AN ANALYTICAL STUDY ON SUSTAINABLE BUSINESS STRATEGIES OF GREEN STARTUPS IN TAMIL NADU

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Abstract
The rise of more companies incorporating green practices into their business models - otherwise known as "green startups" - through the state of TN, there's been a shift toward developing a new form of development that combines economic growth with environmental responsibility. Some examples of sustainable practices are businesses taking advantage of green innovation, building a digital economy and using green marketing techniques to create innovative and new ways of developing businesses that focus on the circular economy. The purpose of this study is to look at what sustainable business practices are adopted by green startups in Tamil Nadu, based on data collected from 120 green startups located in TN, along with an analysis of how these sustainability strategies have an influence on their performance. The research was carried out using percentage analysis, rank mean score analysis and chi-square analysis to determine what sustainable business strategies were being adopted most frequently. The two most frequently adopted sustainable strategies were green innovation and digital integration. Furthermore, the findings of our study show that both of these sustainable strategies significantly improve a company's cost and recognition (brand). Finally, as a result of their strategic use of green (sustainable) business practices, the green startup ecosystem faces several challenges: Limited funding, Technological gaps, Lack of qualified labour. To overcome these challenges, recommendations of policy and managerial practices are proposed for the purpose of increasing the overall effectiveness and support for the green startup ecosystem within Tamil Nadu.

Keywords:Green Startups, Sustainable Business Strategies, Circular Economy, Business Performance, Tamil Nadu.

Introduction
Green companies are now among the largest contributors to global economies, because they are able to combine the ability to use traditional business models with environmentally-friendly practices. Green companies also support sustainable economic growth by creating new employment opportunities and preserving the earth. As more consumers become aware of the growing need for more environmentally sound businesses, green companies can be found everywhere, and are booming in a rapidly developing part of India, Tamil Nadu, where rapid industrialization has caused severe environmental degradation. The rapid growth of green companies is taking place in all four of the main economic sectors of Tamil Nadu: sustainable agriculture; renewable energy; waste management; eco-friendly products. Each of these sectors have large numbers of green companies using innovative methods to reduce their negative effects on the environment, use resources more effectively, and increase their profitability. The use of sustainable business practices will make green companies more competitive and, at the same time, produce long-term social and environmental benefits. Understanding the practices, obstacles, and successes of green companies is an essential component to developing policies that will support the growth of a vibrant green entrepreneurial ecosystem.

Review of Literature

Selvam, Arul, and Shankar (2021) examined how digital integration can improve sustainability performance within eco-ventures. Using a combination of interviews and quantitative analysis (that is, using surveys) they found that digital tools (such as ERP systems or cloud-based tracking) improved resource management, reporting, and decision-making. Digital integration also improved the transparency and traceability in supply chains. However, the study noted there were barriers to adopting technology (due to the high cost of technology or a lack of technical knowledge) and that support mechanisms and training programs need to be developed.

Natarajan & Suresh (2022) explored the relationship between green innovation and brand reputation for Indian startups. They surveyed 75 startups in various sectors and concluded that product and process innovation focused on environmentally sustainable processes positively affects trust and brand loyalty of customers. They suggested that by integrating sustainable functions into their pipelines, startups can differentiate themselves from competing businesses. Furthermore, the authors indicated that marketing strategies which promote the concept of 'green' are essential in maximizing brand impact and suggested that more effective marketing strategies need to be developed.

Ramesh & Devi in 2022 on renewable energy startups in Tamil Nadu regarding how government policies and incentives help these startups develop. Through the use of a case study and secondary data analysis, they identified that subsidies, tax incentives, and technical assistance have a very positive effect on technology adoption and operational expansion.

Venkatesan in 2024, studied how sustainability strategies impact the financial performance of green startups. The study comprised quantitatively 80 green startup businesses and determined through regression analysis that significant improvement was found in cost efficiency and profitability from implementing green innovations, circular economy practices, and energy efficiency processes. Additionally, this finding highlighted that startups demonstrating good management of resources and environmental compliance have a greater chance of attracting investors. However, smaller green startups have difficulty accessing capital and technology and require targeted financial assistance and capacity-building programs.

Priya & Harini (2025) focused on workforce development of skills in promoting sustainable entrepreneurship. Through the use of surveys and interviews from 50 green startups, they discovered that training programs related to environmental technologies and sustainability practice result in increased productivity and innovation adoption. Green startups with skilled workers are more successful in adopting and implementing the circular economy model and using digital tools. Their research found that building skills, providing knowledge through awareness programs, and mentoring can be instrumental in helping green startup overcome operational challenges. and accelerating the growth of green startups.

Objectives of The Study
1. To identify the green startups' adoption of sustainable business strategies.
2. To assess how these strategies influence the startup business performance.
3. To analyse how green start-ups are plagued by obstacles preventing their success.

Hypothesis
(H0) The null hypothesis states that there is no statistically significant association between sustainable business strategies & the level of success achieved by the green startup.

(H1) The alternative hypothesis states that there is a statistically significant association between the level of success achieved by green startups through adopting sustainable business strategies.

Research Methodology

1. Research type: Analytical.
2. Data type: Primary data.
3. Sample size: 120.
4. Method used: Structured questionnaire.
5. Sampling method: Convenience sampling.
6. Statistical methods: Percentage, Mean score, Chi-square.

Data Analysis And Interpretation

Table 1 – Years of Operation of Green Startups

Years	Respondents	Percentage%
Below 3 years	40	33.3
3–5 years	50	41.7
Above 5 years	30	25
Total	120	100

Source: Primary Data

Interpretation: The current green startup sector in Tamil Nadu indicates that 41.7% of green startups have been established for 3 to 5 years, which suggests that the majority of green-startup companies are still in the growth phase of their life cycles. Additionally, the percentage of green startups that have been operating for under 3 years is about 33.3%, reflecting an increase in new eco based ventures. Conversely, the percentage of green startups that are currently operating for over 5 years is only 25.0%. Overall, there appears to be considerable momentum building for green entrepreneurship, supported by an ever-growing startup ecosystem, increased levels of environmentally conscious consumerism, and an ever-growing demand for sustainable products.

Table 2 – Sector-Wise Classification of Green Startups

Sector	Respondents	Percentage%
Renewable Energy	25	20.8
Waste Management	30	25
Sustainable Agriculture	35	29.2
Eco-products	30	25
Total	120	100

Source: Primary Data

Interpretation: The distribution of green startups by industry in Tamil Nadu, it appears that the majority of green startups are located in the sustainable agriculture industry (29.2%) which is indicative of the growing trend toward environmentally friendly agricultural practices and organic products. Other industries, such as waste management and the sale of environmentally friendly products/services, comprise 25% of all green startup companies in Tamil Nadu, suggesting that the demand for recycling, upcycling, and other environmentally sustainable products is strong. The renewable energy industry

accounts for approximately 20.8% of green startups, likely due to the considerable investment and high level of technological barriers present in this industry.

Table 3 – Mean Score Analysis of Sustainable Business Strategies Adopted By Green Startups

Strategy	Mean	Rank
Green Innovation	4.50	I
Digital Integration	4.20	II
Circular Economy	4.00	III
Sustainable Supply Chain	3.80	IV
Green Marketing	3.70	V

Source: Primary Data
*(*Measured using 5-point Likert Scale)

Interpretation: According to a ranking of sustainable strategies utilized by green startups in Tamil Nadu, green innovation was rated the highest (Mean = 4.50) while digital integration (4.20) and circular economy practices (4.00) were next in ranking. Sustainable supply chain management (3.80) and green marketing (3.70) are the next highest rated, indicating that these strategies are currently still developing.

Table 4 – Impact Of Sustainable Business Strategies On Cost Reduction

Level	Respondents	Percentage%
High	58	48.3
Moderate	44	36.7
Low	18	15
Total	120	100

Source: Primary Data

Interpretation According to reports from green startups located in Tamil Nadu, 48.3% of green startups experienced a large reduction in operating costs as a result of implementing sustainable practices, 36.7% of green startups reported a moderate reduction in operational costs through the implementation of sustainable practices, and 15.% of green startups reported a small reduction in operational expenses related to their implementation of sustainable practices. The data collected from green startups in Tamil Nadu indicates sustainability has created substantial operational efficiencies, but both investment, know-how, and the scale of the implemented practices may impact the cost efficiencies derived through the implementation of sustainable practices.

Table 5 – Impact of Sustainable Business Strategies on Brand Image Improvement

Level	Respondents	Percentage %
High	66	55
Moderate	36	30
No Improvement	18	15
Total	120	100

Source: Primary Data

Interpretation
Green businesses have improved their public relations by 55%, improved moderately at 30%, and remained unchanged at 15%. The results of the study revealed that implementing the eco-friendly business model could enhance brand image, trust with customers, and increase competitive advantages

of green startups. However, to achieve a competitive advantage through the eco-friendly business model, green startups in Tamil Nadu must also utilize green marketing.

Table 6 – Challenges Faced By Green Startups In Implementing Sustainable Business Strategies

Challenge	Respondents	Percentage %
Financial Constraint	48	40
Technology	30	25
Skill Gap	24	20
Regulation	18	15
Total	120	100

Source: Primary Data

Interpretation

The majority of green startups in Tamil Nadu are facing many barriers to creating a successful sustainable business model. The primary barriers include financial challenges (40% of green startups), lack of current technology (25% of green startups), lack of knowledge and skilled employees (20% of green startups), and inability to meet regulatory requirements (15% of green startups). In order for the Tamil Nadu green startup ecosystem to be successful, ways to overcome the above barriers will have to be developed through financial assistance, improved access to technology, and improved skill development.

Table 7 – Chi-Square Test Showing Relationship Between Sustainable Business Strategies And Business Performance

Particulars	Value
Calculated Chi-square value	18.64
Table value (df = 4, α = 0.05)	9.49
Level of Significance	0.05

Source: Primary Data

Interpretation

The chi-square test conducted (χ^2 = 18.64 > 9.49, $p < 0.05$) supports that there is a significant relationship between the use of a sustainable business model and the overall performance of Tamil Nadu green startups. Startups that use any of the four strategies of green innovation, digital integration, circular economy, and sustainable supply chain will typically improve their cost efficiencies, profitability, market share, and brand image.

Findings

1. The majority of startups implementing "green" initiatives are considered to have an overall growth or "life stage" of three to five years (41.7%).
2. The sector experiencing the greatest number of green startups is sustainable agriculture (29.2%); other high-growth sectors include waste management and eco-products.
3. Innovations that are considered "green" (mean score of 4.50) and digital integration strategies have the highest rate of adoption among all green startups.
4. Almost half of all green startups (48.3%) reported reductions in costs, while 55% stated they had improved their brand image as a result of implementing sustainability initiatives.

5. Financial constraints (40%) are the biggest challenge for green startups, followed by technology gaps (25%) and lack of available skilled workers (20%).
6. Results of the Chi-square test provide evidence of a statistically significant relationship between sustainability strategies and business performance.
7. In general, implementing sustainability initiatives within your business leads to increased operational efficiency, greater profitability, increased value of your brand, and greater long-term growth of your business.

Suggestions

1. Financial Assistance: Provide affordable loans, grants & green venture capital to help alleviate financial barriers.
2. Promote Technology & Innovation: Support access to new technologies, encourage collaborative R&D, and assist with the transition to clean technology.
3. Skills Development: Offer green skills training and awareness programs to people working with startups, both entrepreneurs and employees.
4. Strengthening Sustainable Supply Chains: Boosting local sourcing, environmentally sound logistics & green supplier networks.
5. Green Marketing/Branding: Provide support to startups for marketing sustainability initiatives, thereby increasing their visibility within the market.
6. Policy Assistance: Streamline regulatory and administrative processes related to sustainability and provide tax incentives for those adopting sustainable practices.
7. Incubator/Ecosystems: Establish green business incubators and mentoring programs to promote economic growth by supporting innovation & entrepreneurship.

Future Implications

1. The contribution of green startups is essential as they will enable the establishment of a climate-resilient and low-carbon economy.
2. Furthermore, the implementation of sustainable strategies is predicted to result in the creation of green jobs, while effective sustainability measures are projected to attract investors who prioritise ESG and impact.
3. Circular economies and eco-innovation will enhance resource efficiency and overall competitiveness.
4. Finally, appropriate policy measures, funding, and access to technology will create opportunities for the growth of green businesses to be established throughout Tamil Nadu and beyond.

Conclusion

This research finds that sustainable business practices such as green innovation, the digital transformation process, and circular economy practice are very important to the performance of green businesses in Tamil Nadu. However, challenges remain in relation to finance, technology and skills; however, policies designed to support them, capacity building initiatives, and access to green finance are necessary for building the green business ecosystem. Sustainable practices are necessary for environmental protection but are critical for economic stability, growing a brand, and ensuring long-term competitiveness. The future growth of green startups will play an important role in creating a low-carbon, resource-efficient, and inclusive economy.

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