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Survey on Crowdsourcing Sustainable Ideas: Student Hackathons and Innovation Challenges

Aaliyah Naaz and Sanjana S
Department of Corporate Secretaryship
Stella Maris College

Submitted under the guidance of
Ms. Reema R Varghese, Assistant Professor,
Department of Corporate Secretaryship
Stella Maris College

Abstract

It is increasingly critical to recognize the value of deriving sustainable solutions from the people themselves. While sustainability has gained momentum over the past decade, the urgency of the environmental crisis is still not fully understood, and public awareness remains slow to catch up. This paper delves into how crowdsourcing can serve as a catalyst for generating impactful, community-driven ideas that contribute to environmental conservation and social resilience. Through a survey assessing the outcomes of sustainability-focused hackathons, the research highlights the innovative solutions offered by grassroots communities and the vital role of student-led initiatives within universities. The study further examines the motivational drivers and engagement strategies that encourage participation, while addressing the limitations and opportunities inherent in this approach. Ultimately, the paper proposes a framework to effectively harness the collective intelligence of diverse communities to achieve long-term, sustainable impact.

Introduction

The urgency of climate change, resource depletion, and environmental degradation has placed sustainability at the heart of global and national discourse. In India, where ecological pressures accompany rapid urbanization and economic growth, the role of young people in shaping sustainable futures is critical. Recognizing this, various organizations and institutions have begun promoting sustainability-focused hackathons and innovation challenges that aim to harness student creativity. Initiatives such as the *Smart India Hackathon*, the *Atal Innovation Mission* under NITI Aayog, and programs like the *Youth Climate Conclave* organized by the Delegation of the European Union to India, have sought to create platforms for students to generate solutions to sustainability challenges. Similarly, university-level events, including green hackathons and idea challenges run by the Indian Institute of Technology (IITs) and other leading institutions, provide opportunities for young innovators to experiment with sustainability-driven ideas.

However, these initiatives, though impactful in their immediate outcomes, are not always sufficient in engaging the wider student population. Many of them are designed as large-scale competitions that often emphasize winning ideas rather than nurturing an inclusive, collaborative community around sustainability. The accessibility of such platforms is also uneven: students from metropolitan and resource-rich institutions participate more actively, while those from smaller colleges, rural areas, or underfunded universities remain on the periphery. This creates a gap between the visibility of sustainability in elite spaces and the lack of deeper grassroots engagement among the larger student community.

Another pressing issue is the lack of awareness about how sustainability directly benefits students — not only in terms of contributing to society but also in enhancing career opportunities, entrepreneurial skills, and personal development. For many, sustainability remains an abstract global responsibility rather than a concrete path to growth and empowerment. This lack of clarity often makes students hesitant to engage, as they may feel their efforts will not make

a tangible difference or be recognized. Moreover, the competitive nature of existing challenges does little to instill the confidence required for sustained participation.

Against this backdrop, this paper seeks to answer a central question, '**Why should sustainability be pursued through students, and how can this approach shape a better future?'** By examining the potential of crowdsourcing sustainable ideas through hackathons and innovation challenges in India, this research highlights both the opportunities and the limitations of current initiatives. It argues that empowering students not only contributes to immediate problem-solving but also builds a long-term culture of innovation, responsibility, and resilience. In doing so, the study emphasizes that the future of sustainability depends on creating inclusive, student-driven ecosystems that go beyond competition to foster awareness, confidence, and community.

ProblemStatement:
Despite the growing number of sustainability hackathons and innovation challenges in India, these efforts remain fragmented, competitive, and limited in scope. They fail to fully engage the diverse student population or to build an inclusive and supportive community that nurtures long-term commitment to sustainability. There is, therefore, a critical need to explore how student-driven crowdsourcing of sustainable ideas can be made more accessible, collaborative, and impactful in shaping a sustainable future.

Literature Review

Hackathons have increasingly been studied as collaborative learning environments that allow students to engage in rapid problem-solving and peer-driven innovation. Nandi and Mandernach (2016) highlight the role of hackathons as informal yet highly effective pedagogical spaces in computing education, enabling authentic and interdisciplinary learning. More recently, Gaikwad, Wadegaonkar, and Dib (2025) introduced the **T-L-E Hackathon model**, which illustrates how hackathon formats can also be applied in non-technical domains such as teacher education, thereby fostering innovation and evaluation practices in Indian classrooms. These studies collectively suggest that hackathons, when designed effectively, provide strong learning outcomes; however, the degree of inclusivity, structure, and long-term continuity determines their overall impact.

In the Indian context, the **Atal Innovation Mission (AIM)** and its flagship **Atal Tinkering Labs (ATLs)** represent one of the largest efforts to cultivate student innovation. D'Souza (2025), in her evaluation of ATLs in Karnataka schools, demonstrates measurable improvements in creativity, computational thinking, and problem-solving ability among students. Similarly, Upadhyay (2024) underscores the transformative potential of ATLs in providing platforms for both rural and urban youth to experiment with real-world problem-solving. Official records note that more than 10,000 ATLs have been established across 722 districts, engaging over 1.1 crore students nationwide (Atal Innovation Mission, 2025). Despite this scale, independent assessments have also noted variations in quality and accessibility, which limit uniform student participation across socio-economic and geographic contexts.

Beyond ATLs, hackathon structures themselves have been studied internationally for their pedagogical contribution. Vanhée and colleagues (2024) developed the **EDUCHIC framework**, outlining a three-phase hackathon model (pre-event, during-event, post-event) that supports sustained interdisciplinary learning. Adinda, Gettliffe, and Mohib (2024), meanwhile, examined a three-month educational hackathon and found that while many students enhanced their collaborative competencies, others experienced setbacks due to uneven facilitation. These findings are highly relevant for India, where hackathons such as the **Smart India Hackathon (SIH)** operate at large national scales. SIH incorporates sustainability-themed problem statements across domains such as clean energy and environmental monitoring, yet evidence on the depth of learning and long-term project follow-through remains limited (Indian Journal of Management, 2023).

The atmosphere of hackathons also influences participation. De Winne et al. (2020) and Calco & Veeck (2015) note that purely competitive structures may discourage participation, particularly among underrepresented groups, whereas

collaborative, low-pressure formats enhance intrinsic motivation, creativity, and inclusivity. This insight is critical for sustainability-related challenges in India, where inclusivity across diverse student populations remains a pressing concern.

Student-oriented sustainability platforms in India extend beyond SIH. The **Youth Climate Conclave (YCC)**, organized since 2019 in partnership with the Delegation of the European Union to India, seeks to build youth climate literacy and advocacy skills. Similarly, campus-level social enterprise initiatives such as **Enactus India** engage students in year-long, SDG-focused projects, offering continuity that one-off hackathons often lack. These initiatives highlight multiple pathways for student engagement in sustainability, but they also raise concerns of uneven reach and limited documentation of long-term community-building.

Overall, the literature suggests three important gaps. First, while hackathons and tinkering environments demonstrably improve problem-solving, creativity, and collaboration, evidence on their ability to build **safe, inclusive, and confidence-enhancing spaces** in India remains scarce. Second, though national initiatives such as SIH, AIM, and YCC illustrate the institutional commitment to sustainability, their accessibility is uneven, leaving many students outside elite or metropolitan institutions unrepresented. Finally, there is little evidence on whether these events successfully link student innovations to post-event incubation, implementation, or community stewardship. Addressing these gaps is central to this paper, which examines **why sustainability through students is a critical pathway and how this approach can better shape India's sustainable future**.

Methodology

To explore the effectiveness and limitations of crowdsourcing sustainable ideas through student hackathons and innovation challenges, a **quantitative research approach** was adopted. The primary method of data collection was a structured survey administered to students between the ages of **18 to 25 years**, as they form the target demographic most actively engaged in such events.

The survey was designed to assess two major aspects:

1. **The current situation of crowdsourcing sustainable ideas**, with a focus on the accessibility of hackathons and innovation challenges to students.

2. **The limitations in scope** of these events, particularly in addressing critical aspects of sustainability and long-term impact.

A **random sampling technique** was employed to ensure diversity among respondents in terms of academic background, gender, and prior participation in innovation events. The questionnaire included both **closed-ended and Likert-scale questions**, allowing for measurable responses while also capturing perceptions and attitudes.

Data collection was conducted online to increase participation and convenience. The survey responses were then compiled and analyzed to identify patterns, challenges, and gaps in the current structure of student-led crowdsourcing platforms.

The methodology was chosen to provide **first-hand insights from students**, as they represent both the participants and beneficiaries of such initiatives. This approach enabled the study to highlight not only the **level of accessibility and awareness** but also the **missed opportunities in sustainability-oriented crowdsourcing**.

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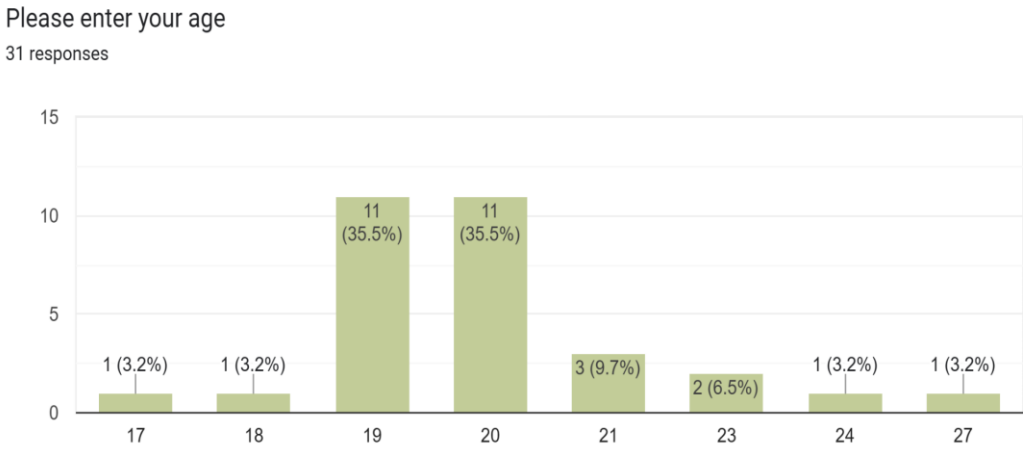
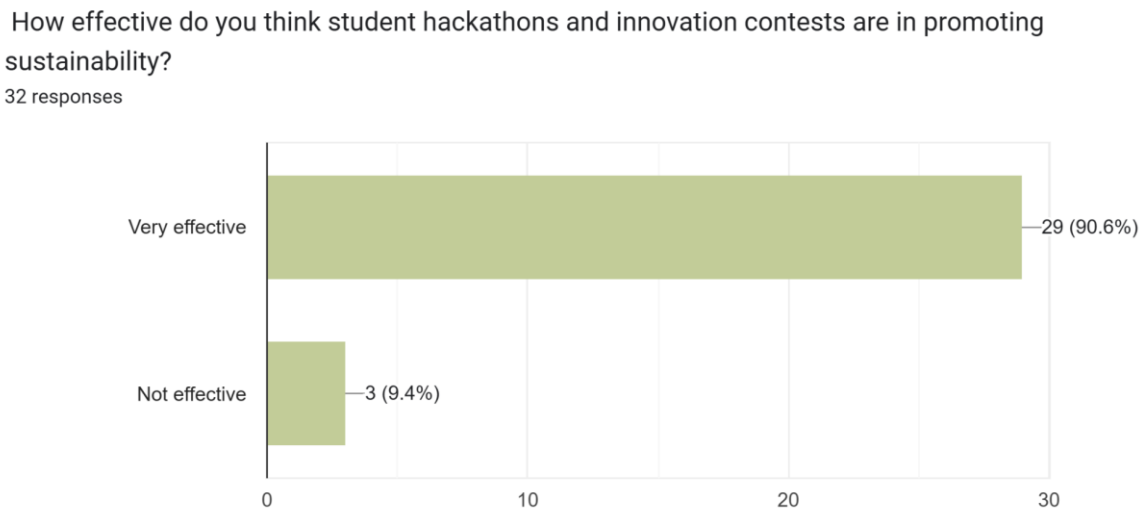
Results and Findings

1. Participant Profile

- **Total responses analyzed:** 32
- **Age range:** 17 to 27 years
  - Most respondents were aged **19–21**, with a few outliers at ages **17, 23, and 24–27**.



- **Perception of Effectiveness:**
  - The majority (~29 out of 32) rated the events as **"Very effective"** in promoting sustainability.
  - Three respondents rated them as **"Not effective"**.



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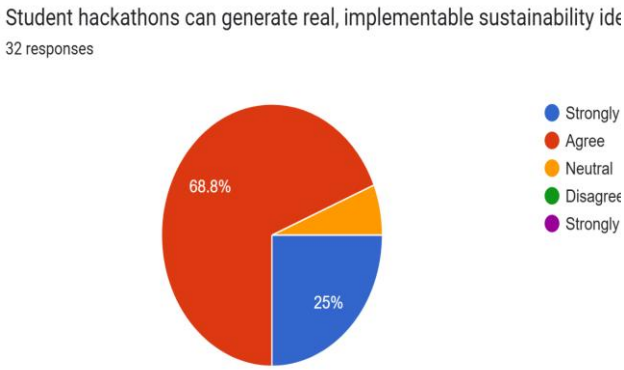
- **Belief in Impact:**
  - ~*All respondents* agreed that student-led ideas from such events can lead to real environmental impact.

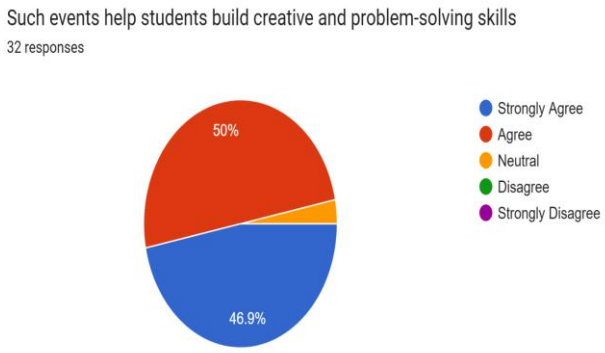
2. Agreement with Key Statements

Participants responded to several Likert-style statements. Below is a summary of agreement trends:

Statement	Agreement Trend
Hackathons generate real, implementable sustainability- ideas	Mostly **Agree/Strongly Agree**



They help students build creative and problem-solving skills	Predominantly **Agree**, a few **Neutral** responses



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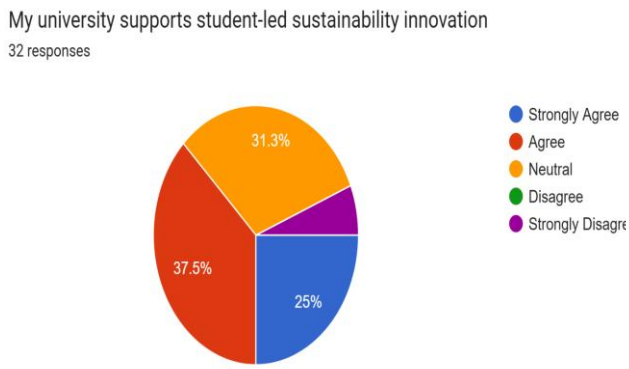
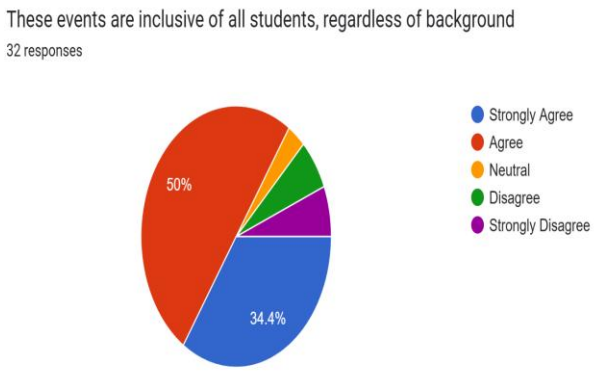
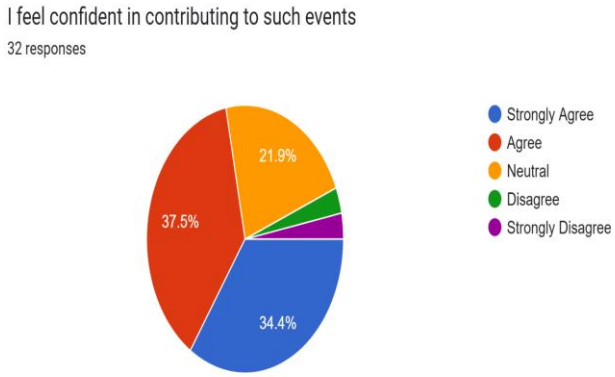
University supports student-led sustainability innovation	Mostly **Agree / Strongly Agree**, some **Neutral**



Events are inclusive of all students, regardless of background	Largely **Agree**, with minority **Neutral / Disagree**



I feel confident in contributing to such events	Majority **Agree / Strongly Agree**



3. Prioritized Innovation Themes

When asked what types of ideas student innovation events should prioritize, the most frequently selected themes were:

- **Plastic Reduction Initiatives** — such as alternatives to single-use plastics
- **Waste Management & Recycling** — creative ways to reduce, reuse, or upcycle materials
- **Eco-friendly Event Planning** — zero-waste festivals, digital ticketing, reusable décor
- **Air Quality Improvement** — including pollution sensors and urban tree-planting

These reflect a strong consensus toward tangible, environment-focused innovation.

4. Student-led Innovations That Impressed

Here are some standout examples shared by respondents:

> "A low-cost water filtration system developed by a group of engineering students in a rural outreach program."
> "A low-cost solar-powered backpack that doubles as a study lamp—very resourceful."
> "An app for visually impaired persons using voice commands and AI—affordable, practical, empathetic."
> "Banana Leaf Technology: preserving banana leaves for up to a year as an alternative to plastic plates—formed into a startup."
> "Biodegradable water bottle made entirely from seaweed extract—practical and affordable creative thinking."

5. Suggestions for Enhancing Accessibility, Inclusivity & Impact

Participants shared multiple actionable suggestions:

- **Remove cost barriers**: Offer free or subsidized registration, travel support, and ensure online participation options.
- **Use clearer language**: Avoid heavy jargon to make events more beginner-friendly.
- **Provide mentorship & support**: Guidance to help students advance ideas beyond the event.
- **Ensure inclusivity**: Accessible venues (wheelchair access), sign-language interpreters, live streaming, diverse topics/speakers.
- **Focus on real-life applicability**: Emphasize projects that address tangible community problems.

Summary of Key Findings

- **Strong belief in impact:** Nearly all respondents viewed student innovation events as effective and believed in the real-world potential of student-led solutions.

- **Preferred themes:** High interest in plastic reduction, waste recycling, eco-event planning, and clean air initiatives.

- **Creative and empathetic projects standout:** Innovations combined practicality, sustainability, and empathy, often rooted in resource-limited or underserved contexts.

- **Concrete accessibility recommendations:** Clear, actionable strategies for making events more inclusive and impactful emerged from the responses.

Conclusion

This study highlights the significant role that student hackathons and innovation challenges play in promoting sustainability and fostering creative problem-solving among young people. The results show that students not only view these events as highly effective platforms for generating sustainable solutions, but also believe in their real-world applicability and long-term impact. The projects that inspired respondents, from biodegradable water bottles to solar-powered backpacks, demonstrate that youth-led innovations are often rooted in practicality, empathy, and community needs.

At the same time, the findings reveal that accessibility and inclusivity remain areas requiring attention. Barriers such as cost, limited awareness, lack of mentorship, and technical gatekeeping restrict broader participation. Suggestions offered by students point to clear opportunities for improvement: reducing financial and logistical constraints, designing events that are inclusive of all disciplines and abilities, and providing structured post-event support to ensure that ideas move beyond conception into implementation.

Importantly, while sustainability remains the central theme of these events, there must also be continuous initiatives to **inspire and motivate students**, creating an environment that nurtures creativity, confidence, and collaboration. Inspiring participants to bring out their best ensures that innovation challenges are not just competitions, but transformative experiences that unlock potential and drive meaningful change.

Overall, the study concludes that while student hackathons already contribute meaningfully to crowdsourcing sustainable ideas, their impact could be greatly amplified through enhanced accessibility, stronger institutional support, and a sharper focus on real-life applicability. Empowering students with resources, mentorship, inclusive platforms, and inspiration will strengthen the innovation ecosystem and accelerate the development of scalable solutions to pressing sustainability challenges.

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