

# **A STUDY OF THE SANITATION ENTREPRENEURSHIP ECOSYSTEM IN INDIA**

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**INDIAN INSTITUTE OF TECHNOLOGY, DELHI**

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# **A STUDY OF THE SANITATION ENTREPRENEURSHIP ECOSYSTEM IN INDIA**

*by*

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*Submitted*

*in fulfilment of the requirements of the degree of Doctor of Philosophy*

*to the*



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*Dedicated to my grandparents,*

***Smt. Bhagwati Devi & Sh. Om Prakash Yadav,***

*whose nurturing embrace filled my life with boundless affection and  
invaluable lessons. Their legacy of resilience, joy and spiritual depth  
continues to illuminate my path.*

## **CERTIFICATE**

This is to certify that "**A Study of the Sanitation Entrepreneurship Ecosystem in India**" being submitted by **Shivani** to the **Indian Institute of Technology Delhi** for the award of **Doctor of Philosophy**, is a record of original bonafide research work carried out by her under my guidance and supervision. In my opinion, the thesis has reached the standard of fulfilling the requirements of all the regulations related to the degree. The research report and results presented in this thesis have not been submitted, in part or in full, to any other university or institution for the award of any degree or diploma. I certify that she has pursued the prescribed course of research.

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## ABSTRACT

Inadequate sanitation is one of the most pressing developmental challenges in emerging economies like India. Particularly, in contexts where ingrained diverse cultural practices, institutional gaps and financial constraints hinder the achievement of universal access to adequate sanitation. This is where sanitation entrepreneurs pave the way in reimagining and innovating solutions for pressing problems. This thesis examines the sanitation entrepreneurship ecosystem in India through a multi-stakeholder lens. The overarching objective is to understand how sanitation enterprises emerge, operate, solve and scale within a complex ecosystem of actors and influences. The study employs a qualitative multi-modal methodology, complemented by systems thinking, hierarchal modelling and cross-case analysis.

The research is structured around three distinct yet interconnected facets of inquiry. First, ethnographic causal loop diagramming is used to examine how end-users and local stakeholders adopt and promote sanitation differently. It examines end-user practices and role of local stakeholders in influencing sanitation behaviour. Second, TISM-MICMAC analysis is applied to decode hierarchal investor decision-making patterns and priorities. It explores how impact investors evaluate enterprises, balancing social impact with financial return. Third, a cross-case analysis of two sanitation enterprises, Eco Femme and Ekam Eco Solutions, is conducted to unveil the enablers and challenges in the field.

The findings converge on the recognition that sanitation entrepreneurship is not merely a matter of technical deployment or financial investment. Rather, it is a systemic process shaped by interdependent actors, behavioural dynamics and

enabling or constraining institutional contexts. Causal Loop Diagrams reveal the reinforcing and balancing feedback loops of sanitation adoption and promotion. It highlights the importance of local stakeholders in reinforcing positive habits amongst end-users. The ethnographic study reveals how habits, cultural norms, patriarchy, economic status, health, gender, local stakeholders and access to sanitation products and services determine adoption and promotion patterns. The hierarchical model reveals nine key factors which impact investors deem critical when investing in an enterprise. The study unpacks the interrelationship between these factors and their importance based on where they are placed in the model. The cross-case analysis underscores the importance of accounting hybrid success parameters, behaviour change integration, institutional navigation, scalability and ecosystem leverage through innovation and partnerships.

To integrate these insights, the thesis proposes a novel three-layered framework of systemic change. The “Who” dimension highlights the interdependence of end-users, local stakeholders, entrepreneurs and investors. The “What” dimension identifies six pillars i.e. social innovation, behavioural nudges, capacity building, stewardship, accountability and knowledge integration, that collectively underpin systemic transformation. The “How” dimension sets out the mechanisms through which these pillars can be operationalised, including green technology and innovation, behavioural interventions, bridging financing disparities, public-private-community partnerships and inclusive sustainability and impact.

The thesis makes both theoretical and practical contributions. Theoretically, it enriches the literature on sanitation entrepreneurship ecosystem by converging three empirical studies into a holistic multi-stakeholder framework. Practically, it

offers policy and practice recommendations that emphasise collaboration, capacity development, financing innovation, behavioural change and accountability.

The research demonstrates that sanitation entrepreneurship holds transformative potential when embedded within supportive ecosystems and guided by inclusive and systemic approaches. Its pursuit not only addresses sanitation challenges but also contributes to broader goals of dignity, health, sustainability and social empowerment.

## संक्षेप

अपर्याप्त स्वच्छता भारत जैसे उभरती अर्थव्यवस्थाओं वाले देशों के समक्ष सबसे गंभीर विकासात्मक चुनौतियों में से एक है। विशेषकर उन परिस्थितियों में जहाँ गहराई से जड़ें जमा चुकी विविध सांस्कृतिक प्रथाएँ, संस्थागत कमियाँ तथा वित्तीय बाधाएँ पर्याप्त स्वच्छता तक सार्वभौमिक पहुँच प्राप्त करने में अवरोध उत्पन्न करती हैं। ऐसे संदर्भों में स्वच्छता उद्यमी गंभीर समस्याओं के समाधान की पुनर्कल्पना और नवाचार के माध्यम से परिवर्तन का मार्ग प्रशस्त करते हैं। यह शोध प्रबंध भारत में स्वच्छता उद्यमिता पारिस्थितिकी तंत्र का बहु-हितधारक दृष्टिकोण से अध्ययन करता है। इसका व्यापक उद्देश्य यह समझना है कि स्वच्छता उद्यम किस प्रकार एक जटिल पारिस्थितिकी तंत्र में विभिन्न हितधारकों और प्रभावों के बीच उभरते हैं, कार्य करते हैं, समस्याओं का समाधान करते हैं तथा विस्तार प्राप्त करते हैं। इस अध्ययन में गुणात्मक बहु-विधात्मक कार्यप्रणाली का उपयोग किया गया है, जिसे प्रणालीगत चिंतन, पदानुक्रमीय मॉडलिंग तथा विषयगत अंतः-प्रकरण विश्लेषण द्वारा पूरक बनाया गया है।

यह शोध तीन विशिष्ट किंतु परस्पर संबंधित अध्ययन आयामों पर आधारित है। प्रथम, नृवंशविज्ञान-आधारित कारणात्मक लूप आरेखन का उपयोग यह समझने के लिए किया गया है कि अंतिम उपयोगकर्ता और स्थानीय हितधारक स्वच्छता को किस प्रकार भिन्न रूप से अपनाते और बढ़ावा देते हैं। यह अंतिम उपयोगकर्ताओं की प्रथाओं और स्वच्छता व्यवहार को प्रभावित करने में स्थानीय हितधारकों की भूमिका का परीक्षण करता है। द्वितीय, निवेशकों के पदानुक्रमीय निर्णय-निर्माण पैटर्न और प्राथमिकताओं को समझने हेतु TISM-MICMAC विश्लेषण लागू किया गया है। यह अध्ययन करता है कि प्रभाव निवेशक सामाजिक प्रभाव और वित्तीय प्रतिफल के मध्य संतुलन स्थापित करते हुए उद्यमों का

मूल्यांकन कैसे करते हैं। तृतीय, दो स्वच्छता उद्यमों, Eco Femme तथा Ekam Eco Solutions, के विषयगत अंतः-प्रकरण विश्लेषण के माध्यम से इस क्षेत्र में सक्षमकारी कारकों और चुनौतियों को उजागर किया गया है।

अध्ययन के निष्कर्ष इस मान्यता पर एकत्रित होते हैं कि स्वच्छता उद्यमिता केवल तकनीकी कार्यान्वयन या वित्तीय निवेश का विषय नहीं है। बल्कि, यह एक प्रणालीगत प्रक्रिया है जो परस्पर निर्भर हितधारकों, व्यवहारगत गतिशीलताओं तथा सक्षमकारी अथवा बाधक संस्थागत संदर्भों से प्रभावित होती है। कारणात्मक लूप आरेख स्वच्छता अपनाने और उसके प्रसार में सुदृढीकरण एवं संतुलनकारी प्रतिपुष्टि चक्रों को प्रदर्शित करते हैं। ये अंतिम उपयोगकर्ताओं में सकारात्मक आदतों को सुदृढ करने में स्थानीय हितधारकों के महत्व को रेखांकित करते हैं। नृवंशविज्ञान अध्ययन से यह स्पष्ट होता है कि आदतें, सांस्कृतिक मान्यताएँ, पितृसत्ता, आर्थिक स्थिति, स्वास्थ्य, लिंग, स्थानीय हितधारक तथा स्वच्छता उत्पादों और सेवाओं तक पहुँच स्वच्छता अपनाने और उसके प्रसार के प्रतिरूपों को निर्धारित करते हैं। पदानुक्रमीय मॉडलिंग से नौ प्रमुख कारकों की पहचान हुई जिन्हें प्रभाव निवेशक किसी उद्यम में निवेश करते समय अत्यंत महत्वपूर्ण मानते हैं। अध्ययन इन कारकों के पारस्परिक संबंधों तथा पदानुक्रमीय मॉडल में उनकी स्थिति के आधार पर उनके महत्व का विश्लेषण करता है। विषयगत अंतः-प्रकरण विश्लेषण मिश्रित सफलता मानकों, व्यवहार परिवर्तन एकीकरण, संस्थागत अनुकूलन, विस्तारशीलता तथा नवाचार और साझेदारी के माध्यम से पारिस्थितिकी तंत्र के लाभों के महत्व को रेखांकित करता है।

इन अंतर्दृष्टियों को समेकित करने हेतु यह शोध प्रबंध प्रणालीगत परिवर्तन का एक नवीन त्रि-स्तरीय ढाँचा प्रस्तुत करता है। “कौन” (Who) आयाम अंतिम उपयोगकर्ताओं, स्थानीय हितधारकों, उद्यमियों और निवेशकों की परस्पर निर्भरता को रेखांकित करता है। “क्या”

(What) आयाम छह प्रमुख स्तंभों, सामाजिक नवाचार, व्यवहारगत प्रेरणाएँ, क्षमता निर्माण, संरक्षकता, उत्तरदायित्व तथा ज्ञान एकीकरण, की पहचान करता है, जो सामूहिक रूप से प्रणालीगत परिवर्तन का आधार बनते हैं। “कैसे” (How) आयाम उन तंत्रों को प्रस्तुत करता है जिनके माध्यम से इन स्तंभों को क्रियान्वित किया जा सकता है, जिनमें हरित प्रौद्योगिकी एवं नवाचार, व्यवहारगत हस्तक्षेप, वित्तीय असमानताओं को कम करना, सार्वजनिक-निजी-सामुदायिक साझेदारियाँ तथा समावेशी स्थिरता और प्रभाव शामिल हैं।

यह शोध प्रबंध सैद्धांतिक तथा व्यावहारिक दोनों प्रकार के योगदान प्रदान करता है। सैद्धांतिक रूप से, यह स्वच्छता उद्यमिता पारिस्थितिकी तंत्र पर उपलब्ध साहित्य को समृद्ध करता है, क्योंकि यह तीन नवीन अनुभवजन्य अध्ययनों को एक समग्र बहु-हितधारक ढाँचे में एकीकृत करता है। व्यावहारिक रूप से, यह नीतिगत तथा व्यावहारिक अनुशंसाएँ प्रस्तुत करता है, जो सहयोग, क्षमता विकास, वित्तीय नवाचार, व्यवहार परिवर्तन तथा उत्तरदायित्व पर बल देती हैं।

यह शोध प्रदर्शित करता है कि स्वच्छता उद्यमिता में परिवर्तनकारी क्षमता निहित है, बशर्ते इसे सहायक पारिस्थितिकी तंत्रों में स्थापित किया जाए और समावेशी तथा प्रणालीगत दृष्टिकोणों द्वारा निर्देशित किया जाए। इसकी प्रगति न केवल स्वच्छता संबंधी चुनौतियों का समाधान करती है, बल्कि गरिमा, स्वास्थ्य, स्थिरता तथा सामाजिक सशक्तिकरण जैसे व्यापक लक्ष्यों की प्राप्ति में भी योगदान देती है।

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## LIST OF ABBREVIATIONS

| Abbreviation | Full Form                                                                                                                                                  |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AMRUT        | Atal Mission for Rejuvenation and Urban Transformation                                                                                                     |
| B2B          | Business-to-Business                                                                                                                                       |
| B2C          | Business-to-Consumer                                                                                                                                       |
| BoP / BOP    | Base of the Pyramid                                                                                                                                        |
| CAC          | Customer Acquisition Cost                                                                                                                                  |
| CE           | Circular Economy                                                                                                                                           |
| CEO          | Chief Executive Officer                                                                                                                                    |
| CHC          | Community Health Centre                                                                                                                                    |
| CLD          | Causal Loop Diagramming                                                                                                                                    |
| COVID        | Coronavirus Disease                                                                                                                                        |
| CSR          | Corporate Social Responsibility                                                                                                                            |
| EE           | Entrepreneurial Ecosystems                                                                                                                                 |
| ESG          | Environmental, Social and Governance                                                                                                                       |
| EWS          | Economically Weaker Section                                                                                                                                |
| FAO          | Food and Agriculture Organization                                                                                                                          |
| FSM          | Fecal Sludge Management                                                                                                                                    |
| GDP          | Gross Domestic Product                                                                                                                                     |
| GM           | Gioia Methodology                                                                                                                                          |
| GOTS         | Global Organic Textile Standard                                                                                                                            |
| GPCB         | Goa Pollution Control Board                                                                                                                                |
| HUL          | Hindustan Unilever Limited                                                                                                                                 |
| HWTPL        | Hindustan Waste Treatment Private Limited                                                                                                                  |
| ICT          | Information and Communication Technology                                                                                                                   |
| IDX          | Indonesian Stock Exchange                                                                                                                                  |
| IMM          | Impact Multiple of Money                                                                                                                                   |
| INR          | Indian Rupee                                                                                                                                               |
| IoT          | Internet of Things                                                                                                                                         |
| IRIS         | Impact Reporting and Investment Standards                                                                                                                  |
| KAP          | Knowledge, Attitude and Practice                                                                                                                           |
| LGB          | Local Government Body                                                                                                                                      |
| LMICs        | Low and Middle-Income Countries                                                                                                                            |
| MDGs         | Millennium Development Goals                                                                                                                               |
| MHM          | Menstrual Hygiene Management                                                                                                                               |
| MICMAC       | Cross-Impact Matrix Multiplication Applied to Classification<br>(also known as <i>Matrice d'Impacts Croisés Multiplication Appliquée à un Classement</i> ) |

| <b>Abbreviation</b> | <b>Full Form</b>                                       |
|---------------------|--------------------------------------------------------|
| NGOs                | Non-Governmental Organisations                         |
| NIMBY               | Not-in-My-Backyard                                     |
| NITI                | National Institution for Transforming India            |
| OD                  | Open Defecation                                        |
| ODF                 | Open Defecation Free                                   |
| PHC                 | Primary Health Centre                                  |
| PPCP                | Public-Private-Community Partnerships                  |
| PPP                 | Public-Private Partnerships                            |
| PUL                 | Polyurethane Laminate                                  |
| R&D                 | Research and Development                               |
| RO                  | Research Objective                                     |
| ROI                 | Return on Investment                                   |
| RQ                  | Research Question                                      |
| RRR                 | Reduce-Reuse-Recycle                                   |
| SBM                 | Swachh Bharat Mission                                  |
| SDGs                | Sustainable Development Goals                          |
| SLWM                | Solid and Liquid Waste Management                      |
| SRI                 | Socially Responsible Investing                         |
| SROI                | Social Return on Investment                            |
| SSIM                | Structural Self-Interaction Matrix                     |
| STP                 | Sewage Treatment Plant                                 |
| TAM                 | Total Addressable Market                               |
| TBC                 | Toilet Board Coalition                                 |
| TISM                | Total Interpretive Structural Modeling                 |
| UK                  | United Kingdom                                         |
| UN                  | United Nations                                         |
| UNICEF              | United Nations International Children's Emergency Fund |
| US                  | United States                                          |
| USD                 | United States Dollar                                   |
| WASH                | Water, Sanitation and Hygiene                          |
| WATSAN              | Water and Sanitation                                   |
| WHO                 | World Health Organization                              |