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EXPLORING THE FEASIBILITY OF ENVIRONMENTAL ENTREPRENEURSHIP IN ARECANUT LEAF SHEATH PLATE MAKING: AN ECONOMIC AND ECOLOGICAL ANALYSIS

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Abstract: As plastics do not biodegrade and contributes significantly to environmental degradation, the widespread use of throwaway plates has a huge negative impact on the environment. This study investigates the viability environmental entrepreneurship through Arecanut leaf plates manufacturing as a sustainable substitute for single-use plates, emphasizing the promotion of regional production and consumption. This research evaluates the ecological viability of Arecanut leaf plates by a thorough assessment of the previous studies and visiting some Arecanut leaf product production facility in Barpeta district of Assam, India. The results showed that Arecanut leaf plates are a viable way to lessen the impact of single-use plates on the environment, promote regional entrepreneurship, and support rural households.

Keywords: *environmentally friendly, sustainable, local production, Arecanut leaf plates, environmental impact*

1. INTRODUCTION

There is a growing demand for ecological alternatives to plastic disposable plates due to increasing awareness of sustainable consumption and production (Korbelyiova, Malefors, Lalander, Wikström, & Eriksson, 2021). The use of disposable containers, including plates, cups, and cutlery, is widespread and contributes significantly to open dumping (Gautam & Caetano, 2017). Disposable plates made from non-renewable resources such as petroleum and natural gas not only deplete these valuable resources but also contribute to environmental degradation (The Good Boutique, 2020). These plates, often unable to be recycled, end up in landfills, oceans, and natural environments, where they take hundreds of years to decompose, causing harm to wildlife

and ecosystems (Kumar et al., 2020). Moreover, the production, transportation, and disposal of single-use plates result in pollution and greenhouse gas emissions, exacerbating already pressing issue of climate change (The Good Boutique, 2020). The environmental toll of disposable plates extends beyond their disposal phase; their production processes are also environmentally taxing, leading to habitat loss, depletion of fossil fuels, emission of greenhouse gases, and unsafe working conditions (Vasarhelyi, 2022). In essence, use of disposable plates significantly contributes to environmental harm, emphasizing the urgent need to reduce waste and transition towards more sustainable alternatives to protect natural resources and prevent further environmental deterioration, Arecanut leaf plates, traditionally used in certain cultures for serving food, present an eco-friendly alternative to disposable plates. Made from fallen leaves of the areca palm tree, these plates are biodegradable, compostable, and chemical-free (Nayak, Barik, & Jena, 2021).

This paper aims to explore the feasibility of Arecanut leaf plates as a sustainable alternative to disposable plates, considering their environmental, economic, and societal aspects.

2. METHODOLOGY

The study was conducted in the Barpeta district of Assam, India. A company named Tamul Plates Marketing Private Limited (TPML) is engaged in manufacturing and selling of Arecanut leaf sheath plates and bowls. The plates are manufactured by small units run by village entrepreneurs and marketed by TPML. Ten small manufacturing units run by village entrepreneurs were conveniently selected for the present study. The information was collected from the units using interview schedule by personally contacting the entrepreneurs. For ecological analysis research paper from various sources like Google scholar , JSTOR and ResearchGate has been reviewed.

3. ECOLOGICAL ANALYSIS OF DISPOSABLE PLATE

Traditional disposable plates that are commonly made from materials like paper, plastic, or Styrofoam have significant negative environmental impact which contribute to resource depletion, pollution, and waste accumulation (Quit Plastic, 2022). Below given are some traditional disposable plates and their environmental consequences in terms of sustainability metrics;

3.1 Material Sourcing:

- Plastic plates are produced from fossil fuels, which contributing to resource depletion and greenhouse gas emissions (Mohla, 2022).
- Paper plates are obtained from virgin paper pulp, and therefore, leads to deforestation. Recycled paper, reduces their impact on the environment, but eventually leads to soluble pollutants, colloidal pollutants etc, (Shen, Huang, Chen, Song, Zeng, & Zhang, 2020).
- Styrofoam plates are produced from petroleum-based chemicals, contributing to pollution and resource extraction (Korbelyiova, Malefors, Lalander, Wikström, & Eriksson, 2021).

3.2 Biodegradability:

- Plastic plates being non-biodegradable persist in the environment for long duration, causing harm to ecosystems (Veerendra, Babu, Manoj, & Nagarjuna, 2022).
- Paper plates even being biodegradable may not break down efficiently in landfills due to lack of oxygen (Halnon, 2022).
- Styrofoam plates are also non-biodegradable which can fragment into micro plastics, posing a threat to wildlife and the environment (Andersen, 2022) (Bio Green Choice, 2020).

3.3 Energy and Water Use:

- Manufacturing of plastic plates requires significant energy input and water consumption, that can contributing to environmental impact (Vasarhelyi, 2022).
- Paper plates also involve in energy-intensive processes like pulping and drying, as well as water usage in manufacturing (Hubbe, 2021).
- Styrofoam plates even though have a lower energy footprint compared to paper and plastic but still contribute to resource consumption (Scott, 2016)..

3.4 Recycling and Disposal:

- Plastic plates are challenging to recycle and often end up in landfills or as litter, causing pollution (Kibria, Masuk, Safayet, Nguyen, & Mourshed, 2022).
- Paper plates can be recycled, but contamination with food waste can reduce recyclability (Kalsher, Rodocker, Racicot, & Wogalter, 1993).
- Styrofoam plates are rarely recycled due to limited facilities and market demand, leading to long-term environmental harm (SUSTAINABILITY OFFICE, 2011).

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3.5 Environmental Impact:

- Plastic plates contribute to marine pollution, wildlife entanglement, and habitat destruction (Mohla, 2022).
- Paper plates have a lower environmental impact if sourced sustainably and recycled properly (Halnon, 2022).
- Styrofoam plates caused by harmful ecological effects due to their non-biodegradability and long term remaining in the environment (Aditia Febriansya, Iskandar, Amalia, & Indah, 2022).

Arecanut Leaf Eco-Friendly plates, in contrast, have a number of advantages for sustainability (Nayak, Barik, & Jena, 2021):

- Compostable and biodegradable, lowering waste production and environmental effect.
- Made from natural materials, encouraging regional manufacturing and lowering carbon emissions.
- Eco-friendly and chemical-free, offering a sustainable substitute for conventional throwaway plates.

4. Economic analysis of Arecanut Leaf Eco-Friendly plates.

Apart from providing environment benefit Arecanut leaf plate offer economic benefits for nearby people, especially in rural areas where the Arecanut palm is grown**.** This plate's production can augment household revenues and lead to job prospects (Patil, Chinnappa, Manjunatha, & Sowmya, 2019).

Manufacturing process of Arecanut leaf sheaths plates:

(i) Collecting Arecanut leaf sheaths

The producers gather raw material from their and surrounding villages and transport the material to their production center. We can get eight good leaves from each palm in one year. From one hectare holding we can get 12000 leaves (@ 8 leaves from 1500 palms).

(ii) Drying of leaf sheath

The leaves are kept upside down and dried for three days under direct sunlight. The drying is also done by using the dryer.

(iii) Raw Material Storages

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After the raw material is dried it is then sorted, depending on its size, and then packed in bundles of twenty five units. Bundles are stored in a special raw material stock room which allows to store bundles for one year.

(iv) Raw Material Cleansing

At the production day, the raw material is removed from the stock room and washed with water. They are submerged in water for 5-10 minutes then scrubbed. The raw material in this process also gets back its flexibility.

(v) Plate Production

The processed raw material is put into the heat press for cutting and shaping it. The products are kept in those machines for 1–2 minutes (taking into account the size of plates) and heated by LPG or electricity to keep their shape.

(vi) Packing of finished product

The plates and bowls are bundled with 25 pieces. Initial packaging is done in plastic pouches and then the bundles are packed in sacks.

(vii) Supply to TPML

The items are supplied to TPML upon duration of either weekly intervals or biweekly. TMPL undergo an examination process for every singular, wherein the ultimate degree of quality assurance is undertaken by TPML. Packaging constituents employed by the manufacturer are reverted to their original source, and conclusive packaging tasks are executed by TPML. Manual encasement is utilized for bulk market segments, whereas mechanical encasement is reserved for retail and superior market echelons.

Picture credit; (KKN EXPORTS)

Table 1: Capital Investment required for establishing Arecanut plate making unit

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Sl.No	Particulars	Amount (₹)	%
1	Semi Automatic Areca-Leaf Plate Making Machine (One Unit)	2,40,000	84.50
2	Power Operated Spray for washing leaf sheath	19,000	6.70
3	Water Tank, Pump Set and Plumbing works	25,000	8.80
	Total investment required	2,84,000	100

Source: *Field Survey*

The machine for making Arecanut leaf plate accounts for 85 percent of the total investment. Remaining 6% is shared by power operated spray and 9% is shared by water tank pump set and plumbing work.

Table 2: Average unit Cost of Manufacturing Arecanut plates

Sl.No	Particulars	Amount (₹)
1	Cost of one leaf sheath	1.00
2	Drying of sheaths	0.20
3	Washing of sheaths	0.20
	Total cost of one leaf sheath (1+2+3)	1.40
4	One sheath can produce at least two rice plates. Thus the cost for raw material per rice plate is	$\frac{1.40}{2} = \mathbf{0.70}$
5	Labour Cost per plate	0.50
6	Rice Plate Production cost (Including gas charge+ electricity)	0.40
	Total cost of Manufacturing (4+5+6)	1.60

Source: *Field Survey*

Table 2 breakdown expenses involved in producing a single Arecanut plate. The total cost amounts to ₹1.60 per plate. Raw materials such as the leaf sheath, drying and washing accounting for ₹1.40 per leaf sheath. Considering that each sheath can yield at least two plates, the raw material cost per plate is ₹0.70. Labor costs add another ₹0.50 to the equation, while production expenses like gas and electricity contribute an additional ₹0.40.

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(Note: Although the company manufactures variety of eco friendly product from Arecanut leaf sheath, only rice plates have been taken for this study.)

Table 3: Income accrued to village entrepreneurs from sale of Arecanut plates (per hectare)

Sl.No	Particulars	Amount (₹)	
1	Number of Arecanut tree Per Hectare	1,500	
2	Number of leaf sheath Per Hectare (1500×8)	12,000	
3	Number of rice plate (12000×2)	24000	
4	Cost of Manufacturing (24000×₹1.60)	38,400	
	Sales; (if sold to)		Profit
	TPML (24,000×3)	72000	33,600
	Retail (24,000×4)	96000	57,600
	Online (24,000×6.50)	156000	1,17,600

Source: *Field Survey*

The table breakdowns areca leaf plates from the economic perspective. 1500 trees are planted on a hectare. Each tree is said to produce about 8 leaf sheaths or 12000 pieces of it in one hectare. From each sheath two rice plates can be produced, so the total becomes 24000 rice plates in one hectare.

The production cost of per plate stands at ₹1.60 hence bringing a sum total of ₹38400 per hectare. The table also deals with potential profits that may be realized through different sales channels. A profit of ₹33,600 for every hectare can be made by selling them to TPML while retailing brings in ₹57,600 which is more profitable than selling them TPML, but the most effective is selling online; this is for the reason that one can earn up to ₹1,17,600 per hectare owing to its high selling price which is at ₹6.50 against other channels.

It's crucial to note that despite potentially receiving lower prices from Tamul Plates Marketing Private Limited (TPML) compared to other buyers, village entrepreneurs often choose to sell products to TPML due to several compelling reasons:

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- **Financial Linkages and Technical Support**: TPML facilitates Financial Linkages and Technical Support to leaf plate producers, helping them access necessary resources for production and growth.
- **Exposure Support and Training**: TPML provides Exposure Support and Training to producers of Arecanut leaf plates, equipping them with the necessary skills and knowledge to enhance their production capabilities.
- **Buyback Guarantee**: TPML provides a buyback guarantee to village-level entrepreneurs, ensuring a market for their products and offering a sense of security in their sales.
- **Quality Control**: TPML conducts quality checks at various stages of production, ensuring that the products meet the required standards and quality certifications.
- **Market Expansion**: By promoting manufacturing of Arecanut leaf plate across the northeast, TPML helps producers tap into a larger market, potentially increasing their sales and revenue.
- **Less Marketing and Distribution:** Selling to TPML requires less marketing and distribution effort on the producer's part. TPML have its own network to distribute that makes easy in getting the plates to the end consumer.

Table 4: Viability of investing in a manufacturing facility for areca leaf plates

Particulars	Value
Pay Back Period (in years)	4.06
Net Present Value (NPV) (discounted @8% and yearly return increased by 10%)	₹ 28,68,434.09
Internal Rate of Return (IRR)	34.63%
Profitability Index (PI)	11.10

(Note: *The computation is performed by averaging the profit earned from sales to the aforementioned three source and considering the output only for one hectare of land.)*

Table 4 gives an analysis of the main financial indicators, which indicate whether it is worth to invest in a manufacturing plant for areca leaf plates. The payback period, which refers to the time taken by the project to recover its costs, has been estimated at about 4.06 years showing shorter

payback period. Furthermore, the Net Present Value (NPV) discounted at 8% with a compounded increase in yearly return of 10%, comes up to ₹28,68,434.09 indicating positive profitability where time value of money has been factored in. Additionally, IRR denoted as internal rate of return is found to be 34.63% suggesting the annualized rate at which investment returns are expected from this venture. PI or profitability index it equals to 11.10 that shows how attractive this investment is; meaning there will be a return on every unit invested proportionate to 11.10 units invested again into business. These figures suggest that investing in areca leaf plates manufacturing would be economically viable and lead to significant social benefits for society at large.

5. CONCLUSION

Research investigation into the practicability of environmental entrepreneurship in the production of plates from the areca leaf sheath indicates that the business in this sector presents opportunities for the use of environmentally friendly materials that replace conventional disposable products. The investigation shows that this project is not only profitable but also beneficial to the environment. Among the main results are listed below:

(i) **Economic Potential:** The availability of raw material in the arecanut-growing areas and the increased interest towards green products makes arecanut leaf plates a viable and scalable business venture. It is a concurrent process where there exists a high need for employment and self-employment opportunities especially in rural locations which helps in addressing the regional economic growth.

(ii) **Ecological Benefits:** The arecanut leaf sheath plates are not only eco-friendly, but also help to lessen the dependence on non-biodegradable plastic products, thereby reducing environmental pollution. Using agricultural byproducts as a source material fosters a circular economy as well and helps in preventing resource overuse.

(iii) **Social Impact:** Encouraging self-reliance in this sector can empower local communities, especially women and small farmers, to provide additional sources of income. This is in line with the broader goals of social equity and sustainable development.

(iv) **Challenges And Recommendations:** Although promising, the industry faces problems such as inconsistent quality standards, lack of access to advanced machinery and market

penetration. Addressing these issues through training, government support and infrastructure support will be key to sustainable development.

In conclusion, promoting environmental entrepreneurship in arecanut leaf sheath plate making represents a harmonious blend of ecological responsibility and economic opportunity. by leveraging local resources and fostering innovation, this initiative can pave the way for a greener and more inclusive economy. policymakers, entrepreneurs, and stakeholders should collaborate to scale this industry, ensuring its long-term viability and contribution to sustainable development.

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