

Catalysts for SDG Attainment: Validating the IIC Pathway in Indian Higher Education

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Abstract – Higher Education Institutions (HEIs) are pivotal in advancing the United Nations’ 2030 Sustainable Development Goals (SDGs). In India, the Ministry of Education’s Institution’s Innovation Council (IIC) initiative, launched in 2018, has expanded across 3,000+ HEIs to foster innovation and entrepreneurship. Yet, empirical evidence linking IIC mechanisms to measurable SDG outcomes remains limited. This study develops and validates the “IIC Pathway Model,” explaining how structured IIC activities translate into SDG impacts. Using a mixed-methods approach across eight HEIs in Maharashtra, we analyze two years of IIC activity reports, 240 Yukti-NIR submissions, and 32 interviews with IIC presidents and student innovators. Findings reveal a five-stage pathway: Ecosystem Creation → Capacity Building → Solution Development → Validation & Scaling → Impact Recognition. IICs significantly contributed to SDG 4 (Quality Education), SDG 8 (Decent Work & Economic Growth), SDG 9 (Industry, Innovation & Infrastructure), SDG 11 (Sustainable Cities), and SDG 13 (Climate Action) through student-led prototypes and startups. The study advances literature by proposing an institutional framework that operationalizes SDGs through grassroots innovation, with implications for policy design and HEI governance.

Higher Education Institutions (HEIs) are increasingly recognized as pivotal actors in advancing the United Nations Sustainable Development Goals (SDGs). In India, the Ministry of Education’s Innovation Cell (MIC) established Institution’s Innovation Councils (IICs) to embed innovation and entrepreneurship education into academic ecosystems. Yet, empirical evidence on how IIC functions translate into SDG-aligned outcomes remains limited. This study addresses that gap by adopting an explanatory sequential mixed-methods design. Quantitative content analysis of IIC activity reports (2022–2024) and Yukti-NIR (Nation Innovation Repository) submissions was complemented by qualitative interviews with IIC presidents, faculty coordinators, student innovators, and industry mentors. Results reveal that IIC activities cluster around five stages—ecosystem creation, capacity building,

solution development, validation & scaling, and impact recognition—collectively forming the **IIC Pathway Model**. Case examples include a low-cost water purifier (SDG 3, SDG 6, SDG 11), a solar micro-grid startup (SDG 7, SDG 13), and sustainable product ventures (SDG 8, SDG 9). The model demonstrates how structured innovation processes operationalize SDGs at the institutional level.

The study contributes theoretically by extending innovation ecosystem, triple helix, and institutional perspectives into the Indian HEI context. Practically, it offers policy recommendations for MIC and AICTE, including stronger industry linkages, SDG-specific challenges, and impact measurement frameworks. Limitations include a Maharashtra-only sample and reliance on self-reported data. Future research should pursue comparative studies across states and longitudinal tracking of startup survival. Overall, the findings position IICs as scalable pathways for embedding sustainability into higher education governance and practice.

1. Introduction

- **Background:** The 2030 Agenda for Sustainable Development underscores the role of HEIs as knowledge institutions capable of bridging academic learning with real-world SDG implementation.
- **Problem Statement:** Despite growing sustainability discourses, Indian HEIs often struggle to translate curricula into tangible SDG-aligned outcomes.
- **Policy Context:** To address this, the Ministry of Education’s Innovation Cell (MIC) launched the Institution’s Innovation Council (IIC) in 2018, establishing a nationwide network to embed innovation culture.
- **Research Gap:** While existing studies highlight IIC’s role in entrepreneurship and ecosystem building, systematic evidence of its contributions to SDGs remains scarce.
- **Research Questions:**

- RQ1: What are the core mechanisms of the IIC pathway?
- RQ2: How do IIC activities map to SDG targets?
- RQ3: What factors moderate IIC impact on SDGs?

2. Literature Review

HEIs and SDGs

Globally, Higher Education Institutions (HEIs) are established as sustainability drivers, functioning as “living labs” that integrate teaching, research, and campus operations with the 2030 Agenda. Evidence from Europe and North America highlights strategic planning, curriculum design, and operational reforms that embed SDGs, producing graduates with sustainability competencies and strengthening community partnerships (UNESCO, 2017; Leal Filho et al., 2019). In Asia, emphasis is placed on SDG 4, SDG 9, and SDG 13 through green campuses and transdisciplinary research. However, Indian HEIs remain under-documented, with most reports descriptive rather than empirical.

Innovation & Entrepreneurship Education (IEE)

IEE has evolved from business-plan pedagogy to experiential, impact-driven learning. Frameworks by Kuratko (2005) and Lackéus (2015) emphasize design thinking, opportunity recognition, prototyping, and value creation as core competencies. International evidence links IEE to SDG-aligned outcomes: student-led ventures contribute to SDG 1, SDG 8, and SDG 12. In India, policies such as NEP 2020 and Startup India position students as grassroots innovators. Yet, Indian studies rarely trace ventures to specific SDG targets or measure their broader development impact.

Institution’s Innovation Councils (IICs)

To institutionalize innovation, the Ministry of Education’s Innovation Cell (MIC) launched IICs in 2018. Literature identifies five core functions:

- **Ecosystem Creation:** IPR workshops, bootcamps, and awareness drives.
- **ARIIA Rankings:** Benchmarking HEIs, incentivizing alignment with SDG 9 and SDG 17.
- **Yukti-NIR Repository:** Documenting and disseminating innovations for scaling.

- **Hackathons & Challenges:** Mobilizing students to solve problems in healthcare, agriculture, education, and clean energy.
- **Mentoring & Pre-Incubation:** Linking students with alumni, industry, and incubators.

Reports confirm increased participation but remain activity-oriented, focusing on event counts and startups rather than outcome quality.

Contribution of Londhe (2025)

Rupesh Chandrasen Londhe’s multi-institutional study provides the first empirical mapping of IIC outputs to SDGs in India.

- **Outcome Mapping Framework:** Classified 400+ projects and startups under IICs/Yukti-NIR according to 17 SDGs and 169 targets.
- **Function-to-SDG Linkage:** Hackathons and mentoring strongly predicted outputs for SDG 3, SDG 6, and SDG 13; ARIIA-driven ecosystem activities correlated with SDG 8 and SDG 9.
- **Institutional Variation:** Tier-2/3 HEIs produced frugal, community-facing innovations (SDG 1, SDG 2, SDG 7), while metro HEIs leaned toward tech-driven solutions (SDG 9, SDG 11).
- **Policy Implications:** Proposed an “SDG-IIC Matrix” to align institutional calendars with priority SDGs and recommended inclusion of SDG-impact metrics in ARIIA/IIC evaluations.

Synthesis

The literature collectively establishes three points:

1. Globally, HEIs are recognized as sustainability drivers, but Indian evidence remains thin.
2. IEE is a proven pathway for student-led solutions, with IICs serving as India’s primary delivery mechanism.
3. While IIC functions are well documented, their measurable SDG-aligned outcomes are underexplored. Londhe (2025) begins to bridge this gap, shifting discourse from inputs to outcomes.

Research Gaps

Despite recent progress, three gaps remain:

- **Empirical Gap:** Limited longitudinal data tracking IIC projects from idea stage to SDG impact, including adoption, scaling, and community benefit.
- **Mechanism Gap:** Insufficient understanding of how specific IIC interventions translate into competencies and ventures addressing particular SDGs.
- **Evaluation Gap:** Current ranking and reporting systems like ARIIA do not yet include SDG-impact indicators, preventing policymakers from assessing whether IICs contribute to national SDG targets or merely increase activity counts.

3. Theoretical Framework

Innovation Ecosystem Theory

Institution's Innovation Councils (IICs) operate as micro-ecosystems within HEIs, enabling knowledge flow, resource mobilization, and collaborative problem-solving. They create environments where student innovators, faculty, and external stakeholders interact to generate SDG-aligned solutions.

Triple Helix Model

The IIC framework embeds collaboration among academia, industry, and government — the three strands of the Triple Helix. This model explains how IICs foster partnerships that enhance innovation capacity, translating academic knowledge into entrepreneurial and societal impact.

Institutional Theory

IICs institutionalize innovation practices by embedding them into HEI governance structures. Through policies, rankings, and reporting mechanisms, innovation becomes a formalized part of institutional identity, ensuring sustainability beyond individual projects.

Proposed IIC Pathway Model

This study advances the IIC Pathway Model, a five-stage framework — *Ecosystem Creation* → *Capacity Building* → *Solution Development* → *Validation & Scaling* → *Impact Recognition*. It operationalizes SDGs through structured innovation processes, linking institutional activities to measurable societal outcomes.

4. Contribution of This Research

To address the documented gaps, Rupesh Chandrasen Londhe's study provides one of the first empirical mappings of IIC outcomes to the SDGs within Indian HEIs. The contributions are fourfold:

- **Empirical Mapping of IIC Outputs** The study provides one of the first systematic classifications of student innovations, startups, and projects under IICs/Yukti-NIR according to the **17 SDGs and 169 targets**. This shifts discourse from activity counts to **outcome-based evidence**.
- **Development of the IIC Pathway Model** The paper introduces and validates a **five-stage model** (Ecosystem Creation → Capacity Building → Solution Development → Validation & Scaling → Impact Recognition). This framework operationalizes SDGs through structured innovation processes at the institutional level.
- **Function-to-Impact Analysis** By linking specific IIC functions (hackathons, mentoring, ARIIA benchmarking, Yukti submissions) to SDG-aligned outputs, the study identifies **which activities generate the highest impact**. This provides actionable insights for HEIs and policymakers.
- **Contextual Insights for Indian HEIs** the research accounts for regional diversity, resource constraints, and policy environments in India. It highlights differences between Tier-2/3 HEIs (frugal, community-facing innovations) and metro HEIs (tech-driven solutions).
- **Policy Recommendations** Practical suggestions for MIC and AICTE include embedding SDG-specific challenges, strengthening industry linkages, and integrating **impact measurement frameworks** into ARIIA/IIC evaluations.
- **Theoretical Advancement** The paper extends **Innovation Ecosystem Theory, Triple Helix Model, and Institutional Theory** into the Indian HEI context, showing how institutional innovation councils can act as catalysts for sustainability.

5. Research Design

Research objectives-

Identify Core Mechanisms To examine the structural and functional mechanisms of the Institution's Innovation Council (IIC) pathway in Indian HEIs.

Map IIC Activities to SDGs To empirically classify student innovations, startups, and projects under IICs according to the 17 SDGs and 169 targets.

Analyze Function-to-Impact Linkages To determine which IIC functions (hackathons, mentoring, ARIIA participation, Yukti submissions) most strongly correlate with SDG-aligned outputs.

Assess Moderating Factors To explore contextual factors (regional diversity, institutional type, resource constraints) that moderate IIC impact on SDGs.

Develop a Framework To propose and validate the **IIC Pathway Model** as a replicable framework for embedding SDGs into higher education governance.

Research Design -

The study adopts an **explanatory sequential mixed-methods design**, combining quantitative content analysis with qualitative insights to triangulate findings.

Design Phase- Explanatory sequential mixed-methods design combining quantitative content analysis with qualitative interviews.

Quantitative Phase

- Data: IIC activity reports (2022–2024) and 240 Yukti-NIR submissions.
- Method: Content analysis mapping outputs to SDGs and targets.
- Output: Frequency distributions of activities, innovations, and startups per SDG.

Qualitative Phase

- Participants: 32 semi-structured interviews with IIC presidents, faculty coordinators, student innovators, and industry mentors.
- Focus: Mechanisms of innovation support, perceived SDG linkages, institutional challenges.
- Method: Thematic coding to identify pathways from IIC functions to SDG outcomes.

6. Results-

Descriptive Statistics

- Number of activities, ideas, and startups were classified per SDG.
- High representation in **SDG 4 (Quality Education)**, **SDG 8 (Decent Work & Economic Growth)**, and **SDG 9 (Industry, Innovation & Infrastructure)**.
- Emerging contributions to **SDG 13 (Climate Action)** and **SDG 11 (Sustainable Cities)**.

Case Examples

- **Social Innovation Challenge** → SDG 3, SDG 6, SDG 11 → *Low-cost water purifier prototype*.
- **Green Energy Hackathon** → SDG 7, SDG 13 → *Solar micro-grid startup*.
- **Entrepreneurship Support Programs** → SDG 8, SDG 9 → *Student-led sustainable product ventures*.

Validated Pathway Model

The five-stage IIC Pathway Model was empirically validated: **Ecosystem Creation** → **Capacity Building** → **Solution Development** → **Validation & Scaling** → **Impact Recognition**. This model demonstrates how institutional innovation activities systematically lead to SDG-aligned outcomes.

7. Discussion

Theoretical Contribution

The study confirms that IICs operationalize SDGs at the institutional level through structured innovation pathways, extending **Innovation Ecosystem Theory**, **Triple Helix Model**, and **Institutional Theory** into the Indian HEI context.

Practical Implications

- Policy recommendations for the Ministry of Education's Innovation Cell (MIC).
- Stronger industry linkages to enhance SDG relevance.
- Introduction of SDG-specific challenges and competitions.
- Development of impact measurement frameworks for ARIIA/IIC evaluations.

Limitations

- Maharashtra-only sample limits generalizability.
- Reliance on self-reported data may introduce bias.
- Short-term data restricts longitudinal insights.

Future Research

- Comparative studies across states and regions.
- Longitudinal tracking of startup survival and community impact.
- Integration of SDG-impact indicators into national innovation reporting systems.

8. Conclusion

The Institution's Innovation Council provides a **scalable pathway for HEIs to operationalize SDGs through grassroots innovation**. By embedding innovation culture, fostering student entrepreneurship, and linking prototypes to incubation and recognition, IICs bridge the gap between academic learning and sustainable development. Strengthening industry partnerships, embedding SDG-specific metrics, and expanding longitudinal impact studies will enhance the IIC's role as a **national catalyst for sustainability**.

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Appendix A – Research Design and Instruments

- **Survey Protocol:** Structured questionnaire used for content analysis of IIC activity reports and Yukti-NIR submissions.
- **Interview Guide:** Semi-structured interview questions for IIC presidents, faculty coordinators, student innovators, and industry mentors.
- **Validation Checklist:** Criteria used by expert panel to review SDG mapping accuracy.

Appendix B – Data Tables

- **Descriptive Statistics:**

SDG	Activities	Ideas Generated	Startups Initiated
SDG 3 – Good Health & Well-being	42	18	6
SDG 6 – Clean Water & Sanitation	35	12	4
SDG 7 – Affordable & Clean Energy	28	9	3

SDG 8 – Decent Work & Economic Growth	65	25	10
SDG 9 – Industry, Innovation & Infrastructure	72	30	12
SDG 11 – Sustainable Cities & Communities	22	8	2
SDG 13 – Climate Action	40	15	5

Appendix C – Case Narratives

Social Innovation Challenge

- **Context:** Organized by the Institution's Innovation Council to mobilize students around community health and sanitation issues.
- **Innovation:** Prototype of a *low-cost water purifier* designed for rural households.
- **SDG Mapping:**
 - **SDG 3 – Good Health & Well-being** → Improved access to safe drinking water reduces waterborne diseases.
 - **SDG 6 – Clean Water & Sanitation** → Direct contribution to affordable clean water solutions.
 - **SDG 11 – Sustainable Cities & Communities** → Supports resilient community infrastructure in underserved areas.
- **Outcome:** Prototype tested in two villages; potential for scaling through incubation support.

Green Energy Hackathon

- **Context:** Hackathon challenge focused on renewable energy solutions, hosted under IIC's ecosystem creation function.

- **Innovation:** *Solar micro-grid startup* designed to provide decentralized energy access in semi-urban areas.
- **SDG Mapping:**
 - **SDG 7 – Affordable & Clean Energy** → Expands renewable energy access.
 - **SDG 13 – Climate Action** → Reduces carbon footprint through clean energy adoption.
- **Outcome:** Startup incubated with industry mentorship; pilot deployment in one district.

Entrepreneurship Support Program

- **Context:** IIC mentoring and pre-incubation program linking students with alumni and industry partners.
- **Innovation:** *Student-led sustainable product ventures* including eco-friendly packaging and frugal consumer goods.
- **SDG Mapping:**
 - **SDG 8 – Decent Work & Economic Growth** → Promotes entrepreneurship and job creation.
 - **SDG 9 – Industry, Innovation & Infrastructure** → strengthens innovation-driven industrial solutions.
- **Outcome:** Three ventures received seed funding; two entered incubation centers for scaling.

Appendix D – IIC Pathway Model Diagram

- **Five Stages:**
 1. Ecosystem Creation
 2. Capacity Building
 3. Solution Development
 4. Validation & Scaling
 5. Impact Recognition

Model Flow

1. **Ecosystem Creation** → builds the foundation for innovation culture.
2. **Capacity Building** → equips stakeholders with skills and competencies.

3. **Solution Development** → generates prototypes and ventures aligned with SDGs.
4. **Validation & Scaling** → ensures innovations are market-ready and scalable.
5. **Impact Recognition** → institutionalizes outcomes and strengthens national SDG contributions.

		Partnerships for the Goals
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IIC Pathway Model—Innovation to SDG Impact -



Model Overview

The **Institution's Innovation Council (IIC) Pathway Model** represents a structured, five-stage process through which Higher Education Institutions (HEIs) operationalize the **United Nations Sustainable Development Goals (SDGs)** via innovation and entrepreneurship. It demonstrates how institutional mechanisms—training, mentoring, incubation, and recognition—collectively transform ideas into measurable social impact.

Stage 1 – Ecosystem Creation Through IIC

At this foundational stage, HEIs establish an innovation-friendly environment through awareness drives, IPR workshops, and ARIIA benchmarking. The focus is on building networks and partnerships that enable knowledge flow and resource mobilization.

Linked SDGs:

SDG 9 (Industry, Innovation & Infrastructure), SDG 17 (Partnerships for the Goals).

Stage 2 – Capacity Building

This stage develops human capital by training students and faculty in design thinking, prototyping, and entrepreneurial skills. It transforms theoretical learning into applied innovation competencies.

Linked SDGs: SDG 4 (Quality Education), SDG 8 (Decent Work & Economic Growth).

Stage 3 – Solution Development

Through hackathons, innovation challenges, and Yukti-National Innovation Repository submissions, ideas evolve into prototypes and ventures addressing real-world

Stage	Description	SDG Linkages
Ecosystem Creation	Establishing innovation culture through IPR workshops, awareness drives, bootcamps, and ARIIA benchmarking.	SDG 9 – Industry, Innovation & Infrastructure; SDG 17 – Partnerships for the Goals
Capacity Building	Training students and faculty in design thinking, prototyping, and entrepreneurship skills.	SDG 4 – Quality Education; SDG 8 – Decent Work & Economic Growth
Solution Development	Hackathons, innovation challenges, and Yukti-NIR submissions leading to prototypes and ventures.	SDG 3 – Good Health & Well-being; SDG 6 – Clean Water & Sanitation; SDG 7 – Affordable & Clean Energy; SDG 11 – Sustainable Cities & Communities
Validation & Scaling	Mentoring, incubation, and industry partnerships to refine and scale innovations.	SDG 9 – Industry, Innovation & Infrastructure; SDG 12 – Responsible Consumption & Production; SDG 13 – Climate Action
Impact Recognition	Recognition through ARIIA rankings, MIC awards, and dissemination of best practices.	SDG 1 – No Poverty; SDG 10 – Reduced Inequalities; SDG 17 –



problems. This stage emphasizes creativity, experimentation, and social relevance.

Linked SDGs: SDG 3 (Good Health & Well-being), SDG 6 (Clean Water & Sanitation), SDG 7 (Affordable & Clean Energy), SDG 11 (Sustainable Cities & Communities).

Stage 4 – Validation & Scaling

Innovations are refined through mentoring, incubation, and industry partnerships. This stage ensures technical validation, market readiness, and scalability of solutions.

Linked SDGs: SDG 9 (Industry, Innovation & Infrastructure), SDG 12 (Responsible Consumption & Production), SDG 13 (Climate Action).

Stage 5 – Impact Recognition

Validated innovations are recognized through ARIIA rankings, MIC awards, and dissemination of best practices. This stage institutionalizes success stories and reinforces the innovation culture within HEIs.

Linked SDGs: SDG 1 (No Poverty), SDG 10 (Reduced Inequalities), SDG 17 (Partnerships for the Goals).

Model Significance-

The IIC Pathway Model bridges the gap between **academic learning and sustainable development**, positioning HEIs as catalysts for national innovation. It aligns institutional calendars, evaluation metrics, and student engagement with SDG priorities—creating a replicable framework for **SDG-driven innovation ecosystems** across India.

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Appendix E – Policy Documents Referred

Ministry of Education	Innovation Cell Reports (2018–2025).
ARIIA Framework Documents	(2019–2025).
Yukti-NIR Data Portal	(2020–2025).
Selected HEI IIC	Annual Reports (2019–2025).