

Lean Startup for Opportunity Exploitation in Sustainable Entrepreneurship: Evidence from India's Sustainability-Oriented Ventures

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Abstract: Sustainable entrepreneurship has received considerable attention as a means of addressing environmental and social challenges through economically viable ventures. Existing research has examined opportunity identification, yet the processes through which sustainability-oriented opportunities are exploited under conditions of uncertainty and resource scarcity remain comparatively underexplored. The lean startup approach with its emphasis on rapid experimentation, iterative learning, and customer feedback has emerged as an influential approach in entrepreneurial practice. Though empirical applications remain concentrated largely in technology and digital venture contexts. This study examines how lean startup approach support opportunity exploitation in sustainable entrepreneurship. Semi-structured interviews were conducted with 8 founders operating in the sustainability-oriented ventures, and the resulting data were analysed using Gioia methodology. Four themes emerged under aggregate dimensions, experimentation for sustainability validation, strategic resource utilization, feedback-driven opportunity refinement, and Iterative learning for adaptive opportunity exploitation. Each consistent with the lean startup literature. The findings indicate that lean startup practices with bricolage approach provide sustainable entrepreneurs with a structured pathway for translating sustainability-oriented ideas into viable ventures while navigating the dual constraints of environmental uncertainty and resource scarcity.

Keywords: Sustainable Entrepreneurship, Lean Startup, Opportunity Exploitation, Sustainability-Oriented Venture

1. Introduction

Climate change, biodiversity loss, and expanding waste streams created conditions to generate solutions which integrate environmental and social value alongside commercial returns (Magistretti et al., 2023). Sustainable entrepreneurship has developed as an important research domain examining ventures pursue economic, social, and environmental value (Muñoz and Cohen, 2018). The entrepreneurship research defines the field around the discovery, evaluation, and exploitation of opportunities (Shane and Venkataraman, 2000; Eckhardt and Shane, 2003). Within this framework, exploitation is the phase in which a recognised and evaluated opportunity is acted upon and converted into a functioning venture; it is analytically distinct from, and sequential to, recognition and evaluation (Shane and Venkataraman, 2000; Kuckertz et al., 2017).

Recognition concerns perceiving a means–ends relationship and evaluation concerns judging its feasibility and desirability (Choi and Shepherd, 2004; McMullen and Shepherd, 2006). Whereas “Opportunity exploitation is characterized by developing a product or service based on a perceived entrepreneurial opportunity, acquiring appropriate human resources, gathering financial resources, and setting up the organization” (Kuckertz et al., 2017). Research in sustainable entrepreneurship has engaged extensively with identification and recognition with an early significant framework, but the exploitation phase has received comparatively little attention (Di Vaio et al., 2022).

“Sustainability-oriented ventures aim to create viable businesses based upon environmentally and/or socially sound products” (Choi and Gray, 2008). They operate under uncertainty alongside market and technological, they must contend with environmental and demand uncertainty that often do not yet exist and uncertainty about whether their intended social and environmental impact will actually be realised (Hall et al., 2010; Bocken et al., 2021). They need to validate commercial, social, and environmental feasibility simultaneously (Belz and Binder, 2017).

Ries (2011) introduced the lean startup approach as a methodology for managing uncertainty in early-stage ventures. Its build–measure–learn (BML) cycle encourages entrepreneurs to develop minimum viable products (MVPs), measure real customer responses, and learn iteratively. Shepherd and Gruber (2021) describe the framework as comprising customer development, validated learning, MVPs, experimentation, and strategic

pivoting. Moreover, hypothesis-testing improves entrepreneurial decision quality, and hypothesis-driven experimentation helps early ventures converge more effectively on viable opportunities (Camuffo et al., 2020; Leatherbee and Katila, 2020). Recent research suggests that lean startup strategies can enhance organizational learning and contribute to the sustainable development of new ventures by promoting iterative learning and continuous adaptation (Zhuge et al., 2023).

Despite the growing application of lean startup in entrepreneurship research, empirical work remains concentrated in technology and digital startup contexts, leaving its relevance to sustainability-oriented ventures underexplored (Ghezzi and Cavallo, 2020). Sustainability-oriented ventures operate under distinct conditions, including longer development cycles, institutional complexity, multi-stakeholder accountability, and the need to validate commercial, social, and environmental feasibility (Bocken and Snihur, 2020).

Whether and how lean startup practices function under these conditions remains a question to be addressed. This study addresses this gap by examining how the lean startup approach supports opportunity exploitation in sustainable entrepreneurship. A qualitative multiple case study draws on semi-structured interviews with 8 sustainability-oriented ventures. The study contributes to the literature by extending lean startup into the context of sustainable entrepreneurship, with particular attention to opportunity exploitation and to the enabling conditions that shape the transferability of lean startup practices to sustainability-oriented ventures.

2. Literature Review

2.1 Opportunity Exploitation in Sustainable Entrepreneurship

Sustainable entrepreneurship integrates the triple bottom line into venture creation (Muñoz and Cohen, 2018), as a convergent process in which social, environmental, and economic objectives are pursued concurrently (Belz and Binder, 2017). However, these operate under conditions of market uncertainty, institutional barriers, and resource scarcity, and the processes through which entrepreneurs exploit opportunities remain poorly understood (Belz and Binder, 2017).

Opportunity exploitation is the translation of a recognised opportunity into a functioning venture (Shane and Venkataraman, 2000). Johnson and Schaltegger (2020) propose a multilevel mechanism linking recognition, venture development, and societal outcomes. Sustainability-oriented ventures face distinctive legitimacy pressures in terms of products addressing environmental problems frequently require customer education and behavioural change, forcing entrepreneurs to continuously refine value propositions and business models (Belz and Binder, 2017; Hockerts and Wüstenhagen, 2010). The creation of a new sustainable venture largely depends on the ability to translate the sustainability goals into product features that are valued by customers (Choi and Gray, 2008; Keskin et al., 2013). A significant gap within the existing literature is that how opportunities are acted on is less explored in sustainability settings (Muñoz & Cohen, 2018).

While Sarma et al. (2024) identify resilience capability as an antecedent of sustainable opportunity recognition, they subsume adaptability within resilience and describe adaptive responses to disruption without explicating the mechanisms through which adaptation unfolds across venture development. Johnson and Schaltegger (2020), advance a multilevel causal-mechanism framework connecting entrepreneurial action to broader market and societal transformation; but the framework remains largely conceptual and offers limited empirical insight. The lean startups minimum viable product, validated learning and the build–measure–learn loop were originally articulated in, and for, technology-driven ventures (Ries, 2011; Bortolini et al., 2021). In the absence of empirical evidence from sustainability settings, it therefore remains uncertain whether these conventional tools can be effectively adapted to the context of achieving triple bottom line (Belz and Binder, 2017). Existing work has focused predominantly on opportunity recognition, with Patzelt and Shepherd (2011) attending to the cognitive antecedents of recognition. However, the exploitation phase remains less studied. Considering this in its nascent stage, and to understand the applicability of lean startup on opportunity exploitation, this study addresses the gaps by providing empirical evidence on how opportunity exploitation unfolds in practice.

2.2 Lean Startup Approach and Sustainable Entrepreneurship

Early-stage firms rarely fail because they cannot build a product; they fail because they build something the market does not want. The central task of a venture is to search for a viable business model, the search proceeds through trial, testing, and analysis of evidence (Bortolini et al., 2021). This reframing of entrepreneurship as a

disciplined search underpins the lean startup methodology and its core engine, the build, measure and learn loop (Ries, 2011).

The lean startup approach originated as a practitioner methodology for managing new ventures under conditions of extreme uncertainty, drawing together ideas from customer development and agile and lean manufacturing (Ries, 2011; Blank, 2013). Its central mechanism is the BML cycle. In the build stage, the entrepreneur translates a business hypothesis into a minimum viable product (MVP) the simplest version of an offering capable of generating learning with the least effort (Ries, 2011; Frederiksen and Brem, 2017). In the measure stage, the entrepreneur collects data on real customer and market behaviour rather than on stated intentions, so that progress is assessed through validated learning (Ries, 2011; Shepherd and Gruber, 2021). In the learn stage, this evidence is used to confirm or refute the underlying hypothesis and to decide whether to persevere with the current course or to pivot to a revised one (Ries, 2011; Blank, 2013). The cycle is then repeated, so that the venture converges on a viable opportunity through iterations rather than through a single, pre-committed plan (Contigiani and Levinthal, 2019; Bortolini et al., 2021). Camuffo et al. (2020) demonstrate that ventures adopting a hypothesis-testing approach reached better decisions and were less susceptible to escalation of commitment than those operating without structured experimentation. Leatherbee and Katila (2020) find that hypothesis-driven probing enabled early-stage teams to converge on viable opportunities more reliably.

The BML cycle offers a mechanism for exploitation under this compounded uncertainty. Building a minimum viable product turns unknowable questions into low-cost, testable hypotheses (Frederiksen and Brem, 2017; Andries et al., 2013); measuring real behaviour rather than stated intention addresses demand uncertainty, as the expressed sustainability values are weak predictors of purchase (Shepherd and Gruber, 2021). Iterative learning, in turn, builds legitimacy and adaptive capacity while its affordable-loss character keeps repeated experimentation feasible for resource-scarce ventures (Reypens et al., 2021; York, O'Neil and Sarasvathy, 2016). Moreover resource scarcity is dealt using entrepreneurial bricolage which is making do by applying combinations of the resources at hand to new problems and opportunities (Baker and Nelson, 2005). What remains missing is direct evidence on how the cycle operates when validation must span commercial, social, and environmental criteria at once.

The intersection of lean startup approach and sustainable entrepreneurship is sparse but growing. Lean startup approach can support sustainability-oriented business model development by reducing uncertainty and building stakeholder confidence (Bocken and Snihur, 2020). Aagaard et al. (2021) find that cleantech startups use experimentation for organisational learning and investor legitimation. Reypens et al. (2021) demonstrate that resource-scarce ventures depend on adaptive resource mobilisation, a pattern structurally consistent with the experiment-first logic of lean startup. The BML cycle gives concrete, observable form to the exploitation stage each turn of the loop is an act of exploiting the opportunity a little further while re-evaluating it.

3. Methodology

3.1 Research Design

A qualitative multiple case study design was adopted following Yin (2018), who argues that case study methodology is appropriate for 'how' questions about processes in real-life contexts. This design allows in-depth examination of entrepreneurial decisions and learning mechanisms that are difficult to capture through quantitative methods, also considering the complexity of the phenomenon and application in non-tech ventures. Eight founders of sustainability-oriented ventures were selected through purposive sampling (see table 1). Cases were included based on secondary and primary data evaluation of venture (a) addressed an environmental and (or) social sustainability problem at its core alongside commercial and (b) at an early or growth stage. The interviews lasted for 45 to 90 minutes.

3.2 Data Collection and Analysis

Primary data came from semi-structured interviews conducted online. Questions covered around opportunity exploitation, experimentation activities, customer and stakeholder interactions, resource mobilization, learning, measuring and adaptation. Although the lean startup is a practitioner methodology, it is used here as an analytical framework rather than as an intervention, its concepts were used to interpret the validation practices founders described. This is a recognised use of the lean startup, where its building blocks are treated as an organising structure for studying early-stage firms (Shepherd and Gruber, 2021).

The BML cycle was selected as the specific lens for three reasons. First, it maps cleanly onto the opportunity exploitation (Shane and Venkataraman, 2000; Ardichvili et al., 2003). Second, it is the most concrete and widely recognised element of the lean startup, and its three phases provide clear, mutually exclusive categories for coding what founders actually do (Ries, 2011; Bortolini et al., 2021). Third, because sustainability-oriented ventures must validate environmental and social claims as well as commercial ones, an iterative, evidence-based framework is well suited to surfacing how they approach. Further supported by Bortolini et al. 2021, confirming that the BML cycle is the analytical core through which the lean startup connects to earlier theory on business-model validation.

All interviews were recorded and transcribed and analysed following the Gioia methodology (Magnani and Gioia, 2023). Coding proceeded in three stages. First, we developed first-order concepts staying close to informant's account. Second, we grouped these into theory-centric second-order themes. Third, we distilled the themes into aggregate dimensions. The design was abductive while the concepts and themes were derived inductively from the data, the build–measure–learn cycle provided the theoretically-informed aggregate dimensions, allowing the analysis to connect grounded evidence to an established process framework. The resulting data structure is presented in Table 2. Four major themes emerged across the three phase of lean startup approach. Reliability was supported through data triangulation across interviews and secondary sources, cross-case comparison to identify consistent patterns.

Table 1: Description of the ventures

Sustainable Venture	Founded in	State	Value Proposition
SV1	2020	Maharashtra	Sustainable fashion and lifestyle products
SV2	2021	Tamil Nadu	Solid waste collection and down-cycling enterprise
SV3	2023	Karnataka	Eco-friendly textile
SV4	2019	Delhi NCR	Technology-enabled recycling startup
SV5	2020	Bihar	Sustainable footwear
SV6	2020	Karnataka	Sustainable straws
SV7	2018	Maharashtra	Sustainable Home & Personal Care
SV8	2020	Uttar Pradesh	Agricultural Waste Utilisation

4. Findings

The analysis produced four second-order themes nested within the three aggregate dimensions of the BML cycle. Firstly, in every case the originating opportunity was framed around an environmental or social problem rather than a purely commercial gap, aligns with Shepherd and Patzelt's, 2011 account of sustainable entrepreneurship. Second, sustainability was embedded in the value proposition rather than treated as a marketing addition. Founders described their environmental or social outcome as inseparable from the product.

Findings show that these ventures operated under resource scarcity, they advanced their opportunities through entrepreneurial bricolage "making do" by recombining the physical, social and institutional resources already at hand alongside lean startup approach for exploiting the opportunity (Baker and Nelson, 2005). Bricolage did not remain static, rather it evolved from "making do" into a more selective, evidence-based way of constructing resources. The full data structure is presented in Table 2, which shows how moving from first order concepts evolved into second order themes to final aggregate dimensions.

4.1 Build: Bricolage-Based MVP Development Under Sustainability Constraints

The build phase was characterised by minimalism. Rather than waiting for a fully developed offering, founders assembled the smallest functional version of their product or service capable of generating operational data, using entry points such as neighbourhood waste-collection trials or product samples placed with a few retail buyers to test logistics before any wider rollout. Founders repurposed domestic settings, discarded or under-

valued inputs, and existing relationships instead of acquiring new assets (Baker and Nelson, 2005). At this stage the bricolage was largely improvisational and driven by necessity.

SV6: "Experimenting with the leaf, I discovered that when soaked, it became leathery, and steaming it revealed a nice shine..my kitchen became an experimentation place where I did my all initial experiments later verified it from my university colleagues"

SV2: "we started this as a side hustle, whether we can do it... during the pilot phase, we could see that there was a good amount of interest in the normal customers."

SV8: "we had no money to build the full system, so we made this product using simple resources and did the first pilot testing...when I reached out to one of the incubators for financial assistance they asked for amount of agri waste treated till now...yes specific work which you do related to social or environmental you need to show that metrics also if targeting some financial or mentor help"

Constraining expenditure to what founders could afford to lose made repeated experimentation financially viable across multiple cycles. This improvised, low-cost resource behaviour constitutes the second-order theme of strategic resource utilisation. The build phase also exposed a tension specific to sustainability-oriented ventures; commercial viability and environmental effectiveness could not be treated as a single dimension. Early prototypes often performed well on one while failing on the other. Founders therefore used each MVP to test commercial and sustainability assumptions, a practice captured in the second-order theme of experimentation for sustainability validation. This was reinforced by external gatekeepers, who required evidence of impact as a condition of support.

4.2 Measure: Dual-Axis Validation and Stakeholder Signals

In the measure phase founders tracked two categories of metrics in parallel commercial and environmental and these did not operate independently. In several cases strong performance on one axis produced weak or ambiguous results on the other, and founders had to decide which signal to prioritise. Direct customer interaction was the primary channel for commercial validation, with social media serving as a secondary channel.

SV6: "When we went on to distribute our products initially to hotels nearby and waited for them to give some feedback, some customers said it is environment friendly some also mentioned that it is soggy after few hours so we did more refinement on this"

SV3: "There was a complaint posted online which told us more than our three months of surveys."

Environmental positioning did not reliably predict adoption. Although customers often voiced strong sustainability values, purchase decisions were driven more by cost, convenience and reliability, so behavioural signals proved more dependable than stated attitudes (Shepherd and Gruber, 2021); founders who relied mainly on satisfaction-based feedback tended to misread demand. Feedback also extended beyond the customer relationship; interactions with stakeholders such as, waste collectors, municipal actors, community organisations and supply-chain partners generated insight into operational feasibility, regulatory compliance and service design, and introduced additional evaluative requirements that shaped what founders had to measure and report. This multi-stakeholder dynamic constitutes the second-order theme of feedback-driven opportunity refinement, exploitation proceeded not as the execution of a fixed plan but as an iterative revision of the opportunity through engagement with several stakeholder groups (Shane and Venkataraman, 2000; Ardichvili et al., 2003).

4.3 Learn: Evolving Bricolage and Adaptive Opportunity Exploitation

The learn phase produced continuous revision of foundational assumptions. Across repeated BML cycles, founders sharpened their understanding of customer identity, willingness to pay, service-delivery requirements and whether the claimed environmental or social impact was being realised, so that each cycle yielded a more calibrated account of the opportunity than the last (Ries, 2011).

It is here that bricolage is seen to evolve rather than simply recur. Early on, resource construction resembled what Baker and Nelson (2005) term parallel bricolage improvising across many domains at once, out of necessity. As validated learning accumulated, founders became more deliberate, retaining and upgrading the improvised combinations that had passed the dual-viability test and abandoning those that had not, moving toward a selective bricolage targeted at resource combinations shown to create both commercial and environmental value. This strengthened founders' adaptive capacity: those who completed several BML cycles adjusted more

readily to market shifts, regulatory change and stakeholder feedback than those who had committed early to fixed plans.

SV7: "Without research and without data, it's very difficult for us to analyze how the entire journey would be".

SV4: "We didn't get it right at the start, we got it right by going around enough times it took a lot of changes and every change showed us a new direction...it was a learning for us each failed step left a new idea behind to track and experiment with"

SV6: "We built a proper machinery for the straws as the earlier was handmade...after understanding the demand for it we switched to mechanize this process."

These accounts support the second-order theme of iterative learning for adaptive opportunity exploitation. Exploitation proceeded as a recursive process in which the attempt to act on an opportunity generated the learning needed to determine what that opportunity was and how it could be viably pursued. These emerged from completing enough BML cycles to convert initial uncertainty into actionable knowledge, and from allowing bricolage to mature under that learning.

Table 2: First order concepts to aggregate dimensions

1st-order concepts	2nd-order themes	Aggregate dimension
Piloting in a few local markets; building a cheap, simple first version; spending only what we could afford to lose; testing commercial and impact assumptions together; prototyping with what was available; home experiments	Experimentation for sustainability validation	BUILD
Turning waste into a usable input; using existing/left-over materials; drawing on local artisans and community networks; using whatever materials were on hand	Strategic resource utilisation	
Collecting customer feedback; watching what customers did, not what they said; learning from social-media comments and complaints; working with municipalities and suppliers; refining the product from user responses; tracking sales and commercial signals; measuring environmental impact; checking what customers would pay; validating both impact and revenue	Feedback-driven opportunity refinement	MEASURE
Trial-and-error learning; continuously revising our assumptions; learning from failed attempts; adapting based on data; changing across repeated cycles; revising who the customer is; adjusting to market and regulatory shifts; improving a bit each cycle; improving the product; adding more resources	Iterative learning for adaptive opportunity exploitation	LEARN

5. Discussion and Contributions

The findings moved lean startup approach beyond its conventional technology and commercial orientation by demonstrating that sustainable entrepreneurs engage in dual validation testing market viability and environmental effectiveness through the same iterative cycles. Existing scholarship conceptualises experimentation primarily as a mechanism for reducing market uncertainty and achieving product-market fit (Ries, 2011; Blank, 2013). The findings indicate that sustainable ventures validate ecological impact alongside commercial feasibility, operating under conditions of dual uncertainty in which environmental legitimacy functions as an evaluative criterion to market acceptance (Cohen and Winn, 2007; Dean and McMullen, 2007). The findings indicate that lean startup practices including bricolage give sustainable entrepreneurs a structured mechanism for developing sustainability-oriented ideas into viable ventures (Baker and Nelson, 2005; Ries, 2011; Shepherd and Gruber, 2021).

This contributes to the growing integration of lean startup and bricolage. Founders drew on resource recombination through locally available materials and informal partnerships (Baker and Nelson, 2005) consistent with bricolage approach. Founders combined bricolage for better application of lean startup experimentation in uncertainty (Reypens et al., 2021; Musona et al., 2020). The study therefore advances theory by showing that sustainable entrepreneurs use hybrid entrepreneurial logics in practice (Camuffo et al., 2020; Priyathee et al.,

2026) while bricolage enables experimentation to remain economically feasible under severe resource constraints (Baker and Nelson, 2005; Musona et al., 2020).

As validated learning accumulated through the measure and learn phases, founders retained and upgraded the combinations shifting towards selective bricolage (Baker and Nelson, 2005). This aligns with Fisher's (2012) call to examine how bricolage and other entrepreneurial behaviours complement one another.

The study further extends stakeholder-oriented perspectives into the lean startup approach, as the founders could not combine effectively commercial viability and environmental or social effectiveness into a single test; each MVP had to interrogate a sustainability hypothesis alongside the value and growth hypotheses of standard practice (Ries, 2011). Firstly, environmental positioning did not predict adoption, customers value sustainability but decided on cost, convenience and reliability, so behavioural signals proved more reliable than stated attitudes (Shepherd and Gruber, 2021). Second, evaluation extended beyond customers to other stakeholders, whose procurement standards and impact-evidence requirements shaped what founders had to measure and report. A demand-side and legitimacy pressure characteristic of sustainability-oriented ventures (Hockerts and Wüstenhagen, 2010).

6. Conclusion and Implications for Future Research

This study examined how lean startup approach support opportunity exploitation in sustainable entrepreneurship. The findings indicate that experimentation, stakeholder feedback, strategic resource management, and iterative learning collectively enable sustainable entrepreneurs to develop sustainability-oriented ideas into viable ventures. Moreover, the importance of resources in handling lean startup approach found to be significant. The findings indicate that, when adapted to sustainability conditions, lean startup practices provide a mechanism for navigating the uncertainty and resource constraints that characterise early-stage sustainable venturing.

The study has some limitations, firstly, it considers relatively small sample, limiting direct generalizability. Future research might extend this inquiry to other non-tech sectors or apply quantitative methods to examine relationships between lean startup practices and sustainable venture performance outcomes with bricolage as a moderating mechanism. Longitudinal designs could also capture how exploitation processes evolve as ventures mature beyond the early stage. Secondly, relying solely on founders' accounts leaving behind the perspectives of other stakeholders remain unrepresented, and future research can incorporate multiple informants would produce a more complete picture of the exploitation process. Third future research can also incorporate resource-based view, causation and effectuation theories as supporting variables while considering opportunity exploitation through lean startup for non-tech ventures.

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Ethics Declaration

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AI Declaration

No artificial intelligence (AI) tools were used in the development, analysis, or writing of this manuscript.

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