with cooperatives and Banks in credit services, conducting marketing and good market expansion, making SOP in the process, manufacture and storage of products, government policies on reforestation and forest area protection, human resource training, preparing market analysis and strategies, alternative food sources for the honeybees, and increasing product development. However, the qualities of *Tetragonula laevicep* honeybees produced by the beekeeper of "Sarining Trigona Pertiwi" are still lower than Indonesia National Standard (SNI) therefore; need to increase the quality in the future.

**Keywords:** Strategy; Development; *Tetragonula laevicep*; Honey quality; Badung regency.

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## 1. Introduction

Honey, in most cases, is widely used as a food ingredient [1]. Due to its natural properties with medical importance, people have used it for healthcare reasons [2]. The demand for honey continues with increased usage meanwhile the number of beekeepers remains the same. For some reason, others may have shifted to other industries or other forms of livelihood which led to one of the critical issues in the beekeeping industry: the unstable supply of honey. One factor that could probably discourage people from raising bees is the sting that it can suffer to beekeepers. This, therefore, suggests an impression that stingless bees may be favored to raise over those bee species that sting. Beekeepers are inclined to choose species with good behavior such as stingless bees [3]. In tropical countries like the Indonesia and Philippines, stingless bees thrive well as most of these bees prefer warm temperatures Kwapong, *et al.* [4] and Salatnaya, *et al.* [5].

Bali is one of the most beautiful islands and is very popular in the world as a tourist destination. Bali has eight regencies and one city. One regency that is very popular due to the tourism sector is the Badung regency. Badung Regency is one of the richest regencies in the province of Bali and its tourism is the largest contributor to the

regional budget for the province of Bali before Covid-19. Based on the Gross Domestic Product (GDP), it is known that the tourism sector is the highest contributor to GDP in that regency (45.19%), then the transportation and communication sector (25.17%), services (8.62%), agriculture (9.01%) and buildings (4.63%), while the contribution of other sectors was below 5% [6].

Unfortunately, in Badung regency, during the pandemic covid-19, many tourism sector workers lose their jobs, causing an increased unemployment level. The number of unemployed in the regency at the end of the year 2018 is 1.543 people and increase rapidly during covid-19 (the year 2020) to 43.960 people ( $\pm$  96.49%) [6]. This is a critical condition for the people to survive their life and they do not know when the pandemic Covid-19 will end. Therefore, the regency creates to development of the agriculture sector in other to offer alternative jobs for people who lose their jobs in the tourism sector. Develop of local beekeeping is one of the new alternative jobs that can do by the people in the regency because easy to cultivate, not too expensive, and can produce honey will give additional income for the survival of their life. Two kinds of stingless bees that many cultivated are *Tetragonula laeviceps* and *Heterotrigona itama*. The *Tetragonula laeviceps* is a local bee was called “kela-kela” in Bali. This bee is more adapted to warm temperatures easier to cultivate and grow and does not need a large investment [7] reported that the production of the stingless honeybee is more economical, requires simple hives, and has healing properties. It is also in line with Abou-Shaara [8], Tomczyk, *et al.* [9], and Gürbüz, *et al.* [10] that beekeeping as agricultural activity can be impacted by environmental and geographical factors. This study aimed to identify and determine the development strategy of honeybee cultivation and evaluate the existing quality of the honeybee.

## 2. Material and Method

This research was conducted in a beekeeper’s group of “Sarining Trigona Pertiwi” and located in Bongkasa Pertiwi village, Badung Regency, Bali Province, Indonesia. The beekeeper has several superiorities such as a lot of local bees colony, a favorable environment, and food resources for the bees. The research started from April to September 2021. This research uses a qualitative and quantitative approach with a descriptive method. Data collection through primary data and secondary data. Primary data is done through observation, interviews, and documentation. To get more information and complete data, also conducted of Focus Group Discussion (FGD) and invited government institutions, the private sector, beekeeper group representatives, academic institutions, and experts. In-depth interviews were conducted with all the beekeepers’ groups. Each group was evaluated with the same questionnaire and the same method. The purposive sampling method was used for collecting the respondents. Totally of 50 samples were used and consists of 22 members of beekeepers of the “Sarining Trigona Pertiwi” group, 4 samples from the local government, 4 from related institutions government and 20 of local people. The secondary data was collected through literature studies and from related institutions. Two bottle samples of the honeybees namely *Tetragonula laeviceps* and *Heterotrigona itama* (100 ml/bottle) were obtained from a member of the beekeeper group for physicochemical analysis in the Laboratory of Agriculture Faculty University of Warmadewa. The quality analysis was conducted to obtain the existing quality of local honeybees and to find a good procedure to increase their quality. The data analyzed then were compared with the Indonesia Nasional Standard (SNI 01-3545:2004 [11].

The analysis used in this research is a descriptive analysis using the SWOT analysis technique [12]. The formulation of alternative strategies is carried out using SWOT analysis, such as analyzing opportunities, threats, strengths, and weaknesses. Strengths and weaknesses are identified as internal factors, while opportunities and threats are identified as external factors. After finishing the SWOT analysis will continue with the Analytic Network Process (ANP) [13].

## 3. Results

### 3.1. Honeybee Cultivation in Badung Regency

Badung Regency has an area of 418.52 km<sup>2</sup> or about 7.43% of the total area of Bali. The area of the regency is 418.52 km<sup>2</sup> which administratively covers 6 districts, 16 sub-districts, and 46 villages. The regency has many tourist objects that are very interesting and are well known in the world. The tourism sector (construction sector, trade, hotel, and restaurant sector) is the highest contributor to GDP in the regency (45.19%), then the transportation and communication sector (25.17%), services (8.62%), agriculture (9.01%) and building (4.63%), while the contribution of other sectors was below 5% [14]. In the regency, most people work in the tourism, transportation, services, and agriculture/plantation sectors.

The cultivation of *T. laeviceps* bees in Badung regency is not too abundant and people do this alternative job, not as the main job. Therefore, there is a limited date for a beekeeper in the Badung regency so the government it difficult to develop and mentor the population of bees. During the pandemic Covid-19, the cultivation of bees has good potency and prospects in the future because many people who lost their jobs in the tourism sector will take this chance to continue their life. Two abundant types of Trigona Sp bees are grown by the beekeepers in Badung regencies such as *T. laeviceps* and *H. itama* although there are other types of bees also grown by the people. Based on observation and interview with the beekeeper found that *T. laeviceps* is more cultivated than *H. itama*. *T. laeviceps* is a local bee, therefore, has more adapted, and stronger, and the price of the colony is cheaper than *H. itama*. The price of local bee colonies is around 150.000 to 200.000 Indonesian rupiah or around the USD10-13.3. Meanwhile, the colony of *H. itama* is around 1.500.000 to 1.700.000 Indonesia rupiah or around the USD 100-13.3, it is mean that to cultivate the *H. itama* needs more capital than *T.laeviceps* or “kela-kela” bees. Both bees are

stingless bees that are no danger to humans and *H. itama* is not a local bee but comes from West Sumatra. Although, *H. itama* is not a local bee and is more expensive however the productivity of honey is higher than a local bee.

### 3.2. Existing quality of *T. Laeviceps* and *H. Itama* Honeybees

Moisture content is one attribute that is used for indicating the honeybee quality. The chemical analysis showed that both honeybees have higher moisture content than Indonesia's National Standard (SNI) a maximum of 22%. The moisture content of *T. laeviceps* 34.99% is lower than honeybee of *H. itama* 37.34% (Table 1).

**Table-1.** The existing quality of honeybees in beekeepers of "Sarining Trigona Pertiwi" group

Parameters of Quality	Type of Bees		Indonesia National Standard (SNI 01-3545-2004)
	<i>T. laeviceps</i>	<i>H. itama</i>	
Moisture content (%)	34.99	37.34	Maximum 22
Ash content (%)	0.75	0.68	Maximum 0.5
Reducing sugar (%)	61.23	64.37	Minimum 65
Acidity level (ml NaOH 1 N)	0.15	0.18	Maximum 50

### 3.3. Development and Evaluation of Beekeeper Group in Badung Regency

The results of the internal factor analysis showed that the highest value of 0.90 was found in a strength factor is its strategic partnership in improving products innovative such as research institutions, universities, and government. Meanwhile, the lowest value of 0.40 is for local government policy (Table 2). The other factors also need to consider are inexpensive workers (0.56), availability of food resources for bees (0.48), product differentiation (0.48), and the lowest value of 0.40 is local government police need to increase as well (Table 2). The weakness factors showed that the highest value of 0.18 is given by an ineffective marketing system and followed by a low control product of 0.15, whereas the lowest value is given by absorption of product innovation. Table 2 showed that the total internal factor value was 3.21 including strength and weakness factors. The strength factor has a value of 2.82 and the weakness factor gave 0.39. The strength factor has a higher value than the weakness factor.

**Table-2.** Internal factors value

Internal factors	Weight value
Strength	
The policy of the local government	0.40
Products differentiation	0.48
Available food resources	0.48
Inexpensive workers and considerable	0.56
Own strategy partnership in improving product innovation (Research Institution, University, Government)	0.90
Weakness	
Ineffective marketing system	0.18
Slowly absorption of product innovative	0.06
Low of control product	0.15
Total	3.21

**Table-3.** External factors value

External factors	Weight value
Opportunity	
Potential for cultivation improvement	0.34
Potential market access	0.45
Utilization of small business enterprise and "KUR"	0.30
The growth rate of Bali people	0.30
Growth of domestic and international visitor	0.49
The increasing diversification of product development	0.70
Threat	
Forestry as a food resource is limited	0.14
Uninteresting as beekeeper job	0.05
Open market access	0.05
Competitor in an income strategy	0.06
Total	2.88

External factor analysis including of opportunity and threat factors as shown in Table 3. Table 3 showed that in the opportunity factor the highest value is 0.70 was given by increasing diversification of product development and whereas the lowest value of 0.30 was given by utilization of small business enterprise and "KUR". On the threat factor, the highest value of 0.14 is forestry as a food resource is limited, and the lowest value is 0.05 given by

uninteresting as beekeeper job and open market access. Based on external factors analyzed that has a total value of 2.88 including opportunity and threat factors.

### 3.4. Strategy for Developing Stingless Bee in Badung Regency

The yield of EFE and IFE was analyzed and combined on the IE matrix as shown in Table 4 and Table 5. Table 4 and Table 5, showed that the important variable key of the beekeeper is in quadrant IV.

Table-4. Matriks of internal-external (IE) strategy

		The average total of IFE		
		Strength 3.00-4.00	Average 2.00-2.99	Weakness 1.00-1.99
The average total of EFE	Strength 3.00-4.00	I	II	III
	Average 2.00-2.99	IV	V	VI
	Weakness 1.00-1.99	VII	VIII	IX

Table-5. Internal-external strategy

External (I)	Strength (II)	Weakness (III)
Opportunity (IV)	SO (V)	ST (VI)
Treat (VII)	ST (VIII)	WT (IX)

## 4. Discussion

Some reasons why the population of a beekeeper in the Badung regency is limited probably due to a lack of knowledge of how to cultivate the bees, they have not enough skills to grow the stingless bees, and they think that the bee will attack and damage their crops and not have the capital for cultivating the bees. Munadi, *et al.* [15] and Sanjaya, *et al.* [16] reported that education is one of the factors that affected business success due to education's impact on the mindset, attitudes, and abilities of farming productivity. Beekeeping is not just positively contributing to income gain it also plays a role in increased food security, but beekeeping activity and its potential receive only subordinate attention within the Indonesian government and population. Bee businesses are mostly considered a part-time farming activity and not only parts of the local community, but people from every social class are not aware of the benefits of the bee Tomczyk, *et al.* [9].

Quality is one important parameter to consider by the consumer to buy honey. Good quality honey contains many nutrients and bioactive compounds that function as antioxidants and health care for the human body. Hernández-Fuentes, *et al.* [17], reported that honey is important food due to contains bioactive compounds that are derived from plants and the bees that produce it. Both honeybees *T. laeviceps* and *H. itama* have higher moisture content than the quality standard are maximum of 22%. Therefore, need to decrease the moisture content to meet lower than SNI in other to increase their quality and shelf-life. According to Mangku, *et al.* [18], honey has moisture contain more than 20% has low viscosity and easier to damage then will shorter the shelf life. The lower temperature and higher humidity of the environment will increase the moisture content of both honeybees. Moisture is one of the most important parameters of honey quality. Hernández-Fuentes, *et al.* [17], reported that the moisture content of honey is influenced by climate and post-harvest handling. According to Gürbüz, *et al.* [10], the factors in the environment that influences the activities of the bees are temperature, relative humidity, season, 26.5 to 27°C [12] and temperature of 26°C, and humidity between 70-80% [13]. On the other hand, the practice of input providers that tend to lower the quality of the extracted honey indiscriminate harvesting of both ripe and unripe honey leads to increased moisture content [15]. The moisture content is greatly influenced by the floral source used by the stingless bee, harvesting season, maturation level in the honeypots, weather, and environmental conditions. [19] revealed that different management, harvesting, and processing technology can influence the final quality of the honey.

The ask content of *T. laeviceps* is 0.75% is higher than *H. itama* is 0.68%. Unfortunately, the ash content of both bees is higher than the standard maximum of 0.5%. Indonesia National Standard (SNI) [20], stated that the reduced sugar content of honeybees is a minimum of 65%. Based on the analysis showed that both sugar contents were lower than standard quality. The reduction of sugar needs to increase in other to fulfill the SNI requirements. The low sugar content is probably due to the honey being harvested not being mature yet or overmatured. When the honey is harvested early before mature will cause the formation of sugar compounds uncomplete but while the honey harvest is overmatured will cause the breakdown of sugar content by a fermentation process. According to Hidayat, *et al.* [21], the lower sugar content is due to the fermentation process in honey.

The higher moisture content in honeybees can accelerate fermentation in the honey. The acidity level of both honeybees is lower than the standard quality maximum of 50 ml NaOH and it is indicated that the acidity of the honeybee has fulfilled the standard quality. Acidity level can use as an indicator of honeybee quality when the acidity level is higher so that the aroma and taste of the honey will be sour. The flavor of both honeybees is not too sour. Stingless bee honey has a sweet and sour taste to *Apis mellifera* honey due to its low pH and high free acidity values [22]. The acidity level in honey is affected by the acid compound content, the higher the acid content will

increase the acidity level. Naturally, the acid compound is in the honey and also formation during harvest and storage due to the fermentation process produce of sugar compound then oxidation process with O<sub>2</sub> will produce new acid compounds which cause an increase of the acidity level of the honeybee. The amount of organic acids in the honey is related to the enzymatic action of glucose-oxidase on glucose, which involves the transformation of glucose into gluconic acid [22]. Fermentation also decreases the pH and increases the free acidity in the honey [23].

This indicates that when the rural community in that Bongkasa Pertiwi Village improves their quality and quantity of beekeepers they have to increase the strategy of partnership for improving products innovative with some other institutions like the institution of research, university, and government. Supporting from local government is essential for the new beekeeper group mainly for capital, mentoring, and guiding of the beekeeper. [24] reported that serious commitment, proper coordination among stakeholders, provision of incentives, and funds by the government are needed to develop sustainable development of entomotourism. Having knowledge of the correct time for honey harvesting is important to provide proper and timely extension service as well as technical support for beekeepers [25].

The production of the honeybee is influenced by food availability. The important factor that influences the foraging behavior of *T. laeviceps* is food source availability [26]. This condition indicates when the beekeepers increase their income from local honeybee cultivation then they have to improve their marketing strategy by using more online marketing systems. According to Hidalgo, *et al.* [7], while honey from stingless bees is viewed as a niche product, marketing plays an important role. The weakness factor is lower absorption product innovation also need to be considered in other to increase the quality and number of a beekeeper in Badung regency, Bali. Increasing product innovation can be cheap with diversification and collaboration with institution research to create new product development based on honey products. However, the limited experience of the beekeeper especially in knowledge and skill in food product development as became limited to grow of the honeybee business. Li, *et al.* [27] and Sanjaya, *et al.* [16] stated that experience was one the factors that influenced the formation of attitudes.

Quadrant IV shows the potential for developing *T. laeviceps* honeybee in Badung Regency, Bali is in a position to grow and develop with the appropriate intensive and integrated strategy. According to Tessema and Zeleke [28], the strategy for this condition of growth and development is intensive and integrated. The matrix is produced of some alternative strategies of the important variable key in the beekeeper.

The research found that the strategies to conduct socialization of the *T. laeviceps* honeybee development in Badung Regency are: having a research program regularly, developing products based on consumer demand, collaborating with cooperatives and Banks in credit services, conducting marketing and good market expansion, making of *Standard Operational Procedure* (SOP) in the process, manufacture, and storage of products, government policies on reforestation, and forest area protection, human resource training, preparing market analysis and strategies, alternative food sources for the “kela-kela” bees, and increasing product development. However, the qualities of *T. laeviceps* honeybees produced by the beekeeper of “Sarining Trigona Pertiwi” are still lower than Indonesia National Standard (SNI) therefore need to improve their quality for the future to make it more competitive and to increase the shelf life.

## 5. Conclusion

Badung regency has a good potential for bee cultivating of *T. laevicep* toward melitourism development in Bali province. The strategy to develop of local stinglessbee “kela-kela” in Badung regency are conducting socialization of cultivation program, having a research program regularly, developing products based on consumer demand, collaborating with cooperatives and Banks in credit services, conducting marketing and good market expansion, making SOP in the process, manufacture and storage of products, government policies on reforestation and forest area protection, human resource training, preparing market analysis and strategies, alternative food sources for the honeybees, and increasing product development. However, the quality of local honey still lower than quality standard especially the moisture content. Therefore need to increase the quality in other to fulfil the Indonesia National Standard (SNI).

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