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# Liberica Coffee Development and Refinement Project in Sarawak Malaysia †

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**Abstract:** This article discusses the past, present, and future development potential of the Liberica coffee industry in Malaysia, a traditional producer of Liberica coffee. It explores the challenges faced by the industry in the context of the specialty coffee movement and global warming. The article focuses on the history of Liberica coffee cultivation among the indigenous communities in the inland regions of Sarawak and Borneo, highlighting the diversity of Liberica varieties and their potential from rainforest highlands to river valleys. The article introduces the "Liberica refinement project" in Sarawak, which emphasizes natural farming methods. It discusses how trust was built with the indigenous communities, effective quality control systems were established, and how this enabled Liberica to enter the specialty coffee market. Through market-driven approaches, the project aims to empower indigenous communities and improve their livelihoods.

**Keywords:** *Coffea liberica*; Sarawak; Long Banga

## 1. Introduction

Amidst global climate change and the ensuing extreme weather conditions, traditional coffee belts dependent on *Coffea arabica* and *Coffea canephora* face significant obstacles. Among the range of coffee varieties available, *Coffea liberica* stands out as a resilient alternative, showcasing adaptability to changing climate scenarios. Malaysia, a primary producer of *C. liberica*, has a deep-rooted history in coffee farming and consumption [1]. The island of Borneo in East Malaysia is also a traditional production area for Liberica coffee [2].

Yet, even after nearly 140 years of Liberica cultivation, Malaysia has struggled to gain significant traction in the export market. Interestingly, there have been instances where the country has had to import Liberica coffee from its neighboring nations [3].

Located on the vast Borneo Island, Sarawak is a Malaysian state with considerable land area. It has seen consistent efforts from both the national government and regional agricultural bodies to boost Liberica coffee farming. These efforts include distributing coffee seedlings and various planting materials to the indigenous communities in remote areas. However, the results have often been disappointing due to lower-than-expected harvests, misalignment with market demands, and the eventual withdrawal from coffee farming by the native farmers [4].

This research, seeking to delve into the underpinnings of the aforementioned predicament and offer comprehensive solutions embracing crop-related expenditures, cultural, economic, and market dimensions, turns its focus to the Long Banga village, nestled in the remote heartland of Sarawak. Through a collaborative partnership with the indigenous inhabitants [5], this study aims to optimize production methodologies, address issues related to product quality and market value, and proffer a micro-success case study that can potentially serve as a salient benchmark for fellow coffee producers across Sarawak.



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## 2. Methods

### *2.1. Community-Based Participatory Observation (CBPO)*

A. We established long-term collaborations with local Liberica coffee producers to comprehensively understand the challenges they face in coffee production from cultural, economic, technological, and market perspectives.

B. Simultaneously, we engaged in continuous discussions and interactions with coffee producers regarding the economic analysis of Liberica crops. Together, we calculated anticipated yields and improvement levels, managing their investment expectations.

C. While ensuring the preservation of the local indigenous culture and natural environment, we empowered their operational practices. Responding to the needs of local coffee farmers, we shared knowledge about coffee cultivation, processing methods, and quality grading. Ultimately, we evaluated the degree of quality enhancement according to the standards of the specialty coffee industry.

### *2.2. Coffee Grading and Sensory Evaluation as Appraisal*

A. We employed suitable analytical instruments to assess whether the moisture content of green coffee beans meets the International Coffee Organization export standards [6].

B. We established a grading system for evaluating visual defects of green coffee beans based on criteria similar to those found in the Coffee Defect Handbook provided by organizations like the Specialty Coffee Association of America [7].

C. We employed flavor evaluation tools akin to those of the Coffee Quality Institute (CQI) and Coffee Consulate Flavor profile to assess improvements in coffee flavor qualities [8].

D. Observing market feedback on the final product.

## 3. Results and Discussion

### *3.1. History of Liberica in Malaysia*

Liberica has been cultivated in Southeast Asia since the late 19th century and has a cultivation history of nearly a hundred years. However, it only accounts for less than 2% of global coffee production. This phenomenon is due to its own biological characteristics and crop economics. Compared to the other two major coffee species, Liberica has relatively lower productivity [9].

Since the devastating outbreak of coffee leaf rust in Sri Lanka and Southeast Asian countries in the late 19th century, Liberica coffee from West Africa was introduced to Southeast Asia as a candidate coffee variety with effective resistance against coffee leaf rust. Later, different factions of Western colonizers planted Liberica coffee in Malaysia, the Philippines, and Indonesia.

In the 1900s, Canephora (Robusta) was discovered as an option with similar resistance to coffee leaf rust but a higher yield, and gradually replaced Liberica as the mainstream coffee crop in Southeast Asia. Subsequently, in 1927, Hybrid de Timor, a natural hybrid of Arabica and Canephora discovered in East Timor, became another option.

Since Hybrid de Timor is an Arabicoid, a tetraploid coffee like Arabica, they can crossbreed. Its emergence provided Arabica coffee with a hybrid genetic resource that not only had resistance to coffee leaf rust but also improved productivity. Planting such Arabica hybrids became a better option in Indonesia and other areas, further diminishing the demand for Liberica.

If we refer to the Coffee Basic World Map by the Coffee Consulate, it is evident that Malaysia stands out within the Coffee Belt. It is one of the few countries in the world where Liberica is the primary coffee species cultivated [10].

In Malaysia, some Liberica coffee trees were abandoned in the dense rainforest, while others became a small-scale option grown by local communities. Despite the continuous efforts of the Malaysian Agricultural Research and Development Institute (MARDI) to develop Liberica varieties with better disease resistance and higher yield over the past few

decades, the limited acceptance of the flavor of Liberica coffee in the market, coupled with its low productivity and challenging harvesting, has hindered its economic viability.

As for the source of the local coffee seedlings, today, most of them are provided by government-based agricultural agencies. Government initiatives are not exactly a strange thing within this part of the world, considering it was the colonial government who initiated the cultivating of cash crops, including coffee in the Southeast Asia region.

Sarawak was once governed by the Raja Brookes who traded within the British Empire system and had an interest in coffee and tea. The second Rajah Brooke, Charles, sought coffee information from Ceylon. Records from the Sarawak Gazette indicate that while *Coffea arabica* was planted in 1866, it was unsuccessful due to environmental factors. By 1879, Liberica was introduced to replace Arabica and was planted widely across Sarawak, including in areas like Segu, Satap, and Bintulu. Some farms were even overseen by Roman Catholic missionaries. Coffee soon became the primary cash crop for the Iban and other indigenous groups.

All of this information can be found in the Sarawak Gazette 1888, the Bulletin of Miscellaneous Information (Royal Botanic Gardens, Kew) Vol. 1888, The Brooke's Archive, and from the columns of Ceylon Observer.

Another theory suggests that coffee seedlings were introduced to Sarawak from neighboring Kalimantan, Indonesia. This is plausible given the Dutch were establishing coffee farms in Indonesia during that era. Even before Malaysia's formation in 1963, there was significant interaction between the indigenous groups of Sarawak and Kalimantan.

However, my current focus is on the highland indigenous communities of Sarawak, including the Kelabit, Kenyah, Penan, and Sa'ban. This is primarily because I am deeply involved with these communities at the moment and am collaborating with local experts who specialize in studying their cultures [11].

Hidden within Borneo's lush rainforest is a subtle political boundary that divides Malaysia's Sarawak and Indonesia's Kalimantan. Spanning more than a thousand kilometers (specifically, 1032 km), there exist unmonitored sections of this "border" that link Sarawak communities with those in Kalimantan. To this day, they continue their age-old tradition of visiting one another, trading goods. It is said that sometimes this includes contraband and sharing labor.

Even in recent years, there have been reports of people smuggling coffee seedlings from the Indonesian border into Sarawak. This has resulted in significant differences between the Liberica coffee grown locally and that in West Malaysia. Local farmers rarely grow the MK series Liberica developed by MARDI.

During a recent cupping session held in Kuching, Sarawak's capital city, our team, together with indigenous Liberica coffee farmers from the rural Sarawak, tested 14 different Liberica samples, including those from West Malaysia, India, Kalimantan, and the lowlands and highlands of Sarawak (Excelsa samples were also among them). There are significant flavor differences among these Liberica varieties.

From another perspective, Liberica coffee has great potential for exploration. Regarding the flavor characteristics of Liberica, a comprehensive flavor report was compiled based on the records of professional judges from around the world during the 2019 Liberica Coffee International Roasting Competition [12].

Setting aside the limited acceptance of Liberica's unique flavor in the market, there are still many challenges faced by the Liberica cultivators.

Due to the diversified sources mentioned above, the Liberica grown in Sarawak also faces complex issues with its varieties.

### *3.2. The Morphology of Liberica and Excelsa in Sarawak*

The first problem encountered is that in Sarawak, the cultivation of *C. liberica* and *C. liberica* var. dewevrei (Excelsa) is often indistinguishable. This could be caused by their similarity and confusion in appearance [13].

Excelsa was initially considered a separate species but later included as a variety of Liberica; this is an ongoing debate. However, from the perspective of seed morphology alone, the differences between Liberica and Excelsa are much greater than those between Arabica and Canephora. Early studies involving morphological traits, molecular markers, and hybrid fertility clearly indicated that their differences are much greater than those of botanical varieties [14].

These two types of coffee are interplanted in the highlands of Sarawak, and the Liberica coffee trees grown by the indigenous communities in this region not only differ in appearance but also in the colors, shapes, yields, and flavors of their cherries and seeds. We also encountered Liberica (or Excelsa) trees with cherries in red, yellow, orange, and purple colors. Among them, the purple cherries could be further categorized into large- and small-sized cherries.

In terms of fruit morphology, in addition to the large-sized, puffy, almond-shaped Liberica with a wider center cut that is commonly seen on the market, there are also variations with smaller-sized, raindrop-shaped Excelsa seeds. Some cherries even resemble dates or olives, with sharp and pointy 'nipples' like a disk. A pink Liberica blossom was also spotted for the first time during the trip.

Cherries that are dark green in color but actually ripened were also spotted during our second trip hundreds of miles downstream in the Uma Bawang region of the Baram River. The fruits of the entire tree would turn black after becoming dark green.

Regarding the petals of the coffee blossom, the general consensus is that the Arabica has between five to six petals, Canephora has six to seven, and Liberica has seven to eight. However, this was not the case at all with the Liberica we found here, with the number of petals ranging from five to nine (which inevitably reminds us of *C. racemosa*).

In addition to white, the flowers are also pink. There is a variety of Liberica trees with extremely small flowers, and short and round petals that do not look like the slender petals of coffee flowers, but rather like miniature jasmine flowers.

Another noteworthy issue is the impact of different altitudes on the shape of Liberica. Based on my observations, the Liberica coffee commonly seen on the market, characterized by large, puffy, elongated beans resembling almonds, is mostly grown in lowland areas and is rarely found in highlands. Liberica grown in the highlands of Sarawak seems to resemble the "hard beans" of many Arabica varieties, with a tighter center cut, smaller bean size, and higher density. There are also noticeable differences in taste. Similar traits were observed in Liberica from high-altitude regions in southern India and the interior of Sarawak around 500 masl.

Given the objective conditions mentioned above, there is significant variability in the local Liberica type. During the 'de-pulp' process, it is easy for the raw coffee beans to break. Meanwhile, in Borneo, where there is a high amount of rainfall, it is challenging to achieve consistency in fermentation and drying. This leads to difficulties in improving the quality.

However, from another perspective, these different shapes and colors of Liberica varieties are all potential genetic repositories that may cultivate different flavor characteristics. This might be a hassle for the local market traditionally accustomed to dark roasting coffee, as in dark-roasted conditions the taste difference between varieties is extremely minimal, almost insignificant. But in the future, if the local Liberica industry intends to move towards refinement and emphasize the flavor characteristics of light roast specialty coffee, these varieties become highly significant.

### *3.3. Economic Challenges of Liberica Crops*

From an agricultural economic perspective, the yield per acre for Liberica is lower than other coffee species. Due to the larger tree size of Liberica compared to other coffee varieties in Sarawak, when planted in a square pattern, only about 300 trees can be planted per acre. This is done to reserve space, ensuring that the local indigenous people can intercrop in the same plot while waiting for the coffee harvest. However, this has resulted in the Liberica planted locally in Sarawak having a lower per-acre planting density compared to

the "triangular" professional planting method in Peninsular Malaysia, which allows for 500 trees per acre [15].

According to observations by Jason Liew, a renowned Liberica estate owner in Malaysia, a mature Liberica tree that is over 4 years old, with proper management and adequate fertilization, can yield approximately 20 kg of cherries annually.

Here, an additional piece of information is provided: one opinion suggests that the potential yield of an average Excelsa tree could reach up to 30–60 kg, with 14.33% cherries to seeds conversion rate [9]. This point merits further in-depth investigation.

Based on Jason's calculations, the conversion rate of Liberica cherries to seed is about 7%, and after removing flawed beans, it is approximately 5%. This means that if a tree produces a more conservative annual yield of 15 kg of cherries, each tree can only produce 1050 g of clean Liberica raw beans each year. An acre produces about 315 kg of coffee raw beans, without deducting the costs.

However, according to another study, it is mentioned that under low-yield conditions, each Liberica tree can produce only about 200 g of green beans per year [16]. This is more relevant to the current situation here in Sarawak, while trees aged 4 to 6 years have an annual yield of 600 g, while mature trees aged ten years or more can yield up to 1 kg per year.

Compared to *C. arabica*, which can be planted at a density of 1000 to 2000 trees per acre, and Canephora, which can be planted at over 1200 trees per acre, the yield of Liberica is relatively low. Not to mention, the cherries to raw coffee seeds conversion rate for Arabica and Canephora can reach as high as 20% to 25%, while Liberica only has a meager 7% [17]. These economic characteristics of the crop determine that Liberica is not suitable for the traditional bulk coffee production model in market strategies. Especially if we considering Malaysia's higher labor costs compared to neighboring countries.

### *3.4. Challenges Brought about by Local Market Prejudices towards Coffee as a Product*

The other apparent issue is the limited understanding and undervaluation of up-to-date coffee knowledge among local coffee farmers. The local's mindset treats coffee production as a conventional, a rudimentary food crop process, lacking craftsmanship and unified grading standards. Additionally, there is a lack of sufficient understanding of the complex and diverse market segments in the global coffee industry.

Some local coffee middlemen often hold biased views regarding the production costs of coffee. They try to suppress Liberica green coffee prices down to the traditional coffee (kopi) level. Such action prevents local farmers from obtaining sustainable returns and perpetuates a vicious cycle of cheap quality, cheap market. Therefore, the local Liberica quality can hardly improve.

Unless we are referring to inexpensive commercial coffee, such as a local cup priced at RM1.50 (USD 0.32), it is essential to recognize that coffee, similar to red wine, is a "cultural beverage" that highly values flavor intricacies. Therefore, understanding the quality nuances emphasized in the specialty coffee market is crucial to produce coffee that aligns with specialty demands. Furthermore, higher returns from the specialty market segment fuel the continuous improvement in quality of local production.

Unfortunately, only a handful of individuals I have encountered believe that investing in coffee knowledge and employing professional consulting services are necessary and valuable for developing our local coffee industry. Many assume that planting coffee with minimal planning will yield significant returns after a few years. However, the reality is quite the opposite. Coffee is an incredibly intricate crop, similar to wine, where a cheap bottle may only cost you USD 3, while an artisan-crafted bottle can fetch well over USD 3000. This scenario also applies to the coffee world.

Take Arabica coffee as an example, the price of mediocre Arabica green beans can be as low as USD 2.5/kg. On the other hand, the price of well-cultivated Arabica, such as internationally auctioned lots or champion coffees that have won the Best of Panama competition, can be more than USD 3000/kg.

In the world of Liberica coffee beans, the distinction between top-tier green beans and their subpar counterparts might not appear as pronounced as it does with Arabica beans. Prices can vary from USD 2.5 (RM 12) to USD 9 (RM 40) per kilogram. While the price gap may not seem staggering, even a modest five-fold difference between market segments holds immense significance. This pivotal decision between cultivating refined Liberica to cater to the high-end market or producing lower-quality beans for the more affordable coffee market plays a paramount role in shaping the industry's overall structure and determining its ultimate success.

We live in an information age where everyone wants to be treated fairly, including farmers. This is why the specialty coffee industry places great emphasis on transparency. Only through transparency can trust and effective communication be established among coffee producers, roasters, and end consumers.

The outdated practice of intermediaries attempting to profit from withholding information is unsustainable for producing high-quality coffee. Lack of transparency leads to market confusion, which weakens the willingness of contemporary farmers to produce exceptional coffees. This, too, becomes an obstacle to developing the Liberica industry.

Therefore, it is evident that the specialty coffee industry places significant importance on transparency.

### *3.5. The Reasons Sarawak Is Suitable and Necessary for Cultivating and Developing Liberica*

According to a report released by the International Coffee Organisation (ICO) in 2017, due to climate change, by as early as 2050 Central American coffee cultivable land will decrease by 48%, Brazilian coffee cultivable land by 60%, and Southeast Asian coffee cultivable land will face a terrifying reduction of 70%.

Meanwhile, global coffee consumption is rapidly increasing, with countries like Brazil, India, China, Taiwan, and Indonesia experiencing significant growth in domestic coffee demand. The global coffee crisis is imminent.

However, while coffee research institutions around the world are struggling to transform coffee through various cultivation and genetic techniques to cope with the pressures of climate change, Malaysia already has a variety, *C. liberica*, which can grow perfectly in low-altitude tropical environments.

As of September 2021, botanists have discovered six new coffee species on the island of Madagascar [18]. In total, there are 130 known coffee species worldwide, primarily distributed in Madagascar, its surrounding islands, the African continent, the Indian subcontinent, and Southeast Asia.

Among the currently known 130 *Coffea* species, there are six main species that are currently commercially valuable or have the potential to be commercially valuable in the future:

1. *C. arabica*
2. *C. canephora*
3. *C. liberica*
4. *C. eugenoides*
5. *C. racemosa*
6. *C. stenophylla*

However, among all these coffee species, there is so far only one that is both commercially valuable and suitable for cultivation in low-altitude tropical regions, and that is Liberica. In other words, in the face of global climate extremes, Sarawak is particularly fortunate to possess a unique Liberica coffee variety that has the potential to withstand climate change.

On the other hand, for the indigenous communities in the inland areas of Sarawak, the biggest challenge they face when trading their agricultural products is the high cost associated with transportation and logistics. However, an even more difficult problem to address is the issue of product shelf life. Agricultural products such as bananas, pineap-

ples, and vegetables can only be stored for less than two weeks at most before they start to deteriorate.

As a commodity, coffee is a product that is well-suited for circulation. With proper processing and storage conditions, raw Liberica coffee can be preserved for one to two years, effectively resolving the transportation challenges faced in the inland regions. In this sense, coffee serves as a currency, like blood in our body, facilitating economic circulation in the inland areas. Other similar commodities are rice, pepper, palm oil, etc.

Due to the fact that the vast majority of cultivated land in Sarawak is below 800 m, the development space for Arabica is limited. It is generally believed that in terms of mass production, our production costs are high, and the price of Arabica produced cannot compete with coffee-producing giants like Brazil and Vietnam.

In terms of quality, we also cannot produce "Strictly Hard Bean" due to the insufficient altitude, which is highly sought after in the coffee world. Therefore, it is not advisable to focus on Arabica coffee production, but again, in my opinion, this is not absolute and I will explain further in the future.

In fact, apart from Liberica, there are still many other varieties suitable for cultivation in Sarawak. Various pure or mixed varieties of Arabica and Canephora (Robusta) that can be grown in similar mid- to low-altitude environments ranging from 650 to 1200 m are available, such as Oeiras, S795, Bourbon Amarello, Catuai Vermelho, Maragogype, Laurina, Obata, Tupi, HDTxCatuai, Sarchimo, SLN 9, CxR, SLN 274, and Old Paradenia [19].

With proper cultivation practices, these varieties can achieve high production levels and profitability in environments similar to Sarawak. It is possible for us to obtain reliable sources of these varieties through private connections, and we would hope that our government could support us in such initiatives.

I also recommend not underestimating the potential of specialty Canephora (Robusta) varieties that can thrive in the 500 to 1200 m altitude range.

Furthermore, international coffee research institutions are currently dedicated to developing various tetraploid and diploid F1 (Filial one hybrid) varieties through biotechnology [20] (p. 61). These varieties are designed to address climate change and pests. Some examples include:

"Centroamericano", a hybrid of Rume Sudan and Sarchimor T5296.

"New C. Arabicas", formed by combining *C. eugenioides* groups and *C. Robusta* groups.

"C. ligeniodes", created by combining *C. liberica* and *C. eugenioides.*

Moving forward, it is essential to weigh these options for the benefit of our coffee farmers. However, our immediate focus should be addressing the challenges associated with Liberica cultivation.

### *3.6. Strategies to Address the Challenges*

To address the aforementioned challenges, we collaborated with a local white indigenous person (Orang Asli Putih) named Alasdair Clayre to initiate a project known as the "Sarawak Liberica Refinement Project" in the relatively remote village of Long Banga, located in the interior of Sarawak.

Starting from March 2023, we employed the approach of community engagement and empowerment to intensively engage with the local Kenyah and Sa'ban ethnic coffee farmers in Long Banga and the surrounding villages. This involved team discussions and on-site surveys of coffee plantations. We conducted in-depth discussions and training sessions covering crop economics, coffee processing methods, coffee field management, disease control, and trade-model analysis.

We conducted two larger-scale knowledge sharing sessions for coffee farmers from the surrounding villages, one of which was in collaboration with the Sarawak Department of Agriculture.

Based on the understanding of various issues faced by local coffee farmers, we formulated the following strategies to improve the local Liberica coffee industry:

A. Conducting crop economic analysis to provide farmers with a more realistic understanding of their actual production costs, as well as a better prediction of their annual Liberica yield. Additionally, assisting them in expanding their coffee tree quantity through seedlings and grafting techniques to ensure an economically viable production scale.

B. Guiding farmers in proper pruning, fertilization, and management practices.

C. Instructing farmers in appropriate coffee processing methods, including the establishment of three well-ventilated greenhouses to ensure that the drying process is not affected by the humid climate of Sarawak.

D. Providing guidance on proper coffee bean grading to enhance the value of their products.

E. Instructing farmers on how to utilize coffee pulp and flowers to produce dried floral tea, thereby increasing their income.

F. Through a "Direct trading" model with coffee producers, we offer a purchasing scheme with prices 80% higher than Fairtrade International's coffee bean procurement prices to encourage the production of refined coffee.

The most interesting aspect of this collaboration is that there is no binding relationship between us and the coffee farmers. We encourage coffee farmers to freely seek better sales markets internationally after improving the quality of their products. This practice aims to enhance the income of local coffee farmers by harnessing the power of international market trade.

G. Traditionally, local indigenous people have used very primitive "natural processing methods" to handle coffee. For instance, some villagers directly sun-dry coffee cherries under alternating weather conditions of sun and rain. Others place coffee cherries in fishing nets and submerge them in the river for a week, using it as an unconventional method to remove pulp and mucilage. Some even boil coffee cherries to remove the pulp. These processing methods are challenging to yield a clean and refined taste of Liberica coffee.

The development of these traditional processing methods is partly due to the lack of equipment such as de-pulpers and hullers among the villagers.

To ensure a more consistent processing quality for local Liberica coffee, we mobilized villagers from Long Banga and Uma Bawang to jointly petition the Federal Agricultural Marketing Authority (FAMA) for the acquisition of four sets of de-pulpers and hullers. As a result, the quality of coffee improved within a short period.

H. We established communication networks and groups to provide real-time technical support to coffee farmers.

### *3.7. Quality Improvement and Economic Implications*

After five months of intensive collaboration, the coffee produced by farmers in the Long Banga region involved in this experiment has shown significant improvements in both quality and market value. These advancements can be illustrated through the following observations:

A. The coffee beans no longer emit a moldy odor; instead, they exhibit fresh grassy aromas and fruity notes. The moisture content of the coffee beans also falls within the range of 8% to 12.5%, complying with ICO standards for coffee bean exports.

B. There is a noticeable improvement in the appearance of the coffee beans, with less than 15 defective beans per 300 g. While further enhancement is needed, this is already a remarkable progress.

C. The cleanliness of the coffee flavors has markedly improved in light roasting cupping tests, with the absence of excessive fermentation odors. Unlike the commonly found strong fermented flavors like jackfruit, mango, and banana in Liberica flavor profiles, our results exhibit flavors more akin to Arabica, such as stone fruit, nuts, "Buah Salat," Mangosteen, and rambutan, along with a high level of sweetness.

D. The quality improvement is also reflected in the price of the coffee beans. The price of locally produced roasted Liberica coffee has increased by 20%, and the demand now outpaces supply.

E. The willingness of local coffee farmers to participate has significantly increased, expanding from the initial three to seven participants in the "Liberica Refinement Project," with even more farmers from neighboring villages expressing interest in joining the program. Farmers originally part of the project are actively expanding the number of coffee trees they cultivate. Local villagers are also actively rescuing abandoned Liberica coffee plantations.

F. The finished quality of cascara and coffee blossom have also improved and achieved stable production.

H. The collaborative efforts have yielded substantial positive outcomes, not only in terms of coffee quality but also in revitalizing the local coffee farming community and contributing to the broader economic growth of the region.

## 4. Conclusions

In conclusion, this study underscores that while Liberica coffee may possess lower production capacity, its sustainability and progress can be guaranteed through meticulous operations that tap into the premium specialty coffee market.

Through profound engagement with coffee producers, including an earnest understanding of crop economics, knowledge dissemination, pursuit of quality elevation, precise targeting of the appropriate market segments, and aligning production with the demands of those segments, Liberica coffee can effectively establish itself as a lucrative commodity in trade.

The provision of fair procurement prices incentives and propels the refinement of coffee farming practices, ultimately elevating the entire industry.

Strict quality control measures ensure the stability of market prices.

This project's success not only instills confidence among local coffee farmers but also paves the way for the replication and expansion of viable models to other Liberica coffee-producing regions across Sarawak.

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