



GRADUATE DISSERTATION

Submitted for partial fulfillment for the award of a Master Degree in

MANAGEMENT OF ORGANIZATIONS

Fostering Sustainable Practices Through Green Education:

Insights from Algerian Green Incubators

“LEANCUBATOR”

Submitted by:

Chahinez BOUBRIK

Supervise by:

Dr. Mehdi BOUCHETARA

Academic year:

2024 / 2025

Abstract

This study explores whether and how private green incubators in Algeria integrate green education to support startups in adopting sustainable practices. The primary objective is to assess the presence, form, and influence of green education within the incubation process. The research focuses on Leancubator as the organizational host, known for its involvement in sustainability-driven programs. A qualitative approach was adopted, using semi-structured interviews with Leancubator staff, structured interviews with startup founders accompanied by the incubator, and brainstorming sessions with experts, consultants, and researchers in sustainability. Data were collected through interview guides and document analysis, and interpreted using thematic analysis.

The results indicate that green education is not formally structured within the incubator but is integrated through occasional expert sessions, project-based learning, and external partnerships. Startups show a growing awareness of sustainability, yet their engagement with green practices remains uneven and often reactive. The findings highlight the influence of individual motivation, international collaborations, and practical exposure as key enablers. However, limitations such as financial constraints, lack of regulatory clarity, and weak internal expertise hinder deeper integration.

This study underscores the potential of incubators to become educational agents for sustainability and calls for the development of structured green learning frameworks tailored to entrepreneurial contexts.

Keywords:

Green education, sustainable entrepreneurship, green incubators, startups, sustainability, green skills, sustainable innovation, Leancubator, Algeria.

الملخص

تهدف هذه الدراسة إلى الكشف عن مدى تكامل مفهوم التعليم الأخضر داخل برامج الحاضنات الخاصة في الجزائر، مع التركيز على الكيفية التي تُسهم بها هذه الحاضنات في ترسيخ الممارسات المستدامة لدى رواد الأعمال الناشئين. تم اختيار حاضنة "لينكيوباتور" كنموذج للدراسة نظراً لانخراطها في برامج الابتكار ذات البعد البيئي. اعتمد البحث على منهج نوعي، تم من خلاله إجراء مقابلات شبه موجهة مع طاقم الحاضنة، ومقابلات مهيكلّة مع مؤسسي الشركات الناشئة، بالإضافة إلى جلسات عصف ذهني مع خبراء وباحثين في مجالات الاستدامة وريادة الأعمال البيئية. وقد استُخدمت أدوات جمع بيانات نوعية، وتم تحليلها وفق مقارنة تحليل المضمون الموضوعاتي.

أظهرت النتائج أن التعليم الأخضر، وإن لم يكن مهيكلًا أو مُدمجًا بشكل رسمي في برامج الحاضنة، إلا أنه يُمارس بطرق غير مباشرة من خلال ورش العمل، والاستشارات، والتعاون مع شركاء دوليين. كما أبانت الدراسة عن وعي متزايد لدى بعض الشركات الناشئة بأهمية البعد البيئي، مقابل محدودية لدى أخرى ما تزال تُولي الأولوية للربح والبقاء في السوق. خلصت الدراسة إلى ضرورة تطوير مسارات تربوية واضحة ومؤطرة داخل الحاضنات، بما يُمكن من تكوين جيل من رواد الأعمال قادر على الموازنة بين متطلبات السوق ومقتضيات التنمية المستدامة.

الكلمات المفتاحية:

التعليم الأخضر، ريادة الأعمال البيئية، الحاضنات الخضراء، الشركات الناشئة، الاستدامة، لينكيوباتور، الجزائر، الكفاءات الخضراء، الابتكار المستدام.

Résumé

Cette étude explore si, et comment, les incubateurs verts privés en Algérie intègrent l'éducation verte afin d'aider les startups à adopter des pratiques durables. L'objectif principal est d'évaluer l'existence, la forme et l'impact de l'éducation à la durabilité dans le processus d'incubation. L'étude a été menée au sein de l'incubateur privé Leancubator, reconnu pour son engagement dans des programmes liés à l'innovation durable. Une approche qualitative a été adoptée, mobilisant des entretiens semi-directifs avec l'équipe de Leancubator, des entretiens structurés avec les fondateurs de startups accompagnées, ainsi qu'un brainstorming avec des experts, consultants et chercheurs spécialisés. Les données ont été collectées à l'aide de guides d'entretien et analysées selon une approche thématique.

Les résultats montrent que l'éducation verte n'est pas formalisée, mais qu'elle est introduite ponctuellement à travers des ateliers, des sessions d'experts et des partenariats externes. Les startups témoignent d'une prise de conscience progressive, bien que leur engagement reste inégal et souvent réactif. Des facteurs tels que la motivation individuelle, les collaborations internationales et les expériences pratiques jouent un rôle facilitateur important. Toutefois, des limites persistent, notamment le manque de ressources, l'absence de cadre réglementaire clair et un déficit d'expertise technique interne.

L'étude souligne le potentiel des incubateurs à jouer un rôle éducatif clé et appelle à la création de dispositifs pédagogiques structurés adaptés à l'entrepreneuriat vert.

Mots-clés :

Éducation verte, entrepreneuriat durable, incubateurs verts, startups, durabilité, compétences vertes, innovation durable, Leancubator, Algérie

Acknowledgements

I would like to begin by expressing my deepest gratitude to Allah for His countless blessings, guidance, and the strength granted to me throughout the completion of this work.

I extend my sincere thanks to my supervisor, Dr. BOUCHETARA, for his mentorship throughout this study, and the Leancubator team for granting me the opportunity to carry out this study and for providing a supportive and professional working environment.

I am also grateful to my father, Kassim, for his unwavering support and trust throughout this journey. His encouragement and dedication have constantly motivated me to pursue excellence. To my mother, Samia, whose endless patience, love, and faith in me have been a pillar of strength.

I would like to acknowledge the support of my twin sister, Bouchra, and my younger brother, Ayoub. Your presence, laughter, and encouragement have been constant sources of motivation and joy throughout this journey.

I would like to express my appreciation to my grandparents, especially my grandmother Aicha, whose memory, affection, and values continue to inspire and uplift me. My thanks also extend to my aunts, uncles, and cousins whose support and encouragement have always brought motivation and comfort.

To my friends, the ones who became my home away from home, thank you for your support, loyalty, laughter, and constant presence throughout this journey.

I would also like to sincerely thank all the professors and teaching staff at ENSM for their guidance, knowledge, and dedication, which have greatly contributed to my academic and personal growth.

To all those who, in one way or another, contributed to the completion of this journey, your presence has been truly appreciated.

Table of Content

Abstract	III
Acknowledgements	VI
Table of Content	VII
List of Tables	X
List of Figures	XI
List of Abbreviations, Acronyms and Symbols	XII
Introduction	3
1. Background & Problem statement:	3
1.1. General Context	3
1.2. Specific Context of Startups and Green Incubators in Algeria	4
1.3. Problem Statement	4
2. Objectives of the Study	5
2.1. Primary objective	5
2.2. Secondary objectives:	5
2.3. Research Questions	5
3. Significance of the Study	7
4. Structure of the study	7
Chapter 1: Literature Review Conceptual Framework	10
Section 1: Green Education and the Development of Green Skills	10
1. Definition and Evolution of Green Education	10
2. Pedagogical Approaches in Green Education	12
2.1. Experiential Learning	13
2.2 Problem-Based Learning (PBL)	13
2.3 Systems Thinking Pedagogy	15
2.4 Critical and Reflective Learning	16
2.5 Behavioral Change Approaches	18
2.6 Interactive Methods: Simulations and Fieldwork	19
3. Theoretical Foundations of Green Education	22
4. Green Education in Entrepreneurial Training	23
4.1 Development and Evaluation of Green Skills	25
Section 2: Green Entrepreneurship and Green Startups	28
1. Definition and Evolution of Green Entrepreneurship	28
2. Green Startups and Sustainable Innovation	29
3. Sustainability Practices	32
3.1 Green Skills and their Role in Green Startups:	33
3.2 Common Sustainability Practices and Strategies in Startups	34
4. Challenges and Opportunities for Green Entrepreneurs	35

Section 3: The Role of Green Incubators in Supporting Sustainable Practices	38
1. Definition and Historical Development of Incubators	38
2. Emergence and Definition of Green Incubators	39
3. Green Incubators as Agents of Sustainability Transformation	41
Chapter 2: Methodological Framework	44
1. Introduction	44
2. Presentation of the Host Organization: Leancubator	45
2.1. Overview	45
2.1. Missions and Objectives	45
2.2. Organizational Structure	46
2.3. Commitment to sustainable development goals (SDGs)	47
3. Methodological Framework	47
3.1. Research Approach	47
3.2. Epistemological Stance: Interpretivism	48
3.3. Methodological Choice: Qualitative Inquiry	49
3.4. Reasoning Logic: Inductive Approach	50
4. Population and Sampling	50
4.1. Target Population	50
4.2. Sampling Strategy	51
5. Data Collection and Tools	52
5.1. Interviews	53
5.1.1. Interview Guide Structure	54
5.2. Document Analysis	55
5.3. Brainstorming	55
6. Data Analysis	56
7. Ethical considerations	56
Chapter 3: Results and Discussion	59
1. Results Analysis	59
1.1. Interviewee profiles	59
1.2. Results Analysis	61
1.2.1. Category A: Incubator Managers and Staff	61
1.2.2. Category B: Startup Founders	67
1.2.3. Insights from Experts	75
2. Results Discussion	77
2.1. Integration of Green Education in Private Incubators	77
2.2. Pedagogical Approaches and Green Skills Development	77
2.3. Impact of Green Education on Startup Practices	78
2.4. Barriers and Levers to Green Education and Practices	78
2.5. Need for Institutionalization and Strategic Policy Support	79
Conclusion	81

Bibliography	85
Journal Articles	85
Books	92
Chapters in Edited Books	93
Research Methodology Sources	94
Reports and Institutional Publications	94
Theses and Dissertations	95
Web Sources or Blog Articles	96
Appendix A: Survey Guide	99
1. French Version:	99
Groupe A : Incubateurs — Managers et Équipe	99
Groupe B : Startups accompagnées par l’incubateur	100
2. English Version:	101
Category A: Incubator Managers and Staff	102
Category B: Startup Team Members	103
Thematic Grid	104

List of Tables

Table 1 Relationship between objectives and research questions	6
Table 2 Comparison of Interactive Pedagogical Methods in Green Education	21
Table 3 Common Barriers and enablers for startups	36
Table 4 Interview Logistics: Participant Groups, Data Collection Period, Mode, Duration, and Recording Method	54
Table 5 Overview of Interviewee Characteristics	59
Table 6 Word Frequency Classification	61
Table 7 Word Frequency Classification	62
Table 8 Word Frequency Classification	64
Table 9 Word Frequency Classification	65
Table 10 Word Frequency Classification	66
Table 11 Word Frequency Classification	68
Table 12 Word Frequency Classification	69
Table 13 Word Frequency Classification	71
Table 14 Word Frequency Classification	72
Table 15 Word Frequency Classification	73
Table 16 Insights from Brainstorming on Green Entrepreneurship Education	75

List of Figures

Figure 1 The four phases of the advancement of Education for Sustainable Development	11
Figure 2 GEP Framework of Education of sustainable development	12
Figure 3 Figure. PBL Implementation	14
Figure 4 Strategies of systems thinking in Education	16
Figure 5 Cycle of critical and reflective learning	17
Figure 6 Key concepts of the behavioral climate change education “CCE”	18
Figure 7 Theoretical model of learning for action through the world climate simulation	20
Figure 8 Best practices in advancing green education in the MENA region	21
Figure 9 Component of VBN Theory of environmental Behavior prepared	23
Figure 10 Key competencies in Sustainability	24
Figure 11 Skill needs for the low-carbo economy	25
Figure 12 Challenges in green skills assessment	26
Figure 13 Types of entrepreneurship	28
Figure 14 The relationship of circular start-ups with other types of enterprises	30
Figure 15 Triple bottom line - Framework	32
Figure 16 Sustainability Development Goals	33
Figure 17 Principles for a Sustainable Circular Economy	34
Figure 18 Different Green Incubator Characteristics by the student	40
Figure 19 Leancubator logo	45
Figure 20 Leancubator Organizational Structure	46
Figure 21 Qualitative Data Collection and Analysis process	53
Figure 22 Word Cloud 1 Green Education Integration	61
Figure 23 Word cloud 2 Supporting Sustainable Practices	62
Figure 24 Word cloud 3 Barriers and Challenges	63
Figure 25 Word cloud 4 Enablers and success factors	65
Figure 26 Word cloud 5 Suggestions and recommendations	66
Figure 27 Word cloud 6 Experience with Green Education	68
Figure 28 Word cloud 7 Applying Sustainable Practices	69
Figure 29 Word cloud 8 Barriers and Challenges	70
Figure 30 Word cloud 9 Enablers and Success Factors	72
Figure 31 Word cloud 10 Suggestions and Recommendations	73

List of Abbreviations, Acronyms and Symbols

Abbreviation / Acronym / Symbol	Definition
ASC	Algeria Startup Challenge
CBAM	Carbon Border Adjustment Mechanism
CO ₂	Carbon Dioxide
CRE	Centre de Recherche en Environnement
CSR	Corporate Social Responsibility
ESD	Education for Sustainable Development
ESG	Environmental, Social, and Governance
EU	European Union
GEP	Global Engagement Program
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
NGO	Non-Governmental Organization
RE	Renewable Energy
SD	Sustainable Development
SDGs	Sustainable Development Goals
SMEs	Small and Medium Enterprises
UNSDGs	United Nations Sustainable Development Goals

INTRODUCTION

Introduction

1. Background & Problem statement:

1.1. General Context

Climate change has become one of the most urgent and defining challenges of the 21st century, with rising global temperatures, intensifying natural disasters, water scarcity, and biodiversity loss threatening not only environmental stability but also social cohesion and economic prosperity. In response, the international community has embarked on a broad shift toward sustainable development, exemplified by frameworks like the Paris Agreement and the UN Sustainable Development Goals. Policymakers and businesses increasingly prioritize sustainability to mitigate climate risks and foster resilience. Indeed as climate risks intensify, there is a growing consensus that achieving sustainable development will require urgent, coordinated action across all levels of society ([Karadayi et al., 2025](#)).

Entrepreneurial ventures play a pivotal role in driving the innovation needed for sustainability. Startups, agile and innovation-driven by nature, are emerging as key catalysts of green technology and sustainable business models. In fact, turbulent market conditions fueled by climate change, environmental regulations, and shifting social expectations are “compelling startups to align their innovations with ESG principles” ([Jung et al., 2025](#)).

Yet, the journey toward sustainability is far from automatic for startups. While many founders are motivated by environmental concerns, they often face significant challenges in translating their aspirations into effective sustainable practices. By supporting the growth of green startups, incubators effectively “*accelerate the transition to a more sustainable economy*”, bringing novel clean technologies and environmentally conscious business models to market at a faster pace ([Diana Ailyn, 2024](#)).

Notably, sustainability-oriented incubators are now emerging worldwide to specifically nurture ventures with environmental and social missions. Studies suggest that incubators *can* be important catalysts for sustainable development by launching new “green” companies; however, the integration of sustainability into incubation programs remains nascent ([Samuel Carvalho de Azevedo Marques et al., 2024](#)). In practice, relatively few incubators have explicit green education or eco-innovation curricula so far, highlighting an opportunity to strengthen how incubators foster sustainability competencies in startups.

1.2. Specific Context of Startups and Green Incubators in Algeria

In recent years, Algeria's startup ecosystem has undergone rapid growth under government impetus, laying the groundwork for innovation-driven sustainability initiatives. After 2020, Algeria established a dedicated Ministry for Knowledge Economy and Startups and introduced a national "startup label" certification to recognize innovative new companies (EDJO, 2023).

The impact of these measures is evident in the numbers: by 2024, over 2,300 startups had obtained the official "Startup" label (Sidali, 2024), a remarkable increase considering the program was launched just four years prior.

The number of business incubators in Algeria grew from 14 in 2020 to around 60 by 2023, reflecting strong public and private support for startups. Algiers notably rose 225 spots to rank 546th globally in StartupBlink's 2023 index. Despite this progress, empirical research on Algeria's green startups and incubators remains limited, as both the startup ecosystem and its focus on sustainability are still emerging.

Few studies have examined how Algerian startups are implementing sustainability practices, or how incubators here incorporate environmental education into their programs (Samuel Carvalho de Azevedo Marques et al., 2024). This mirrors a broader gap: even globally, researchers have only recently started to explore "incubation for sustainability" and have yet to develop a clear research agenda on the topic.

1.3. Problem Statement

While Algeria's startup ecosystem is growing and green entrepreneurship is gaining traction, the integration of sustainability into incubation programs is underexplored. There is little empirical evidence on how green education is delivered by incubators or how it influences startups' sustainable practices.

As green innovation becomes essential to environmental and economic resilience, understanding the role of incubators in fostering such practices is critical. This research aims to fill that gap by investigating "how private green incubators in Algeria support startups through green education?".

2. Objectives of the Study

2.1. Primary objective

The primary objective of this research is to explore how private green incubators in Algeria promote green education and support startups in adopting sustainable practices, and what are the levers and barriers involved in this process.

2.2. Secondary objectives:

- a. Identify the existence of pedagogical approaches used by green incubators to educate, raise awareness, and train startup teams in sustainable practices.
- b. Examine the key factors that facilitate or hinder the adoption of sustainability principles within Algerian startups supported by incubators.
- c. Explore the main drivers and barriers encountered by startups in implementing sustainable practices during and after incubation.
- d. Provide evidence-based recommendations for enhancing the educational role of green incubators and improving sustainability outcomes in Algeria's entrepreneurial ecosystem.

2.3. Research Questions

The research questions are designed to guide an in-depth exploration of how green education influences sustainable practices within Algerian startups supported by private green incubators. This study seeks to understand how environmental knowledge is transmitted, how it shapes entrepreneurial behavior, and how it is perceived to impact sustainability outcomes. The research is guided by the following questions:

a. RQ1:

How do private green incubators in Algeria educate, raise awareness, and train startups in sustainable practices?

This question examines the pedagogical strategies and educational tools used to promote sustainability among startup founders and teams.

b. RQ2:

What factors facilitate or hinder the adoption of sustainability principles in startups supported by green incubators?

This question explores the key levers and barriers influencing the implementation of sustainable practices.

c. RQ3: What are the main drivers and barriers encountered by startups when implementing sustainable practices during and after incubation?

This question investigates the internal and external challenges startups face and how they respond to them.

d. RQ4: What evidence-based recommendations can be proposed to strengthen the educational role of green incubators and improve sustainability outcomes in Algerian startups?

This question focuses on translating empirical insights into actionable guidance for incubators and policymakers.

Table 1 Relationship between objectives and research questions

Primary Objective: Explore how private green incubators in Algeria promote green education and support startups in adopting sustainable practices, and what are the levers and barriers involved.	
Secondary Objectives	(RQs)
1. Identify the pedagogical approaches used by green incubators to educate, raise awareness, and train startup teams in sustainable practices.	RQ1
2. Examine the key factors that facilitate or hinder the adoption of sustainability principles within Algerian startups supported by incubators.	RQ2
3. Explore the main drivers and barriers encountered by startups in implementing sustainable practices during and after incubation.	RQ3
5. Provide evidence-based recommendations for enhancing the educational role of green incubators and improving sustainability outcomes in Algeria's entrepreneurial ecosystem.	RQ4

The Source: developed by ourselves

3. Significance of the Study

This research addresses a critical and underexplored intersection between green education, sustainable entrepreneurship, and incubation in Algeria. It offers both academic and practical contributions to the growing field of sustainability-driven startup development.

3.1 Scientific Significance

1. It highlights how private incubators support sustainability transitions through startup development.
2. It fills a gap in the literature on green education within incubation programs in emerging economies.
3. It contributes to qualitative research on how startups adopt sustainable practices through educational mechanisms.
4. It lays the groundwork for future studies on the long-term impact of green education in entrepreneurship.

3.2 Practical Significance

4. It provides insights for policymakers to support sustainability-focused startup ecosystems.
5. It offers guidance for incubator managers on how to design and implement green education strategies.
6. It helps startups identify ways to integrate sustainability into their operations and improve competitiveness.
7. It contributes to strengthening incubation models by positioning green education as a core component.

4. Structure of the study

This study is divided into five chapters that follow a logical progression from theory to practice, aiming to understand how green education fosters sustainable practices in Algerian startups incubated by private green incubators.

Introduction: Provides the study's context, research problem, objectives, questions, and significance.

Chapter I: Literature Review: Reviews key concepts and frameworks related to green education, sustainable entrepreneurship, and incubators, while identifying research gaps.

Chapter II: Methodological Framework: Describes the qualitative design, data collection methods, sampling, analysis approach, and ethical considerations.

Chapter III: Results and Discussion: Presents the research findings and interprets them in relation to the research questions and existing literature.

Conclusion: Summarizes key insights, discusses practical and academic implications, and offers recommendations for future research and stakeholder action.

CHAPTER 1:
LITERATURE REVIEW AND
CONCEPTUAL FRAMEWORK

Chapter 1: Literature Review Conceptual Framework

Section 1: Green Education and the Development of Green Skills

1. Definition and Evolution of Green Education

“Green education” broadly refers to educational approaches that foster sustainability awareness, values, and skills. Its roots lie in environmental education of the 1970s, which focused on nature conservation and pollution awareness. A landmark was the 1977 Tbilisi Declaration, which established a global framework for environmental education and laid out principles later reflected in sustainable development agendas ([“Tbilisi+35,” 2012](#)). By the 1990s, the concept evolved into Education for Sustainable Development (ESD), expanding the scope to include social and economic dimensions of sustainability. The Brundtland Commission’s 1987 report and Agenda 21 (1992) formally introduced ESD, emphasizing education as key to achieving sustainable development ([Yuan et al., 2023](#)). As stated by ([Grosseck et al., 2019](#)) UNESCO became the lead agency advancing ESD globally, notably through the UN Decade of ESD (2005–2014) and the current ESD for 2030 framework.

UNESCO defines ESD as education that “empowers people to change the way they think and work towards a sustainable future”, The phrase ESD is, however, most widely used, predominantly in United Nations documents ([Sivapalan & Speight, 2019](#)).

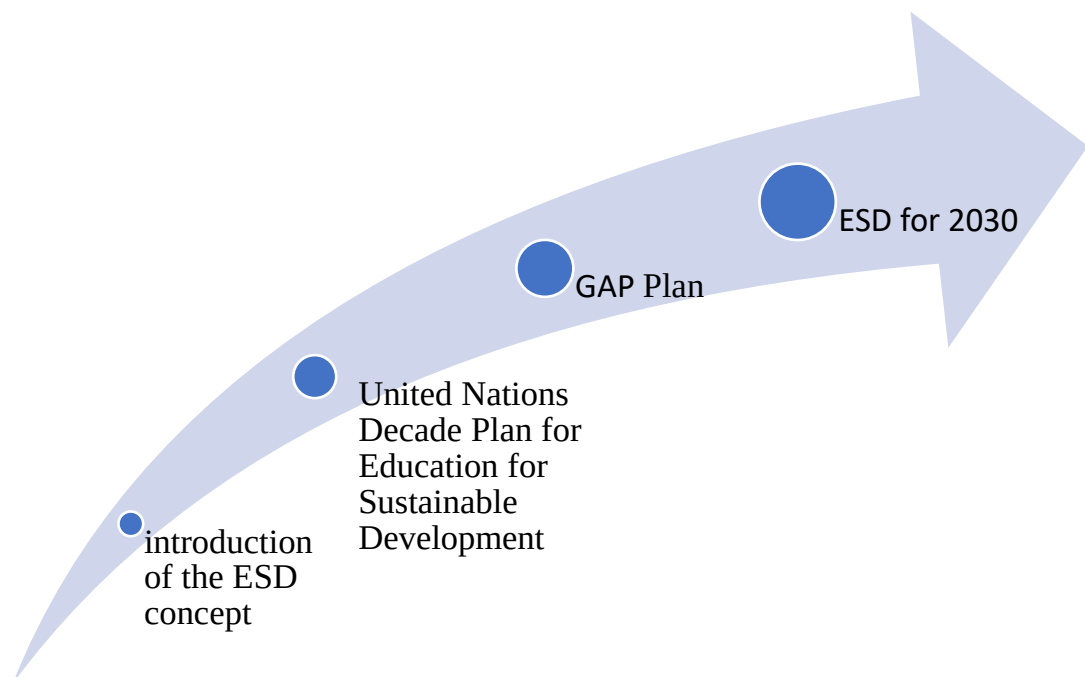
Unlike traditional environmental education, which centered mainly on ecological knowledge, ESD integrates environmental, economic, and social learning and encourages learners to take responsible action. UNESCO’s initiatives have established ESD as a worldwide paradigm: during the Decade of ESD, curricula were reshaped to embed sustainability principles, and ESD was recognized as critical to quality education (SDG Target 4.7) ([Yuan et al., 2023](#)).

Today, green education encompasses not only formal curricula but also community and lifelong learning programs oriented toward sustainable living. The advancement of Education for Sustainable Development (ESD) can be categorized into four distinct phases, according to ([Yuan et al., 2023](#)) since its inception in 1972:

- The initial phase, termed the embryonic stage, lasted until 2004 and was characterized by the gradual introduction of the ESD concept without any formal global guidelines for its implementation

- The second phase, spanning from 2005 to 2014, involved the initiation of the "United Nations Decade Plan for Education for Sustainable Development (2005–2014)" (referred to as the "Decade Plan").
- The third phase, from 2015 to 2019, introduced the "Global Plan of Action for Education for Sustainable Development (2015–2019)" (known as the "GAP Plan") as a continuation of the Decade Plan.
- The current and fourth phase, beginning in 2020 and ongoing, features UNESCO's launch of "Education for Sustainable Development 2030" ("ESD for 2030"), which builds on the GAP Plan and aligns with the 2030 Agenda for Sustainable Development, serving as the present framework for ESD implementation

Figure 1 The four phases of the advancement of Education for Sustainable Development (ESD)



The Source: developed by ourselves

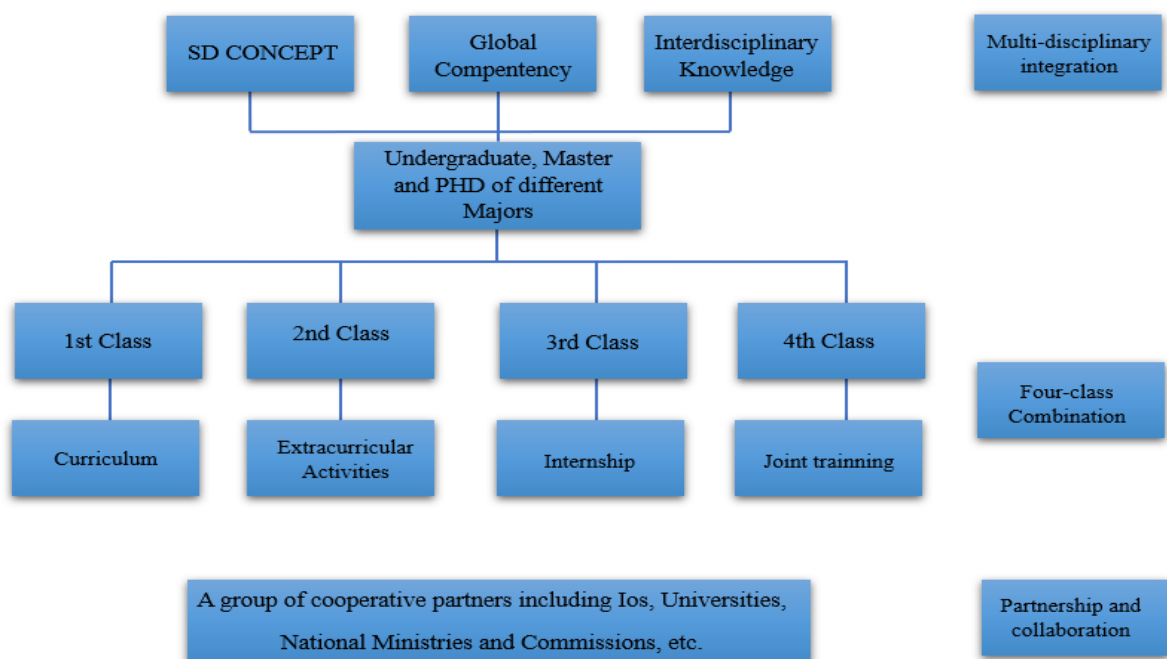
ESD and Its Relationship with Other Education-Related Concepts

As stated ([UNESCO, 2024](#)) that Education for Sustainable Development (ESD) is closely linked with other key education concepts like equity, lifelong learning, and global citizenship education (GCED).

Study case:

The case of the Global Engagement Program (GEP), launched in China in 2015, exemplifies ESD in practice. GEP aims to cultivate internationally minded, interdisciplinary talents equipped with sustainable development knowledge, intercultural communication, innovation skills, and foreign language proficiency. It includes undergraduate, minor, and master's degree programs, making it China's first comprehensive ESD system across academic levels. The program's framework integrates multidisciplinary learning and partnerships to enhance global competence and sustainable development understanding, reflecting continuous improvement and alignment with Higher Education for Sustainable Development (HESD) principles.

Figure 2 GEP Framework of Education of sustainable development



The Source: developed by ourselves by (UNESCO, 2024)

2. Pedagogical Approaches in Green Education

The effectiveness of green education depends not only on its content but also on the pedagogical strategies through which sustainability competencies are developed. This entails adopting innovative, learner-centered methods that go beyond traditional instruction to actively engage students in real-world environmental challenges. These pedagogical approaches aim to cultivate critical thinking, systems thinking, and behavioral change, skills essential for future leaders and professionals in a sustainable economy. The following section outlines the most widely used and research-backed strategies in green education:

2.1. Experiential Learning

Experiential learning, often described as “learning by doing,” immerses students in real-world sustainability challenges through hands-on activities, community projects, or campus initiatives. As mentioned in study ([Álvarez-Vanegas et al., 2024](#)), this category encompasses service-learning, internships, field projects, and campus living-lab experiences where academic coursework is combined with practical action. For example, service-learning projects align community service with sustainability learning objectives, allowing students to apply theory to concrete problems in tandem with stakeholders. Such experiential programs are closely aligned with UNESCO’s Education for Sustainable Development (ESD) framework and are intended to build not only knowledge but also skills like teamwork, problem-solving, and civic responsibility.

Recent research underscores the effectiveness of experiential approaches in building sustainability competencies. ([Álvarez-Vanegas et al., 2024](#)) found that service-learning initiatives in universities can address a broad range of ESD competencies, though successful implementation often hinges on faculty training and institutional support.

Students engaged in sustainability projects report deeper engagement and a stronger grasp of how sustainability principles translate into action. In the Middle East and North Africa (MENA) region, where experiential programs are emerging, innovative participatory learning methods (e.g. hands-on activities, fieldwork and green campus projects) have been noted to not only educate students but also motivate them to carry their green values into their daily lives ([Onyeaka & Akinsemolu, 2025](#)).

This indicates that learning-by-doing can inspire long-term attitude and behavior shifts. However, studies also caution that many universities struggle with scaling up experiential learning due to challenges like limited funding, insufficient staff capacity, or lack of formal evaluation of outcomes ([Álvarez-Vanegas et al., 2024](#)). These hurdles suggest that while experiential learning is a promising strategy for green education, it requires systemic support to realize its full impact.

2.2 Problem-Based Learning (PBL)

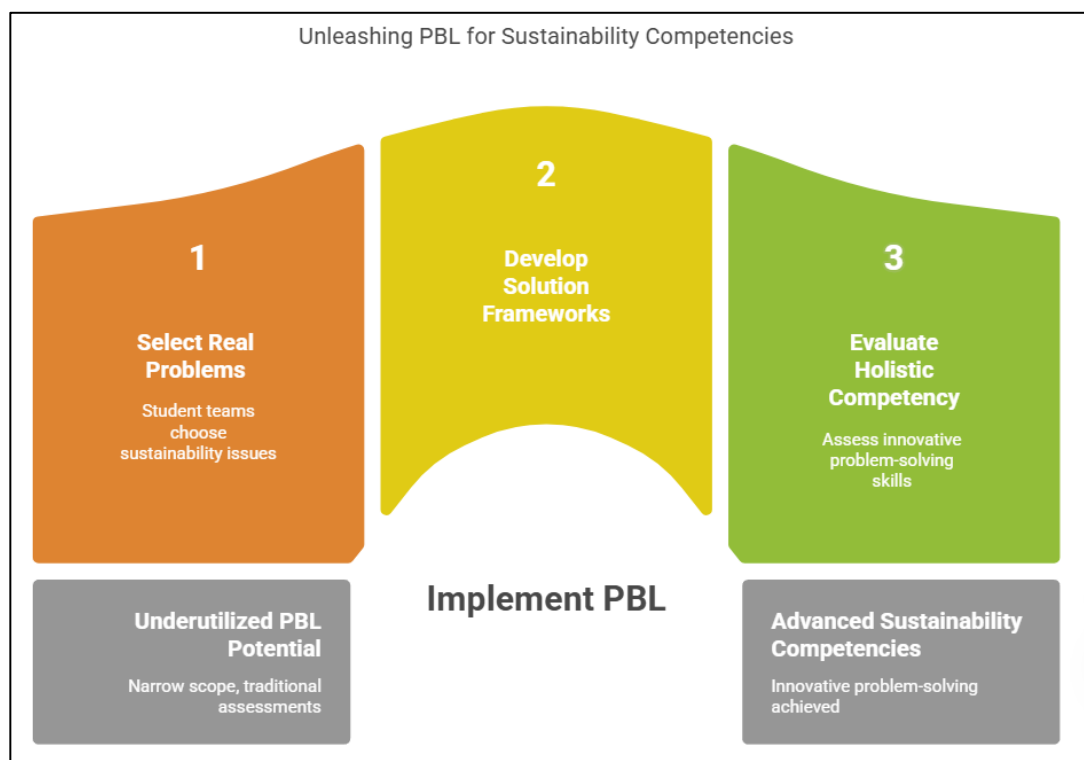
One of the pioneers of PBL ([Barrows, 1986](#)), defined it as a learner-centered approach where students "learn about a subject through the experience of solving an open-ended problem." In the context of sustainability education, PBL is especially relevant because sustainability

challenges-such as waste management, water scarcity, and renewable energy-are complex and “wicked” problems that do not have straightforward solutions (Rittel & Webber, 1973).

As it was described by (Cavadas & Linhares, 2022) a PBL implementation in an environmental education program where student teams selected real sustainability problems and developed solution frameworks (e.g. creating educational webpages following iterative inquiry cycles). The results showed that students achieved high levels of sustainability competencies, many reaching “advanced” or “expert” proficiency in areas like innovative problem-solving and making interdisciplinary connections. This suggests that PBL can foster higher-order competencies (learning to know and to do in sustainability terms) by engaging students in authentic problem-solving tasks.

Despite these positive outcomes, literature indicates that PBL’s potential in sustainability education is not yet fully realized. A recent systematic review by (D’Escoffier et al., 2024) found that the integration of PBL into higher education for sustainability is still relatively recent and often narrow in scope. Many PBL initiatives focus on environmental dimension content and use traditional assessments (e.g. exams or project reports) rather than evaluating holistic competency development.

Figure 3 Figure. PBL Implementation



The Source: developed by ourselves

2.3 Systems Thinking Pedagogy

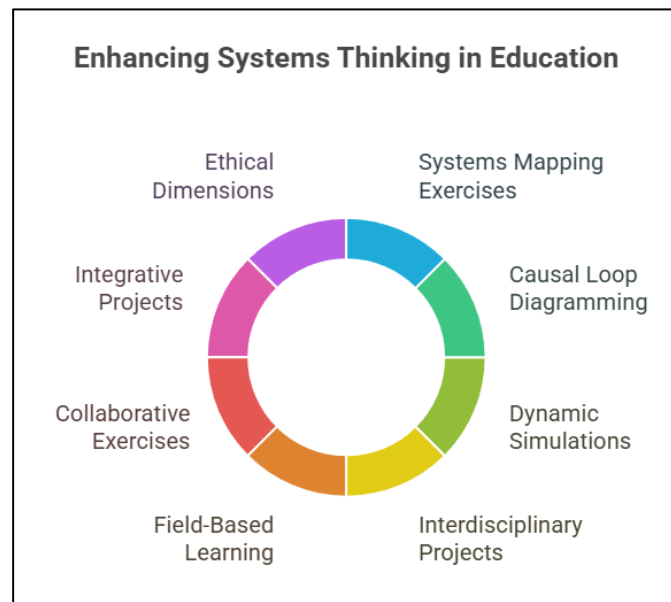
Education for sustainable development places a premium on systems thinking, the ability to understand complex interdependencies in socio-ecological systems. Pedagogically, this means teaching students to see beyond siloed knowledge and to analyze how environmental, social, and economic factors interact as part of a larger system. In practice, instructors have adopted various strategies to instill systems thinking competence: from systems mapping exercises and causal loop diagramming, to dynamic simulations and interdisciplinary projects that require a “big picture” perspective.

For example, (Demssie et al., 2023) demonstrated that combining field-based learning with collaborative exercises can significantly boost students’ systems thinking skills. In their study, higher education students participated in field trips to observe real-world sustainability challenges first-hand, and then worked in teams (using tools like mobile learning apps and notebooks) to analyze their observations. The pre/post evaluations showed that this mixed approach, immersing students in a complex real environment and prompting group reflection, improved students’ understanding of complex interrelationships and enabled them to exchange diverse ideas, ultimately strengthening their systems thinking competency. This finding aligns with social constructivist learning theories, suggesting that exposure to real-world complexity coupled with peer dialogue helps learners grasp systems concepts in a more meaningful way.

In sustainability-focused business, systems thinking is increasingly taught through integrative projects and simulations. For instance, a didactic intervention in a dual business-Engineering degree in Spain used project-based learning alongside system dynamics simulation to cultivate a holistic mindset. Students reported that this approach allowed them to develop a holistic view of problems, enhancing their capacity for systemic and sustainable problem resolution (Marcos-Sánchez et al., 2022).

Such interventions indicate that when students actively engage in modeling or simulating complex scenarios (e.g. constructing energy system models or sustainability strategy games), they practice seeing the “whole system” and anticipating unintended consequences. Scholars note that effective systems-thinking pedagogy also integrates affective and ethical dimensions, helping students appreciate uncertainty, ambiguity, and the value perspectives in sustainability issues (Qudrat-Ullah, 2024).

Figure 4 Strategies of systems thinking in Education



The Source: developed by ourselves

In sum, teaching methods that explicitly target systems thinking (through real-world case analysis, simulations, or cross-disciplinary teamwork) have been shown to build the “ability to see the forest for the trees” a critical sustainability competency. Still, challenges remain in assessment. The literature suggests that continued innovation in this area, including more use of interactive system modeling and reflection, can further strengthen students’ systemic understanding of sustainability problems.

2.4 Critical and Reflective Learning

Critical and reflective learning originates from philosophical and educational traditions, with key contributions from Aristotle, John Dewey, and Donald Schön. Dewey emphasized reflective thinking as a way to connect experience with learning, while Schön introduced the ideas of reflection during and after action ([Donald A. Schon, 1987](#)).

Critical and reflective pedagogies in green education encourage students to question assumptions, examine values, and reflect on their own learning experiences in relation to sustainability. This approach is rooted in the idea that sustainability challenges are not only technical problems but also require introspection about personal and societal values, ethical dilemmas, and power structures. In practice, educators use tools like reflective journals, guided class discussions, critical essays, and even arts-based reflection to prompt deeper thinking. The benefits of reflective pedagogy are well-documented: it has been shown to enhance students’ critical thinking skills, increase their engagement, and improve overall quality of learning

outcomes (Ayers et al., 2020). By regularly reflecting on what they learn (for example, writing about how a climate change topic relates to their lifestyle or community), students develop a greater awareness of their own attitudes and are better able to integrate theoretical knowledge with personal action.

In sustainability education, critical reflection often leads students to recognize the complexity of socio-environmental issues and the implicit biases or paradigms that underlie “business-as-usual” thinking. For instance, Mezirow’s transformative learning theory (Fleming, 2018) frequently cited in ESD contexts, posits that through critical self-reflection, learners can experience a shift in worldview or “perspective transformation” that makes them more open to sustainable lifestyles. Empirical work supports this: courses that incorporate reflective journaling and dialogue have been found to increase students’ eco-centric values and sense of responsibility (Barth & Rieckmann, 2016). In management education, reflective journals are increasingly used to cultivate *responsible leadership* by having students examine the ethical and sustainability dimensions of business decisions (Harvey et al., 2025).

Figure 5 Cycle of critical and reflective learning



The Source: developed by ourselves

2.5 Behavioral Change Approaches

Behavioral change approaches in sustainability education explicitly focus on translating knowledge and attitudes into sustainable actions and habits. As stated by (Barth et al., 2015) Recognizing that information alone does not automatically lead to eco-friendly behavior, these pedagogical strategies aim to bridge the “knowledge-action gap” by engaging students in practice-oriented and psychologically informed activities.

One model, proposed by (Tang, 2022), is the “behavioral Climate Change Education (CCE)” framework, which integrates three domains:

- Knowledge.
- Practical skills
- Community engagement

In this model, students first learn key concepts and correct misconceptions about (for example) climate change (knowledge domain). Then, through practical CCE, they develop actionable skills such as calculating carbon footprints or conducting life-cycle assessments of products, and are guided in identifying and altering their own daily activities that contribute to carbon emissions. Finally, the community CCE domain involves students in outreach or community projects, enabling them to apply their learning in real-world contexts and influence others,

Figure 6 Key concepts of the behavioral climate change education “CCE”



The Source: developed by ourselves

thereby reinforcing their pro-sustainability attitudes and behaviors. Such structured approaches underline that building sustainable behavior is an educational objective, not just an incidental outcome.

Empirical studies support the importance of linking education to behavior change(Chen et al., 2025) surveyed over 400 university students in China to examine how environmental education and campus sustainability practices influence students' "green behavior." They found that a supportive institutional environment, including green campus initiatives, hands-on sustainability workshops, sustainable dining options, and guided campus visits focusing on sustainability practices, significantly strengthened students' green intentions, which in turn translated into more sustainable behaviors.

Notably, students who experienced tangible institutional support (like seeing their campus implementing recycling, or participating in a sustainability event) were more likely to adopt habits such as conserving energy, reducing waste, or advocating for sustainability in their daily lives. This indicates that exposure to sustainability in action (not just in theory) can shift personal norms and routines.

2.6 Interactive Methods: Simulations and Fieldwork

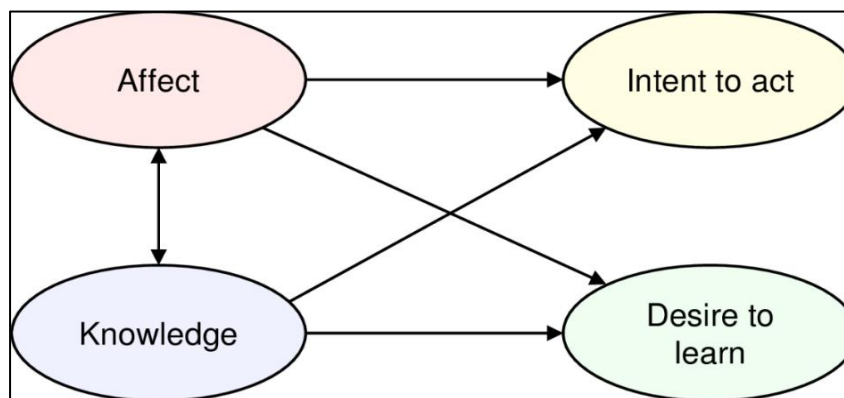
Interactive pedagogical methods, particularly simulations, serious games, and fieldwork – have become popular in green education as ways to actively engage students with sustainability scenarios (Barth & Rieckmann, 2012; Wiek et al., 2011).

Simulation-based learning allows students to role-play complex situations and experiment with decision-making in a risk-free environment(Tingström et al., 2006).For example, business students might use a simulation to manage a virtual company with sustainability targets, or environmental science students might play a climate policy negotiation game. Such interactive simulations have been shown to significantly enhance learning outcomes by making abstract concepts concrete and by invoking emotional engagement (Rooney-Varga et al., 2018).

A notable example is the "World Climate" role-play simulation (a UN climate summit game): research by (Ockwell et al., 2009) found that participants in World Climate workshops showed statistically significant gains in climate change knowledge, including understanding of carbon emissions dynamics, and also experienced heightened affective engagement (greater sense of urgency and hope) about climate solutions.

Importantly, the simulation experience also increased students' intent to act on climate change ,many reported being more motivated to reduce their carbon footprint and educate others after the exercise (Rooney-Varga et al., 2018). These findings illustrate how well-designed simulations can move learners beyond rote learning, as students feel the weight of sustainability decisions and witness the systemic consequences in real-time, leading to deeper understanding and personal commitment.

Figure 7 Theoretical model of learning for action through the world climate simulation



The source (Rooney-Varga et al., 2018)

Beyond digital or in-class simulations, **fieldwork and outdoor learning** are highly interactive methods central to sustainability education. Fieldwork can range from short field trips (e.g. visiting a recycling facility, a wetland, or a sustainable farm) to longer field courses and community-based research projects. Such experiences expose students to real-world environmental and social contexts, enriching their learning with sensory and practical dimensions. Studies indicate that field-based experiential learning can strengthen students' connection to nature and contextualize theoretical knowledge. For instance, (Demssie et al., 2023) incorporated field trips into a sustainability course and found that seeing “complex real-world systems” first-hand and then collaboratively analyzing them significantly improved students' systems thinking competence.

Students often describe field experiences as “eye-opening,” reporting greater appreciation for sustainability challenges and a clearer sense of how their academic learning applies on the ground. In the MENA region, where local environmental issues (water scarcity, desertification, etc.) are pressing, educators have found that hands-on fieldwork projects can empower students by showing them tangible impacts and solutions. citizens (Onyeaka & Akinsemolu, 2025) highlight that in MENA, interactive methods like field projects do more than impart

knowledge, they actively motivate students to adopt sustainable practices, which is crucial for cultivating a new generation of environmentally conscious.

Figure 8 Best practices in advancing green education in the MENA region



The source: (Onyeaka & Akinsemolu, 2025)

We summarized the different interactive pedagogical methods in this table:

Table 2 Comparison of Interactive Pedagogical Methods in Green Education

Characteristic	Simulation-Based Learning	“World Climate” Role-Play Simulation	Fieldwork and Outdoor Learning
Engagement	Role-playing complex situations	Statistically significant gains in knowledge	Exposure to real-world environmental contexts
Learning Outcomes	Abstract concepts become concrete	Heightened affective engagement	Strengthened connection to nature
Impact	Increased intent to act	Increased intent to act	Motivate students to adopt sustainable practices

The Source: developed by ourselves

Overall, interactive methods like simulations and fieldwork make sustainability education more engaging and impactful by enabling students to “learn by experiencing”, whether by immersing themselves in a simulated scenario or by directly encountering the environment and communities they study.

3. Theoretical Foundations of Green Education

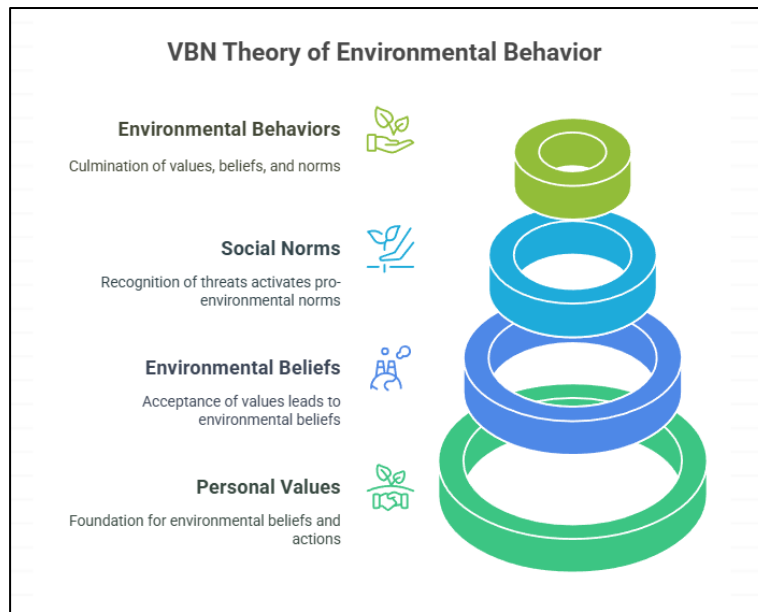
Green education is underpinned by learning theories that support transformative change. **Constructivism** is a key foundation: learners build knowledge through experience and reflection. ESD programs often adopt constructivist and inquiry-based approaches, engaging students actively rather than via rote learning (Bourn & Soysal, 2021). This aligns with the idea that sustainability challenges are complex and open-ended, requiring learners to construct meaning and solutions themselves.

Transformative learning theory (Mezirow) is also influential. It posits that education can prompt fundamental shifts in worldview. In sustainability contexts, transformative learning “focuses on stimulating a radical reassessment of worldviews” among students. The goal is for learners to question unsustainable assumptions and adopt new, ecological perspectives. For instance, (O’Grady, 2023) found that faculty using transformative sustainability teaching had to move from the role of expert to co-learner, co-creating knowledge with students, an approach that can lead to profound changes in students’ mindsets.

Green education draws on theories of environmental behavior from psychology to bridge the knowledge–action gap. Frameworks like Ajzen’s **Theory of Planned Behavior** and **Schwartz’s** Norm-Activation inform program design, highlighting that pro-environment behavior depends on factors like attitudes, social norms, and perceived control. A frequently cited model is the **Value–Belief–Norm (VBN)** theory (Stern, 2000), which explains that individuals’ personal values (e.g. altruistic or biospheric values) shape their ecological beliefs and awareness of consequences, which then activate a sense of moral obligation (personal norms) to act sustainably.

Empirical studies support this chain: for example, a survey of workplace energy conservation found that “biospheric values significantly predict pro-environmental beliefs, awareness of consequences, and ascription of responsibility,” and that these in turn foster personal norms and intentions to conserve energy (Al Mamun et al., 2022).

Figure 9 Component of VBN Theory of environmental Behavior prepared



The Source: developed by ourselves from (Wisdom, 2024)

Green education programs often aim to influence each part of this chain, cultivating pro-environmental values, increasing understanding of ecological consequences, and nurturing a sense of responsibility and agency (Stern, 2000). By integrating constructivist, transformative, and behavior-change theories, green education seeks to not only inform learners about sustainability but also motivate and empower them to adopt sustainable behaviors.

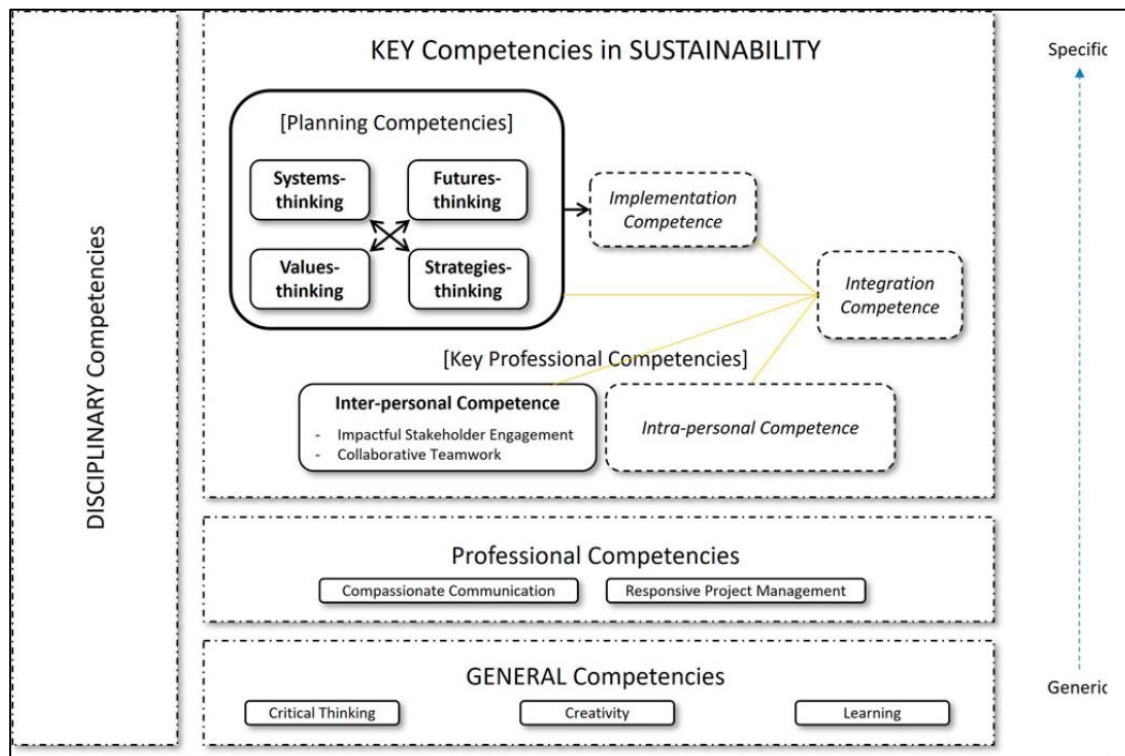
4.Green Education in Entrepreneurial Training

In recent years, sustainability concepts have been increasingly incorporated into entrepreneurship education and startup training. Educators recognize that tomorrow's entrepreneurs need competencies for sustainable innovation alongside traditional business skills. As stated (Mohammed et al., 2024), This has led to the integration of green education in business curricula, sometimes termed *sustainable entrepreneurship education*. Programs are redesigning course content and objectives to include sustainability principles, from responsible supply chain management to circular economy thinking.

However, (Rosário & Raimundo, 2024) note that integrating sustainability into entrepreneurship education remains challenging and is "often criticized" for lack of depth. As a response, some entrepreneurship programs have adopted a **competency-based sustainability education** approach, identifying specific sustainability competencies to be developed in students.

For example, (Redman & Wiek, 2021) framework of key sustainability competencies (**systems-thinking, futures-thinking, normative, strategic, collaboration**) has influenced many curricula. The aim is to ensure that entrepreneurs graduate with the ability to recognize environmental challenges as business opportunities and to design ventures that balance profit with social-environmental value.

Figure 10 Key competencies in Sustainability



The source by (Redman & Wiek, 2021)

Pedagogically, this often means shifting from lecture-based teaching to experiential, project-based learning focused on sustainability problems. Studies highlight that entrepreneurship education “embraces the learner’s knowledge and capabilities” through experiential learning, and that sustainable entrepreneurship training should be interdisciplinary – combining business acumen with environmental and social understanding (Rosário & Raimundo, 2024).

In practice, some universities now offer green startup incubator courses, sustainable venture pitch competitions, or require business plans to address Sustainable Development Goals (SDGs). The motivation of eco-entrepreneurs is also addressed: many have “wider motivations than just launching eco-friendly products” as stated by (Saari & Joensuu-Salo, 2019), such as community well-being or climate action. Thus, programs seek to nurture values-driven entrepreneurship, encouraging students to pursue purpose in addition to profit.

There is evidence that such integrated training is effective. A systematic review by (Rosário & Raimundo, 2024) finds that *sustainable entrepreneurship education (SEE)* programs provide entrepreneurs with the capability “to seize business opportunities *considering sustainability issues*”.

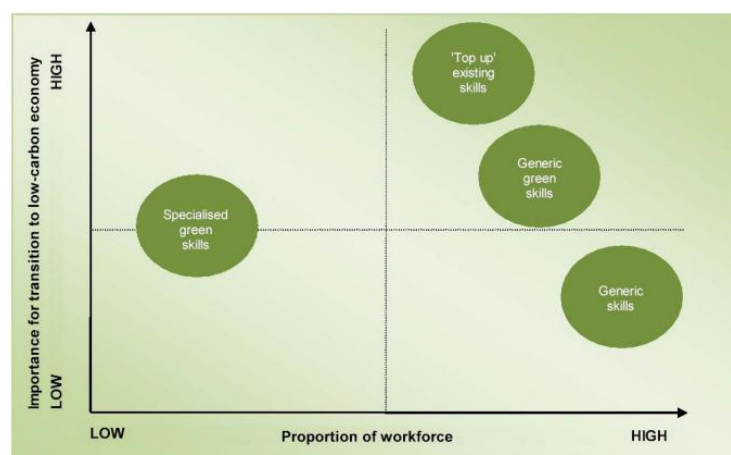
Nonetheless, gaps remain in fully institutionalizing green education in business schools. Many entrepreneurship programs still treat sustainability as an elective topic rather than a core tenet. The current literature calls for a more “multifaceted strategy to bridge the gap” between entrepreneurship and sustainability in higher education (Rosário & Raimundo, 2024), including faculty training, industry collaboration, and competency-based curriculum design.

4.1 Development and Evaluation of Green Skills

The term “green skills” refers to the competencies needed to support environmental sustainability in the workforce. As defined by (Cedefop, 2012), green skills as “the knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society”. These skills range from technical know-how (e.g. installing solar panels, energy auditing, sustainable agriculture techniques) to soft skills like systems thinking, adaptability, and collaboration geared towards sustainability.

Researchers often distinguish between *specific* green skills and *generic* sustainability competencies. A European study of (CEDEFOP, 2010) noted that many skills for a low-carbon economy are modified versions of existing skills – a “balance of generic skills (e.g. communication), generic green skills (e.g. waste reduction practices), and topping up job-specific skills” is more important than narrow specialized skills.

Figure 11 Skill needs for the low-carbo economy



The source : by (CEDEFOP, 2010)

In other words, most workers will need some green competencies (like efficient resource use) in addition to their regular skill set, while certain sectors also require advanced technical skills (e.g. wind turbine engineering). Multiple frameworks exist to categorize and develop green skills. (OECD & European Centre for the Development of Vocational Training, 2014) and have produced reports on skills for green jobs, and the OECD has studied how education and training systems can anticipate green skill needs. Common elements across frameworks include: technical skills for emerging green industries, transversal skills like problem-solving and innovation, and environmental literacy for all.

Measuring and evaluating green skills acquisition is challenging. One difficulty is assessing behavioral and values-based competencies – for example, how to evaluate a learner’s commitment to sustainability or their systems thinking ability in practice. Standard academic assessments may not capture these outcomes. Moreover, green skill development often occurs through informal and on-the-job learning (workshops, field experience), making it harder to quantify. Scholars acknowledge a “recognized knowledge–action and values–action gap” in sustainability education (Hanisch & Eirdosh, 2023), meaning having knowledge doesn’t guarantee applying it.

Figure 12 Challenges in green skills assessment



The source: by the student from (Hanisch & Eirdosh, 2023)

International bodies have also suggested indicators for green skills at systems level, such as the number of green training programs, certifications in environmental management, or employment rates in green jobs. A recent study in STEM higher education observed

“significant challenges” in grading sustainability competencies due to their complex, multi-dimensional nature ([Valdes-Ramirez et al., 2024](#)). It calls for new assessment tools, including self-assessments, peer evaluations, and scenario-based testing, to more effectively gauge competence gains.

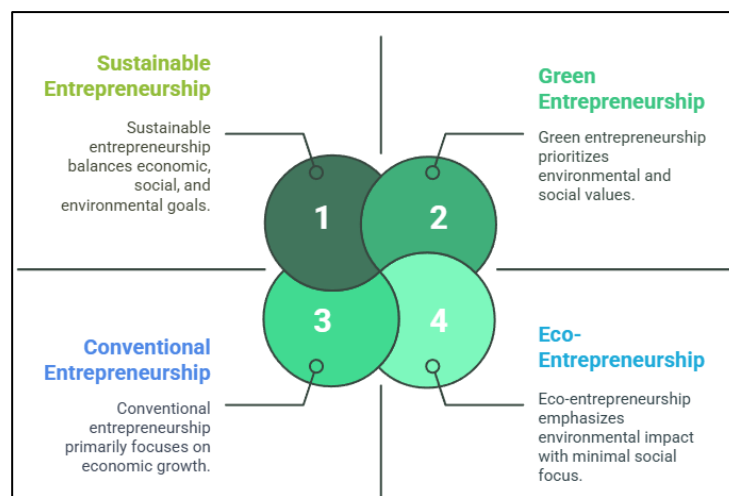
In summary, developing green skills requires both defining the competencies clearly and creating innovative ways to measure learning outcomes. While progress has been made in articulating what green skills are (through frameworks and standards), evaluating their development remains an area where further research and tool-building is needed.

Section 2: Green Entrepreneurship and Green Startups

1. Definition and Evolution of Green Entrepreneurship

Green entrepreneurship refers to entrepreneurship that explicitly addresses environmental and sustainable development goals. It is often used synonymously with terms like eco-entrepreneurship or sustainable entrepreneurship. (Saari & Joensuu-Salo, 2019) defined green entrepreneurship as a subset of entrepreneurship aiming “to create and implement solutions to environmental problems and to promote social change so that the environment is not harmed”.

Figure 13 Types of entrepreneurship



The source: developed by ourselves from (Saari & Joensuu-Salo, 2019)

In essence, green entrepreneurs launch and grow businesses that have a core mission of environmental improvement, whether through the nature of their products (e.g. renewable energy technology), processes (e.g. zero-waste manufacturing), or services (e.g. recycling programs). This concept has evolved from simply “doing business and being green” into a potential new paradigm of enterprise. An academic discourse on environmental entrepreneurs (Domańska, 2023) framed them as niche actors driven by personal ecological values (sometimes called ecopreneurs).

Over the past two decades, however, green entrepreneurship has gained momentum in the context of global sustainability imperatives like climate change. Scholars highlight key differences between traditional and green entrepreneurship. As mentioned by (Saari & Joensuu-Salo, 2019), the main distinction is in value creation logic: conventional entrepreneurship is typically driven by profit and market share, whereas green entrepreneurship treats economic success as a means to achieve broader environmental and social value. Green entrepreneurs

still operate businesses for profit, but they integrate the “ecological dimension in the core business strategy”.

Research by (Kirkwood & Walton, 2010) noted that green entrepreneurs often have wider motivations than just selling eco-friendly products, such as advancing a sustainability cause or changing consumer behavior. This aligns with the eco-entrepreneur motivation literature: many green founders are motivated by personal environmental values, desire for community impact, or ethical concerns, in addition to recognizing a business opportunity (Saari & Joensuu-Salo, 2019).

The rise of international sustainability agendas has also shaped green entrepreneurship. The UN Sustainable Development Goals (SDGs) and the Paris Climate Agreement (United Nations, 2015) created both normative pressure and market opportunities for sustainable business solutions. Governments worldwide have committed to climate targets (e.g. net-zero emissions by 2050), acknowledging that achieving these goals will require massive deployment of clean technologies and sustainable service.

Green entrepreneurship has thus evolved from a fringe concept into a recognized driver of sustainable innovation and job creation. Nevertheless, the field is still coalescing in terms of formal definition and scope. (Grosseck et al., 2019) pointed out that there is not yet a single clear definition of green entrepreneurship accepted universally, which can make it tricky for policymakers to target supports. Broadly, it can be seen as part of sustainable entrepreneurship (which balances the “triple bottom line” of profit, people, planet) but with a particular emphasis on environmental outcomes.

In summary, green entrepreneurship has progressed from isolated eco-business efforts to a growing movement aligned with global sustainability transitions. Its distinct value proposition lies in coupling entrepreneurial innovation with environmental stewardship, effectively turning market failures (like pollution or resource waste) into business opportunities.

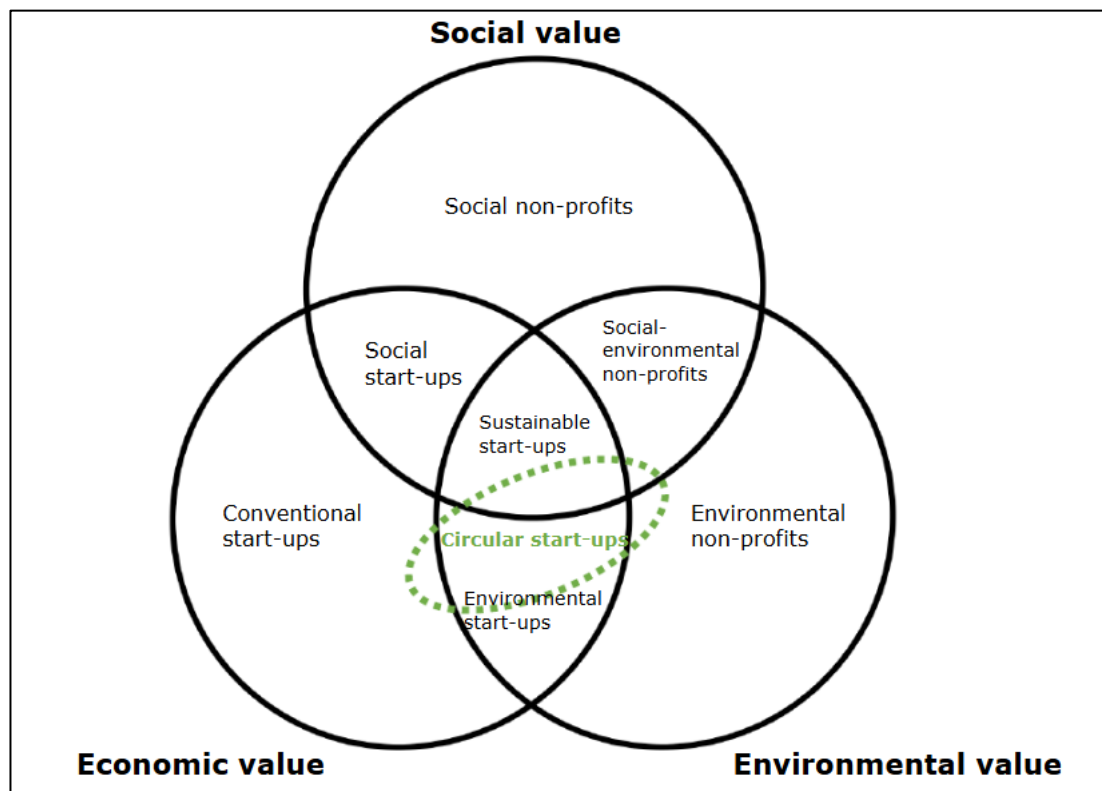
2. Green Startups and Sustainable Innovation

Green startups are new ventures that embed sustainability into their products, services, or business models from inception. They are new and young firms that produce market-based solutions to environmental problems (Linda & Klaus, 2015). These startups drive sustainable innovation, meaning their innovations reduce environmental impacts or advance social well-being while also being commercially viable. Green startups can be found across industries –

renewable energy tech firms, sustainable agriculture and food startups, eco-fashion labels, circular economy platforms, and so on. A defining feature is that the opportunity they pursue is inherently linked to a sustainability challenge.

There are various typologies of green startups. Some literature distinguishes as (Henry et al., 2019), for example, *cleantech startups* (focused on clean energy, water, or materials technology), *social enterprises with environmental focus*, or “*circular*” startups that base their model on reusing and recycling resources. Regardless of type, innovation is a core component. Many green startups are built on technological innovation (e.g. a new solar panel design, an energy-efficient appliance) or business model innovation (e.g. sharing economy platforms that promote resource efficiency).

Figure 14 The relationship of circular start-ups with other types of enterprises



The source: developed by ourselves from (Henry et al., 2019)

Research has shown that startups are especially well-positioned to develop *circular economy* business models. Circular economy (CE) models aim to replace the traditional linear “take-make-dispose” approach with closed-loop systems that minimize waste. According to (Petri et al., 2025) CE models offer “innovative solutions to environmental issues” and startups play a key role in advancing these models. Indeed “*born circular*” startups have emerged – companies whose entire operation is designed around reuse, remanufacturing, or sustainable inputs.

In addition to circular models, a study by (Geissdoerfer et al., 2018) indicated that green startups often adopt other sustainable business models such as: product-service systems (selling a service outcome instead of a product, thereby incentivizing efficiency), base-of-pyramid models (providing sustainable solutions to low-income communities), and B Corporation models. B-Corps are companies certified for meeting high social and environmental performance standards. Many green startups pursue B-Corp certification to formalize their mission. Such certifications and legal forms (like benefit corporations) are part of the sustainable business model landscape, although academic research on B-Corps shows both benefits (brand credibility, mission lock-in) and challenges (certification costs, rigorous reporting) (Wendy, 2014).

The role of innovation in green startups cannot be overstated. These ventures are often at the forefront of developing climate-tech and eco-innovations. They experiment with ideas that incumbents might shy away from (Klaus & Irina, 2020). For example, startups are pioneering plant-based and cultured proteins in food, also leverage digital technologies (AI, IoT) to optimize resource use. Innovation also occurs in financing mechanisms and in engaging consumers (e.g. apps that encourage sustainable habits, then monetize the data).

According to (Cohen & Winn, 2007) being new entrants, startups can incorporate cutting-edge sustainability knowledge from the start, rather than retrofitting an old business. They can also more easily adopt progressive governance models (like inclusive decision-making or capped dividends to reinvest in impact). Importantly, green startups contribute to sustainable innovation not only by their individual success, but by pushing entire industries forward. Their presence creates competitive pressure on established firms to improve environmental performance

In summary, green startups are catalysts of sustainable innovation, bringing new technologies and business approaches to market that address ecological problems. By design, they adopt

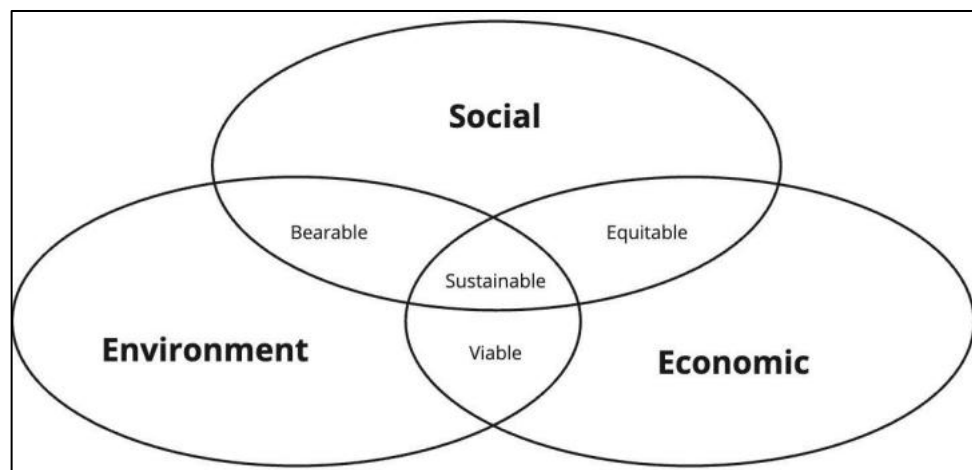
business models like circular economy and social enterprise that decouple growth from environmental harm.

3. Sustainability Practices

Sustainable entrepreneurship As defined by (Selmane et al., 2025) in so-called green startups, refers to the creation of new ventures that pursue environmental and social goals alongside profit objectives. In other words, a green startup is an entrepreneurial venture designed to address ecological or social issues through its products, services, and operations while still remaining financially viable.

This aligns with the broader concept of sustainability in business, which moves beyond the single-minded pursuit of profit to encompass a “triple bottom line” of economic, environmental, and social performance (Mühle et al., 2024).

Figure 15 Triple bottom line - Framework



The source: developed by ourselves from (Mühle et al., 2024)

The **Triple Bottom Line (TBL)** framework, first popularized in the 1990s, stresses that a company’s success should be measured not only by financial results but also by its contributions to society and the environment (Mühle et al., 2024). Historically, research on corporate sustainability focused on large firms, but recent literature emphasizes that startups, despite their smaller size and resource constraints, are also crucial players in sustainable development.

In fact, as it was stated by (Mühle et al., 2024), that sustainability-oriented startups are seen as key contributors to developing solutions for global challenges and fostering the transition to a low-carbon economy. Their flexibility allows them to test novel ideas in untapped fields, meaning green startups can directly target Sustainable Development Goals (such as clean

energy, waste reduction, or sustainable agriculture) through entrepreneurial innovation. Still, the diffusion of formal sustainability management practices is generally less developed in startups than in mature corporations. Whether a startup embraces sustainability often depends on the founders' personal outlook – research indicates that an entrepreneur's life experiences and values (and even the skills they possess) strongly influence the decision to embed sustainability into a new venture's mission from the outset.

Figure 16 Sustainability Development Goals



The source: Adapted from United Nations, 2015

3.1 Green Skills and their Role in Green Startups:

The success of green startups hinges not only on visionary ideas but also on the capabilities of their team, in particular, the green skills and sustainability competences they bring to the venture. As mentioned by (Montanari et al., 2023), green skills are commonly defined as the specialized knowledge, technical abilities, and values needed to support environmental sustainability in professional settings. In other words, these are the operational and technical competencies, often science- or engineering-based expertise, that enable a company to design, produce, and manage products or processes in an eco-friendly.

"Green skills," such as expertise in renewable energy, sustainable materials, life-cycle assessment, and circular product design, are essential for startup teams to innovate eco-friendly solutions. These skills differ from broader "sustainability competences," which include analytical and leadership abilities that support holistic sustainable development. Both are crucial for green startups, as technical skills enable teams to identify eco-innovation opportunities, while entrepreneurial competences like strategic thinking and stakeholder

engagement help integrate these innovations into successful business models (Montanari et al., 2023).

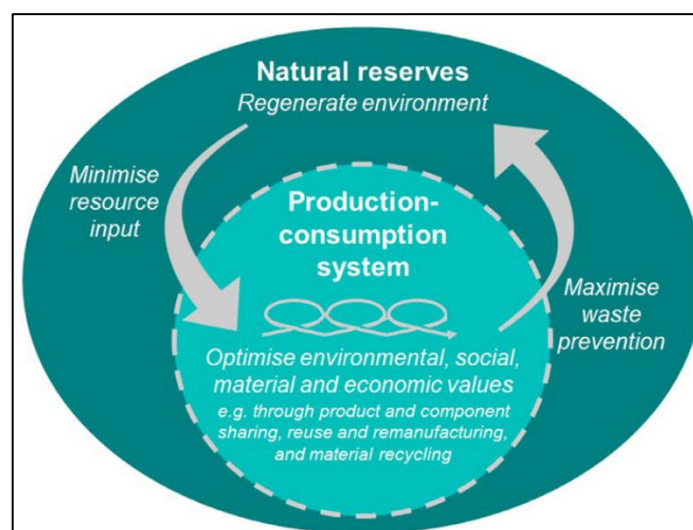
Once the venture is launched, continuing to build capacity (through training, hiring, or partnerships) is often necessary to fill skill gaps in areas like sustainable design, clean production techniques, or impact measurement. This is especially pertinent in developing regions (e.g. parts of Africa) where access to formal green skills training may be limited; incubators and international programs have begun to emphasize up-skilling entrepreneurs in areas such as climate-smart agriculture, renewable energy technology, and environmental management (APRI, 2024).

3.2 Common Sustainability Practices and Strategies in Startups

Once a startup commits to sustainability, it implements various practices to integrate this commitment into its products, processes, and business models. Recent research indicates that green startups employ a diverse array of strategies that often reflect those of larger sustainable companies.

A fundamental approach involves adopting **circular economy principles**, which emphasize reducing, reusing, recycling, and recovering materials throughout the production and consumption processes (Anne & Phil, 2021)

Figure 17 Principles for a Sustainable Circular Economy



Source : developed by ourselves from (Anne & Phil, 2021)

Another core practice area is **resource efficiency** and **clean operations**. Startups with an environmental focus typically prioritize minimizing their use of energy, water, and raw materials, and they often turn to renewable or low-impact resources where possible. **Waste**

reduction and pollution prevention are similarly key: even at early stages, sustainable ventures implement practices like recycling and repurposing materials, using biodegradable alternatives to plastics, and ensuring that any manufacturing or logistics processes generate minimal harmful emissions (Mühle et al., 2024).

4. Challenges and Opportunities for Green Entrepreneurs

Key challenges cited by (Badjeena et al., 2024) include difficulties in obtaining capital, navigating policy environments, and overcoming market barriers. Access to funding is often the number one hurdle. Emerging green industries (clean energy, climate-smart agriculture, etc.) can require significant upfront R&D or infrastructure investment, and traditional financiers may be cautious due to perceived risks. Studies indicate it is “difficult for green entrepreneurs to obtain funding” because green ventures typically have longer development timelines and slower market penetration than conventional startups

Additionally, many green solutions aim to deliver public goods (like carbon reduction) which are not fully valued in the market, affecting profitability in early stages. Even when interest exists, the scale of available venture capital in some regions is small. An analysis by (OECD, 2022) in Denmark noted that “insufficient access to funding” and a relatively small domestic VC market were inhibiting the growth of Danish green start-ups

Another challenge mentioned by (Kollmuss & Agyeman, 2002) is market limitations and acceptance. Green products can be more expensive or unfamiliar to customers. Breaking consumer habits (e.g. convincing drivers to adopt electric vehicles in the early days, or persuading farmers to try an organic fertilizer) takes time and effective marketing.

A 2020 study by (Makki et al., 2020) identified “a shortage of investors, a short-term investor mindset, and a strong incumbent industry” as top barriers hindering green entrepreneurship. The short-term mindset refers to investors or customers expecting quick returns or immediate gratification, whereas many sustainable solutions play out over a longer horizon (e.g. energy efficiency investments that pay off after several years).

Policy support for green entrepreneurship is increasing but can be a double-edged factor:

- Unclear or inconsistent policies create uncertainty.
- Effective policies.

Green entrepreneurs often call for more predictable and supportive policy frameworks to help level the playing field with conventional businesses. Challenges can be amplified in certain contexts, especially developing countries or localities with nascent ecosystems. In many emerging economies, there is a *lack of supportive ecosystem* – few accelerators or mentors with green expertise, minimal green supply chain infrastructure, and difficulty in finding skilled workers knowledgeable about new green technologies. The (OECD, 2022) noted that green start-ups in smaller economies face “small domestic markets” which limit their growth potential unless they can internationalize early. Policy and institutional support is also improving.

Many governments and international organizations have launched green startup funds, incubators, or competitions. For example, the EU’s Green Deal and related funds allocate substantial resources to climate innovation, and institutions like the World Bank and UN have green entrepreneur support programs in MENA and African countries. Such initiatives can mitigate some financial barriers by providing grants or first-loss capital by (Badjeena et al., 2024).

The balance of challenge and opportunity varies by region and sector, but overall, the momentum is on the side of sustainability-driven business models as the world increasingly prioritizes climate and environmental solutions.

Table 3 Common Barriers and enablers for startups

Common Barriers (for Green Startups)	Key Enablers (support mechanisms)
Funding constraints: Difficulty securing capital from risk-averse investors; short-term return uncertainty.(Kato & Arinaitwe, 2024)	Public financing programs: e.g. government venture capital funds in Europe to fund high-uncertainty green innovations (Lee et al., 2025)
Market/consumer adoption: Uncertain demand for novel green products; need to educate customers; competing against unsustainable incumbents. (Lee et al., 2025)	Supportive policies & market incentives – Government regulations (carbon pricing, sustainability standards) that create demand for green solutions. Procurement policies or tax credits can give green startups a market boost.(Lee et al., 2025)

Resource and skill gaps: Limited human capital and technical know-how in specialized areas; small teams stretched thin. (Lee et al., 2025)	Incubators & accelerators: Provide mentorship, training, and networking. Sustainable venture incubators (often backed by universities, NGOs or corporates) (APRI, 2024).
Regulatory hurdles: Lack of clear framework for new sustainable products (Kato & Arinaitwe, 2024)	Networking and partnerships: Collaboration with research institutions, NGOs, and corporate partners can open doors. Joining startup networks or alliances (locally and globally) helps in knowledge sharing and finding mentors/investors. (Neumann, 2023)

Source : developed by ourselves

Section 3: The Role of Green Incubators in Supporting Sustainable Practices

1. Definition and Historical Development of Incubators

A business incubator is an organization designed to support the growth of new ventures by providing a combination of services such as workspace, mentoring, networking opportunities, and sometimes seed funding. The incubator concept emerged in the late 1950s. The world's first business incubator is widely credited to the Batavia Industrial Center founded in 1959 in Batavia, New York (Walsh, 2019).

Joseph Mancuso, who started that incubator in a disused factory, offered startups affordable rent and shared office services, an innovation at the time (Kelly, 2012). Through the 1960s and 1970s, the incubation model spread in the United States, and by the 1980s it had expanded internationally, including to Europe and Asia. Early incubators were often tied to economic development initiatives, aiming to create jobs and diversify local economies by nurturing small businesses. Over time, incubators evolved into various typologies and specialized models.

A seminal classification by (Alessandro & Rosa, 2006) identifies at least four main types of incubators:

- Business Innovation Centers (BICs): typically, public or public-private incubators focusing on regional economic development.
- University Business Incubators (UBIs): attached to universities and leveraging academic resources to spawn startups (often tech-oriented).
- Independent Private Incubators (IPIs): run by private investors or companies for profit (sometimes taking equity in tenants).
- Corporate Private Incubators (CPI): large firms hosting incubators to foster internal innovation or spin-offs (Barbero et al., 2014).

The objectives of incubators are generally to increase startup survival and growth rates by mitigating common challenges faced in early stages. Incubators typically offer mentoring (business planning, management coaching), skills training workshops, professional services, and facilitate access to finance through investor networks. By 2010, there were estimated to be over 7,000 incubators worldwide as stated (Samuel et al., 2018), including a vast network in China (the first Chinese incubator opened in 1987 in Wuhan).

In summary, business incubators have grown from a single warehouse in 1959 to an integral part of entrepreneurship ecosystems worldwide.

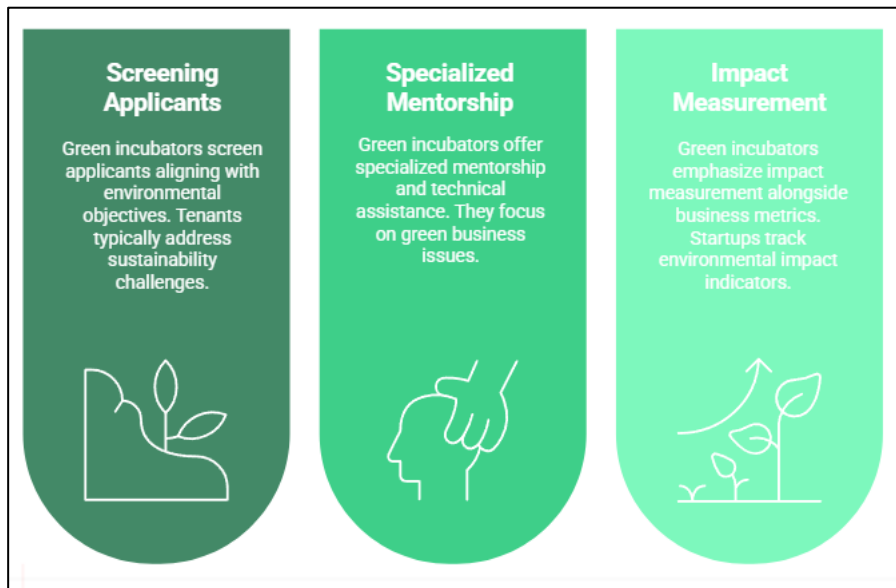
2. Emergence and Definition of Green Incubators

A green incubator (or green business incubator) is a business incubator dedicated to nurturing startups and entrepreneurs whose ventures aim to deliver environmental or sustainable outcomes. In essence, it is an incubator with a sustainability mission – providing the same kind of startup support (office space, mentoring, investor linkages) but focused on companies in sectors like renewable energy, clean technology, sustainable agriculture, circular economy solutions, eco-friendly consumer products, and similar ([Samuel Carvalho de Azevedo Marques et al., 2024](#)). Green incubators began to appear as the green entrepreneurship wave gained momentum in the 2000s and 2010s. They often grew out of existing tech incubators or government innovation programs that saw the need for targeted support for climate and environmental industries.

Distinct characteristics set green incubators apart from traditional incubators:

- First, green incubators screen applicants for alignment with environmental objectives, tenants are typically required to have a business model addressing sustainability challenges (for example, reducing carbon emissions, pollution abatement, resource efficiency, etc.). This creates a curated community of mission-driven startups, which can share domain-specific knowledge (e.g. on regulatory compliance for clean tech or life-cycle analysis).
- Second, green incubators tend to offer specialized mentorship and technical assistance on *green* business issues. For instance, they may have experts in energy policy, environmental law, or lifecycle sustainability assessment available to advise startups.
- Third, green incubators often emphasize impact measurement alongside business metrics. They encourage startups to track environmental impact indicators (like emissions saved, energy produced, waste diverted) and may help them develop methodologies to do so. This focus on impact is part of holding startups accountable to their green mission. ([GIZ, 2019](#))

Figure 18 Different Green Incubator Characteristics by the student



Source: developed by ourselves

In practice, many green incubators also incorporate education on environmental management and certifications, connecting entrepreneurs to labs for product testing, or facilitating pilot projects with municipalities for climate solutions.

A green incubator will often connect startups with environmental research institutions, government sustainability departments, and impact investors. There is also a community-of-practice element: the startups in a green incubator share a sustainability ethos, which can lead to collaborative problem-solving (for example, one startup's waste might be another's input, a synergy actively encouraged in some green incubators).

Being part of a green incubator can lend credibility to startups in the eyes of stakeholders. It “signals commitment to sustainability” ([FasterCapital.](#)) which can attract conscious consumers, strategic partners, or investors specifically interested in green innovation. Many green incubators brand themselves accordingly – using certifications or affiliations (like supported by UN climate programs) to enhance the profile of their cohort companies.

In summary, green incubators have emerged to address the specific needs of green startups and amplify their impact. By doing so, they aim to increase the success rate of environmental ventures and accelerate the deployment of green solutions.

3. Green Incubators as Agents of Sustainability Transformation

Green incubators are not just service providers for startups; they can be seen as active agents driving sustainability transitions in the economy. Through the ventures they nurture and the practices they promote, green incubators help mainstream sustainable business and innovation. One important role of green incubators is education and capacity-building for sustainability ([Diana Ailyn, 2024](#)).

They often incorporate formal or informal training for entrepreneurs on sustainable practices, essentially blending ESD

with enterprise development. For example, a green incubator might run workshops on life-cycle assessment, eco-design of products, or ESG (environmental, social, governance) reporting for startups. By educating founders and their teams, incubators ensure that knowledge of sustainability is embedded in the company culture from early on.

The mentoring in green incubators similarly extends beyond conventional business advice to include guidance on how to build a viable business and achieve environmental impact. This dual mentorship is crucial for green startups who must balance two bottom lines.

Case studies illustrate this transformative mentorship. In one French incubator program as stated ([Lamperti et al., 2025](#)), focused on sustainability, incubator coaches facilitated knowledge transfer not only in finance and marketing but also connected startups with environmental scientists to validate impact claims .

Green incubators also play a role in shaping startups' business models toward sustainability. Incubator mentors frequently challenge entrepreneurs to strengthen the sustainability aspects of their models. As reported by an incubator manager ([Bonfanti et al., 2025](#)) in a recent study, incubators can “facilitate the creation of a sustainability-oriented ecosystem” around the startups by linking them with relevant partners and pushing them to set ambitious impact goals.

As these startups graduate and interact with investors and customers, they carry forward a mindset of rigorous impact tracking, thereby setting higher standards in their respective markets. Additionally, green incubators often convene stakeholders (through demo days, innovation forums, etc.), effectively acting as bridging institutions between entrepreneurs, governments, corporates, and NGOs. This convening power can shift mindsets beyond the startups themselves.

In Algeria, as few studies have explored how private green incubators integrate pedagogical strategies to foster sustainable practices among green startups. This research aims to address that void by examining a private green incubation in the Algerian context.

CHAPTER 2:

METHODOLOGICAL FRAMEWORK

Chapter 2: Methodological Framework

1. Introduction

This chapter presents the methodological framework adopted to explore how private green incubators in Algeria promote green education and how this supports the adoption of sustainable practices among the startups they accompany.

To achieve the objectives of this research, a qualitative approach was employed. This approach enables an in-depth exploration of the experiences, perceptions, and practices of incubator managers, staff, and startup team members regarding green education and sustainability. The study focuses on collecting rich, descriptive insights through semi-structured interviews, complemented by document analysis and informal observations.

The chapter is organized as follows:

- a. Introduction: Presents the purpose and overview of the methodological framework.
- b. Presentation of the Host Organization: Leancubator: Provides an overview of Leancubator, including its mission, objectives, organizational structure, and commitment to sustainable development goals
- c. Methodological Framework: Describes the research approach, epistemological stance, methodological choice, and reasoning logic guiding the study.
- d. Population and Sampling: Defines the target population and explains the sampling strategy used to select participants.
- e. Data Collection and Tools: Details the methods used to collect data, including interviews, the interview guide and its structure, document analysis, and observations.
- f. Data Analysis: Outlines the steps taken to analyze the data, including transcription, dual-level analysis, tools for data organization, and the linking of themes to the research questions.
- g. Ethical Consideration: Discusses the ethical principles and procedures followed to ensure the integrity and ethical compliance of the research.

This methodological framework provides a foundation for exploring the role of green education in shaping sustainable practices in Algerian incubators and startups, offering a rigorous and structured approach for interpreting participants' insights.

2. Presentation of the Host Organization: Leancubator

2.1. Overview

Figure 19 Leancubator logo



The source: Leancubator website

Leancubator is an innovation hub and private incubator, founded in 2018 and headquartered in Algiers, Algeria. It is dedicated to fostering sustainable growth and promoting impactful entrepreneurship in Algeria and across the Mediterranean and MENA region. Positioned as a strategic bridge between visionary startups and small- and medium-sized enterprises (SMEs), established corporations, investors, and public-sector actors, Leancubator plays a pivotal role in catalyzing innovation and facilitating cross-sector collaboration.

With a strong commitment to addressing pressing global challenges, Leancubator empowers youth entrepreneurs to move from ideation to market success by offering a comprehensive range of programs and services. It has rapidly emerged as a central actor in Algeria's entrepreneurial ecosystem and an advocate for sustainability-driven innovation.

2.1. Missions and Objectives

Leancubator's mission is to accelerate sustainable development and inclusive growth by empowering startups, SMEs, and entrepreneurs to create solutions with measurable economic, social, and environmental impact. The incubator's objectives are multifaceted and ambitious:

- Deliver tailored programs that drive innovation, strengthen collaboration, and enable startups to scale solutions for a more sustainable future.
- Empower youth entrepreneurs to address global challenges and transform visionary ideas into market-ready solutions.

- Serve as a connector between startups, corporations, investors, governmental institutions, and international networks, building a dynamic innovation ecosystem.

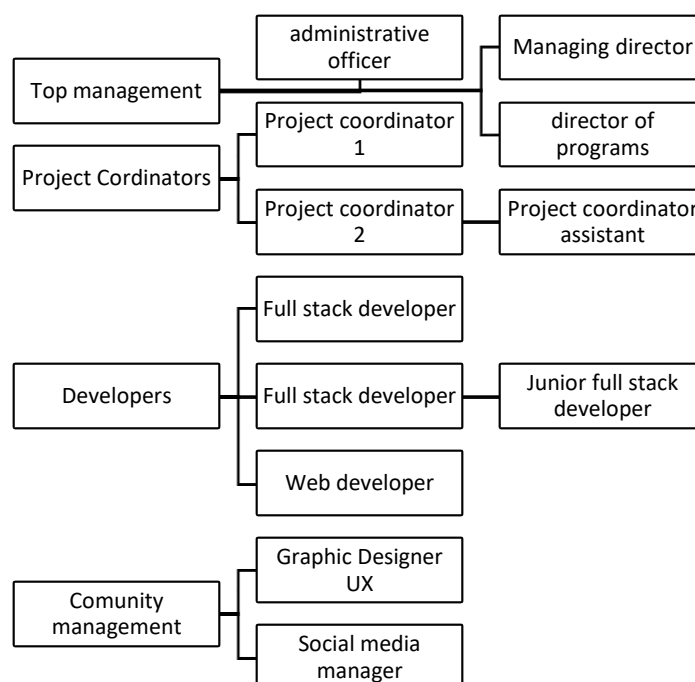
Key milestones reflecting Leancubator’s reach and influence include:

- 50+ programs and projects addressing critical needs across diverse industries.
- 350+ startups and SMEs supported with tailored incubation and acceleration services, market access, and funding opportunities.
- 4,000+ project holders and entrepreneurs provided with business training and mentorship.
- 50+ experts and coaches integrated into its support network across multiple domains.
- 250+ events and workshops fostering knowledge-sharing, networking, and peer learning.
- 200,000+ community members cultivating a thriving, collaborative innovation environment

2.2. Organizational Structure

Leancubator’s organizational structure is designed for agility and efficiency, enabling it to respond effectively to the fast-evolving needs of startups. The incubator’s core team comprises:

Figure 20 Leancubator Organizational Structure



The source: Leancubator website

It is important to note that this incubator operates in constant connection with external actors, including international and local experts, companies, non-governmental organizations (NGOs), universities, and other incubators from both the private and public sectors. These collaborations strengthen its capacity to support startups and promote sustainable innovation.

2.3. Commitment to sustainable development goals (SDGs)

Leancubator explicitly aligns its mission and programs with the United Nations Sustainable Development Goals (SDGs), with a focus on:

- **SDG 5: Gender Equality;** Empowering women in entrepreneurship and promoting female leadership in innovation.
- **SDG 9: Industry, Innovation, and Infrastructure;** Accelerating innovation and fostering resilient, sustainable industries.
- **SDG 17: Partnerships for the Goals;** Building global partnerships to amplify the reach and impact of sustainable solutions.

3. Methodological Framework

This section outlines the overall design of the study, which aims to explore how private green incubators in Algeria promote green education and how this influences the adoption of sustainable practices among the startups they accompany. The methodological framework is structured to guide the investigation in a coherent and rigorous manner, beginning with the selection of a qualitative approach, followed by the description of the epistemological positioning, methodological choice, justification for the selected methods, and the reasoning logic employed.

3.1. Research Approach

Given the exploratory and context-sensitive nature of this study, a qualitative research approach was adopted. This methodology is particularly suitable for investigating the perceptions, experiences, and practices associated with how private green incubators in Algeria promote green education and facilitate the adoption of sustainable practices among startups.

Qualitative research is especially valuable for examining complex and socially constructed realities that cannot be fully captured through quantitative tools (Creswell & Cheryl, 2018).

By focusing on the lived experiences of incubator managers, staff, and startup teams, this approach allows for a deeper understanding of how green education is delivered, implemented, and perceived within the incubation process.

The choice of a qualitative design is consistent with prior research on green entrepreneurship and sustainability education. For example, studies by (Saari & Joensuu-Salo, 2019), emphasized that qualitative inquiry is crucial for capturing the motivations, behaviors, and challenges faced by green entrepreneurs. Similarly, (Belloum & Khemili, 2024) and (REDOUANE & MIGHRI, 2022) demonstrated how the qualitative approach provides rich insights into pedagogical strategies and sustainability-oriented startup development in both developed and emerging contexts.

These works validate the relevance of qualitative approaches when exploring under-researched phenomena like green incubation in Algeria.

3.2. Epistemological Stance: Interpretivism

This study is grounded in an interpretivist epistemological stance, which holds that social reality is constructed through the meanings individuals and groups assign to their experiences (Pervin & Mokhtar, 2022). Rather than assuming a single objective truth, interpretivism recognizes multiple, context-dependent realities (Schwandt, 2000).

Such an approach is well suited for exploring organizational and cultural factors in green incubators, as it enables deep access to participants' subjective interpretations of sustainability practices (Alharahsheh & Pius, 2020). It supports an understanding of how green education is perceived and implemented within specific organizational settings.

Interpretivism also acknowledges that organizational culture both shapes and is shaped by individual beliefs and values. Only qualitative, interpretive methods can uncover the underlying assumptions that guide behavior in such contexts (Idowu, 2017).

Aligned with the qualitative and exploratory nature of this study, this stance supports the use of semi-structured interviews, document analysis, and expert brainstorming to generate rich, contextual insights (Ponelis, 2015).

3.3. Methodological Choice: Qualitative Inquiry

This study adopts a qualitative methodological approach to explore how private green incubators in Algeria promote green education and support sustainable practices among startups. This choice aligns with the exploratory and interpretive nature of the research, aiming to understand complex, context-specific processes from the perspectives of those directly involved (Creswell & Cheryl, 2018).

Qualitative research is particularly effective in uncovering rich, in-depth insights into how participants experience, interpret, and act upon their environment (Adissu et al., 2022). It offers the flexibility to refine data collection as themes emerge, making it well-suited for investigating evolving phenomena in dynamic organizational contexts (Lorelli et al., 2017). This approach is consistent with the study's interpretivist epistemology, which prioritizes socially constructed meanings and participant subjectivity (Schwandt, 2000).

The choice of a qualitative methodology is further supported by previous research in similar contexts:

- A study by (Moberg & Emilie, 2021) explored how sustainable entrepreneurship is understood and implemented in Danish universities, employing qualitative methods to delve into educators' interpretations and applications of sustainability concepts.
- A qualitative study conducted by (Johansson & Reetta, 2024) on startup companies in Sweden's clean technology industry, examining how environmental sustainability is integrated into their business models.

Following these models, this study adopted a purposive sampling strategy. According to (Palinkas et al., 2015), Purposive sampling is a technique widely used in qualitative research that allows researchers to select participants who are most informative about the phenomenon of interest.

In summary, the qualitative methodology provides the necessary tools to explore the nuanced and context-dependent nature of green education within Algerian incubators, facilitating a comprehensive understanding of the practices and perceptions that shape sustainable entrepreneurship in this setting.

3.4. Reasoning Logic: Inductive Approach

This study adopts an inductive reasoning logic, which allows patterns, themes, and insights to emerge from the data rather than being guided by predefined hypotheses or theoretical models (Thomas, 2006). Inductive reasoning is especially suitable for exploratory research aiming to understand under-researched phenomena.

An inductive approach enables the researcher to remain open to emergent meanings and to develop interpretations grounded in participants' lived experiences (Braun & Clark, 2006). Through semi-structured interviews, qualitative data will be gathered and thematically analyzed, allowing the researcher to identify recurring concepts and refine categories iteratively. This process supports the construction of a contextually relevant understanding of how incubators deliver green education and how it influences sustainability outcomes among startups.

Unlike deductive logic, which aims to test existing theories, the inductive approach prioritizes discovery over confirmation. It is particularly useful when the goal is to develop new conceptual frameworks or theoretical insights that are rooted in specific social contexts (Gioia et al., 2013). In this way, the inductive reasoning applied in this study contributes not only to academic theory but also to practical strategies for enhancing green incubation practices in Algeria.

4. Population and Sampling

4.1. Target Population

The target population for this study includes three primary groups directly involved in the design, implementation, and experience of green education within the incubation process in Algeria:

- Private green incubator staff, including program managers, project coordinators.
- Startup founders or team members who were enrolled in incubation programs that incorporate sustainability-related training mentoring.
- Subject-matter experts, including sustainability consultants, who offer external insights into green education and incubation strategies.

This combination of groups ensures a 360-degree view of how green education is developed and applied, from institutional structuring to end-user experience. This triangulation of perspectives is a recognized strength in qualitative studies aiming to understand multi-actor processes (Patricia et al., 2018).

Although the incubator under study (Leancubator) does not operate a formalized or structured green education program, it integrates sustainability principles into its programs through various activities such as clean-tech challenges, green innovation hackathons, and project-based mentoring. These embedded educational elements are key to understanding how green education is delivered in practice rather than as a fixed curriculum.

In Algeria, between 2020 and 2023, the number of active business incubators in Algeria increased from 14 to 60 Incubators (Boufarha & Djeddi, 2024).

4.2. Sampling Strategy

This study employs a purposive sampling strategy, a non-probabilistic method widely utilized in qualitative research to deliberately select participants based on their relevance to the research objectives. This approach is particularly suitable when the goal is to gain in-depth insights from individuals who possess specific knowledge or experience pertinent to the phenomenon under investigation (Palinkas et al., 2015).

Purposive sampling is especially appropriate for this research for several reasons:

- Information-rich cases: It enables the inclusion of participants who can provide substantial and detailed information about green education practices within incubators.
- Diversity across key groups: The strategy allows for the deliberate selection of varied participants, such as incubator staff and startup representatives.
- Contextual relevance: By focusing on individuals directly involved in sustainable incubation practices.

This sampling approach aligns with the qualitative and exploratory nature of the study, where the aim is not statistical generalization but the development of a nuanced, context-sensitive understanding of how green education fosters sustainability within the Algerian entrepreneurial ecosystem.

5. Data Collection and Tools

This study employs a qualitative data collection approach, integrating:

- Structured and Semi-structured interviews.
- Expert brainstorming sessions
- Document analysis.

This combination of methods ensures a comprehensive understanding of the research questions from multiple perspectives.

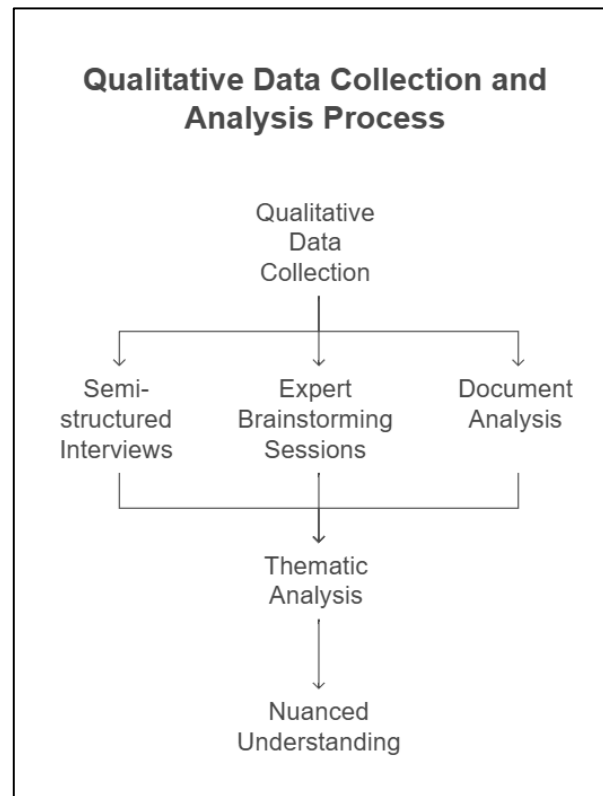
There are four fundamental techniques for data collection in qualitative scientific research: individual interviews, group interviews, observation, and document analysis ([Taherdoost, 2021](#)). Semi-structured interviews serve as the primary data collection method, allowing for in-depth exploration of participants' experiences and perceptions. This approach provides flexibility to probe emerging themes while maintaining a consistent structure across interviews.

To enrich the data, expert brainstorming sessions are conducted with professionals in sustainability and entrepreneurship. Brainstorming encourages participants to build on each other's ideas, leading to broader exploration of solutions and a higher volume of creative concepts ([Murphy et al., 2023](#)).

Additionally, document analysis is employed to examine educational materials and guides related to green entrepreneurship. This method allows for the triangulation of data and provides context to the practices observed in interviews and brainstorming sessions ([Bowen, 2009](#)).

The analytical strategy involves thematic analysis, systematically identifying patterns and themes across the collected data. This process enables the researcher to construct a nuanced understanding of how green education is integrated into incubation processes and its impact on sustainable practices among startups.

Figure 21 Qualitative Data Collection and Analysis process



The source: developed by ourselves

5.1. Interviews

Interviews served as the principal method for data collection in this study.

- **Structured Interviews:** Structured interviews are characterized by a standardized set of questions presented in a fixed order, ensuring uniformity across all interviews. This format enhances comparability of responses and minimizes interviewer bias (Nicholls, 2009). Structured interviews are particularly useful when the research aims to collect specific information across a large sample (George, 2022).
- **Semi-Structured Interviews:** Semi-structured interviews combine a predetermined set of open-ended questions with the flexibility to explore emerging themes during the conversation. This approach allows for a deeper understanding of participants' perspectives while maintaining a consistent framework across interviews (Ruslin et al., 2022). Semi-structured interviews are especially effective in exploratory studies where the research seeks to uncover behaviors and motivations.

The decision to employ both structured and semi-structured interviews was guided by the study's exploratory nature and the need to balance consistency with depth.

Initial contact was made via LinkedIn and email, reaching out to approximately 20 startup team members. Of these, 7 responded and agreed to participate in the study. Given the bilingual context of Algeria, interviews were conducted in either French or English, depending on the participant's preference.

Table 4 Interview Logistics: Participant Groups, Data Collection Period, Mode, Duration, and Recording Method

Interview Logistics				
Interviewee	Period	Mode of Interview	Interview Duration	Data Recording Method
Incubator Managers and Staff	April–May 2025	Face to face, online	30 minutes	Notes, Excel
Startup Founders		Online via Teams, LinkedIn	40–60 minutes	Notes Audio-recorded with informed consent Excel

The Source: developed by ourselves

Two distinct interview guides were developed to address the specific roles and experiences of the two participant groups: incubator managers/staff and startup founders. Each guide was designed to align with the study's central research question.

The interview guides were inspired by previous research, notably the studies ([Chloe Hartmann, 2024](#)) and ([Johansson & Reetta, 2024](#)), which explored the integration of environmental sustainability in startups and the role of business incubators in fostering sustainability transitions, respectively. These guides were adapted to the Algerian context to ensure relevance and comprehensiveness.

5.1.1. Interview Guide Structure

Two participant categories were targeted: incubator managers and staff, and startup founders.

Each guide includes six sections:

1. Background Information
2. Green Education Strategies and Delivery (for incubators) / Experience with Green Education (for startups)

3. Supporting Sustainable Practices (for incubators) / Applying Sustainable Practices (for startups)
4. Barriers and Challenges
5. Success Factors and Positive Outcomes
6. Suggestions and Recommendations

These sections directly correspond to the four research questions and the core objectives of the study, ensuring thematic coherence and methodological rigor.

The complete interview guide is available in the appendix.

5.2. Document Analysis

Document analysis is a systematic procedure for reviewing or evaluating documents, both printed and electronic (computer-based and Internet-transmitted) material. As by (Bowen, 2009) explains, this method involves the examination and interpretation of documents to elicit meaning, gain understanding, and develop empirical knowledge. In qualitative research, document analysis is particularly valuable for triangulating data sources, providing contextual understanding, and uncovering insights that may not emerge through interviews alone.

In the context of this study, document analysis serves as a complementary method to semi-structured interviews, aiming to enrich the understanding of how green education is integrated and operationalized within private incubators and the startups they support. By examining relevant documents publicly available, that provide insights into green education, sustainable business practices, and the role of incubators in promoting sustainability.

Additionally, attempts were made to access internal documents from Leancubator, such as program curricula, training materials, and reports on collaborations with NGOs and international organizations. However, due to confidentiality constraints, access to these internal documents was limited.

5.3. Brainstorming

Brainstorming is a qualitative research technique designed to generate a wide range of ideas and perspectives through collaborative discussion (“Wikipedia,” 2025). This method is particularly effective in exploratory research, where the goal is to uncover insights that may not emerge through more structured data collection methods (Byron, 2012).

In this study, brainstorming sessions were conducted with five experts in sustainability to gain deeper insights into the integration of green education within Algerian incubators. The experts included professionals from large corporations and researchers from” the Centre de Recherche en Environnement” in Annaba, GIZ Algeria.

6. Data Analysis

This study adopted a **thematic analysis** approach to analyze qualitative data collected through interviews and brainstorming sessions. Thematic analysis is a widely used method in qualitative research that involves identifying, analyzing, and reporting patterns (themes) within data (Braun & Clark, 2006). It offers a flexible and systematic framework for organizing and interpreting qualitative material, especially when exploring complex social processes such as the integration of green education in entrepreneurial ecosystems.

The data analysis was conducted manually in several stages:

- a. **Data Organization:** All interview responses and expert brainstorming notes were manually transcribed and entered into an Excel spreadsheet. This enabled a clear visual organization of the data and facilitated initial familiarization with the content.
- b. **Initial Coding:** Key phrases and recurring ideas were identified and highlighted. These initial codes represented basic units of meaning in the participants' responses.
- c. **Thematic Grid Development:** A **thematic grid** was then developed to group similar codes under broader categories aligned with the research objectives and interview guide structure. This grid was used to systematically trace how different participants addressed core themes such as green education delivery, sustainable practices, challenges, and success factors.
- d. **Theme Refinement and Interpretation:** Themes were reviewed for coherence, consistency, and relevance. Patterns were interpreted within the contextual framework of Algerian incubators and sustainability education, ensuring that the findings remained grounded in participants' perspectives and the broader literature on green entrepreneurship (Lorelli et al., 2017).

7. Ethical considerations

The study places great importance on ethical issues to safeguard the rights of participants and maintain the integrity of the research process.

- **Informed Consent:** Each participant will get comprehensive information regarding the study's objectives, methodologies, and their entitlements as participants. Prior to commencing
- **Confidentiality:** The participants' identities will be kept anonymous, and all data will be anonymized to ensure their privacy is protected. The data will be stored in a safe manner and will only be accessible to the study team.
- **Transparency and Honesty:** Participants will receive clear information regarding the utilization of their data, and the results will be communicated in a truthful and transparent manner.

CHAPTER 3:

RESULTS AND DISCUSSION

Chapter 3: Results and Discussion

To ensure a rich and contextual understanding of how private green incubators in Algeria promote green education and foster sustainable practices among startups, this study engaged a total of 17 participants. These included four incubator staff (excluding the ones who are not effective), seven startup founders (approximately 15 were contacted but only 7 accepted to participate), and six sustainability experts and researchers. Participants were purposively selected for their direct involvement in green entrepreneurship initiatives and incubation processes in Algeria.

Interviews were conducted in French or English, according to the participant's preference, and took place between April and May 2025. Modalities included both face-to-face and online sessions, ranging from 20 to 50 minutes.

1. Results Analysis

1.1 Interviewee profiles

This section presents the profiles of the interviewees from both categories. It includes basic information:

Table 5 Overview of Interviewee Characteristics

Role	Organization Type	Gender	Interview Mode	Language	Duration
Incubator staff	Managing director	male	Face-to-face	French	40 min
	Director of programs	female	Online (Teams)	English	20 min
	Project coordinator	female	Face-to-face	English	30 min
	Junior project manager	female	Face-to-face	English	30 min
Startup Founders	OptiCarbone	male	Online (LinkedIn)	French	20 min
	Shems Wa Tabrid	female	Online (Teams)	English	45 min

	EcoTashira	female	Online (LinkedIn)	French	40 min
	Dynamics	male	Online (Teams)	French	30 min
	Treelamp	male	Online (Teams)	French	40 min
	Anonym	Anonym	Online (Teams)	French	30 min
	Anonym	Anonym	Online (Teams)	English	45 min
Experts, consultants, and researchers	GIZ Algeria employee	female	Online (Teams)	English	30 min
	GIZ Algeria employee	male	Online (Teams)	French	30 min
	Environmental Researcher CRE Annaba	male	Face-to-face	French	50 min
	Environmental Researcher CRE Annaba	male	Face-to-face	French	30 min
	Consultant KPMG	female	Online (LinkedIn)	French	40 min
	Private Green incubator founder	male	Online (LinkedIn)	English	30 min

Source: developed by ourselves

1.2. Results Analysis

1.2.1. Category A: Incubator Managers and Staff

Section: Green Education Integration

Question: A.4. How is green education defined and understood within the incubator?

Question A5: What types of training or awareness activities on sustainability are offered to

Question A6: Who is responsible for organizing or delivering these activities?

Question A7: How often are they conducted, and are they mandatory?

Illustration: Word Cloud

Word Cloud 1 Green Education Integration

Figure 22 Word Cloud 1 Green Education Integration



The source: developed by ourselves by Nuagedumots.co

Table 6 Word Frequency Classification

Keyword	Frequency	Percentage
sustainability, green, circularity, resilience	21	25%
education, awareness, knowledge, tools	15	18%
bootcamp, workshops, webinars	7	8%
Internal, external	10	12%
participation	9	11%

The source: developed by ourselves

Analytical Commentary

The responses from incubator staff emphasize that sustainability values are deeply implemented such as circularity and climate resilience, with over 25% of references focused

on these principles. The pedagogical objective centers on raising awareness and equipping entrepreneurs with knowledge and practical tools to embed sustainability into their ventures.

The training is delivered through bootcamps, webinars, and thematic challenges, supported by a hybrid delivery structure involving both internal staff and external institutional partners like GIZ. While not mandatory, sustainability education is regularly offered and often tied to program milestones, showing a semi-structured integration into the incubation process.

Section: Supporting Sustainable Practices

Question A8: How does the incubator support startups in adopting sustainable practices?

Question A9: Has green education influenced startups' actions?

Illustration: Word Cloud

Figure 23 Word cloud 2 Supporting Sustainable Practices



The source: developed by ourselves by Nuagedumots.co

Table 7 Word Frequency Classification

Keywords	Frequency	Percentage
sustainability, green, impact	14	31.1%
diagnostics, mentoring, technical, funding	11	24.5%
eco, circular, KPIs, reduce	11	24.4%
networks, partnerships	5	11.1%
education, influenced	4	8.8%

The source: developed by ourselves

Analytical Commentary

The analysis of this section highlights the central role of sustainability outcomes (31.1%) in the incubator's support strategy. Interviewees emphasize observable behavioral shifts among startups, such as eco-material adoption, energy reduction, and incorporation of environmental KPIs.

Support tools (24.5%) emerge as key mechanisms driving these results, through diagnostics, mentoring, and access to green funding. These tools are embedded within challenge-based programs and tailored to startup needs.

Equally strong is the emphasis on sustainable practices (24.4%), such as eco-design and circular business models. These practices appear to be applied in action, influenced by real-life experimentation rather than abstract education.

Though less frequent, partnerships (11.1%) with international actors and networks are recognized as critical for mobilizing resources and legitimacy. Finally, the influence of training (8.8%), though less directly mentioned, points to a growing internalization of sustainability principles among startup teams.

Section: Barriers and Challenges

Question A10: What are the main challenges in promoting sustainability and green education?

Question A11: What are the technical, financial, or organizational barriers?

Question A12: Have you received external support from institutions, NGOs, or international programs?

Illustration: Word Cloud

Figure 24 Word cloud 3 Barriers and Challenges



The source: developed by ourselves by Nuagedumots.co

Table 8 Word Frequency Classification

keywords	Frequency	Percentage
Financial & Technical Barriers	11	37.9%
External Support	10	34.4%
Knowledge & Perception Barriers	8	27.5%

The source: developed by ourselves

Analytical Commentary

Among the incubator staff, the most cited challenges in promoting sustainability revolve around financial and technical constraints (37.9%). This includes budget limitations for advanced training, insufficient technical expertise in areas like carbon foot printing, and general resource scarcity.

Closely following are references to external support mechanisms (34.4%). While such support is essential, the interviews underscore that external partnerships are often compensatory, used to fill in for internal capacity gaps.

Lastly, knowledge and perception barriers (27.5%) reveal a persistent issue: many early-stage startups do not perceive sustainability as a strategic priority. Sustainability is often viewed as costly or irrelevant at the startup phase, with a lack of clarity around its long-term value.

These barriers reflect both structural limitations and mindset gaps, suggesting that future green education initiatives must address both resource access and attitude shifts.

Section: Enablers and success factors

Question A13: What factors have helped make your green education initiatives successful?

Question A14: Have you observed cultural or attitude changes as a result of your green education initiatives?

Illustration: Word Cloud

Figure 25 Word cloud 4 Enablers and success factors



The source: developed by ourselves by Nuagedumots.co

Table 9 Word Frequency Classification

keywords	Frequency	Percentage
Ecosystem Partnerships	9	34.6%
Cultural Change	8	30.7%
Strategic Integration	5	19.2%
Applied Learning Approaches	4	15.4%

The source: developed by ourselves

Analytical Commentary

The most prominent enabler reported by incubator staff is the role of ecosystem partnerships (34.6%). Collaborations with national and international actors have proven essential in providing startups with credibility, access to expert networks, and valuable resources. These relationships expand the reach and legitimacy of the incubator’s sustainability mission.

Closely following is the theme of cultural change (30.7%). Staff observed that startups are now increasingly confident in articulating sustainability goals and demanding mentorship tailored to green innovation. This indicates a shift in mindset where environmental concerns are no longer peripheral but central to entrepreneurial identity.

Strategic integration (19.2%), embedding sustainability in performance indicators and pitch frameworks, shows that green criteria are not only encouraged but institutionalized. Meanwhile, applied learning approaches (15.4%) such as real-case exercises and challenge-based training were seen as essential to translating theory into practice.

Together, these enablers point to a multi-level dynamic: the effectiveness of green education is amplified when external support, internal processes, and cultural shifts work in tandem.

Section: Suggestions and recommendations

Questions A15: What improvements would you suggest?

Questions A16: Would you recommend other incubators adopt similar sustainability programs?

Questions A17: Any success stories to share?

Illustration: Word Cloud

Figure 26 Word cloud 5 Suggestions and recommendations



The source: developed by ourselves by Nuagedumots.co

Table 10 Word Frequency Classification

keywords	Frequency	Percentage
Program Improvement	11	42.3%
Impact Stories	5	19.2%
Pedagogical Development	5	19.2%
Strategic Vision	5	19.2%

The source: developed by ourselves

Analytical Commentary

The majority of suggestions provided by incubator staff (42.3%) revolve around programmatic improvement. This includes deepening collaboration with universities and research centers, localizing case studies, and conducting post-program follow-ups to measure sustainability integration over time.

The second cluster of themes (each at 19.2%) shows a balanced focus on pedagogical development, strategic vision, and impact storytelling. Staff called for more structured environmental education models, underlining the need for consistent learning pathways. They

also emphasized the importance of embedding sustainability from the outset, as a way to “future-proof” startups and shift long-term entrepreneurial mindsets.

Additionally, success stories like the biodegradable packaging startup from Startup10 serve as validation of the incubator’s green education efforts, reinforcing their credibility and potential for replication.

These findings highlight a readiness among staff to institutionalize green education and transform sporadic support into a long-term, systemic practice.

Category A: Incubator Staff – Synthesis Summary

Incubator staff highlighted a growing integration of green education through challenge-based programs, expert sessions, and informal mentoring. While no structured curriculum was in place, sustainability themes were embedded across key activities such as bootcamps, hackathons, and startup evaluations. Staff emphasized their role in promoting eco-innovation by offering support tools, including diagnostics, technical guidance, and access to green funding or partnerships.

Despite these efforts, challenges persisted, notably financial limitations, a lack of local technical expertise, and low awareness among early-stage startups. However, collaborations with international partners were crucial enablers, bringing valuable content and networks. Staff called for a more formalized pedagogical model, stronger ties with research institutions, and tailored follow-up to ensure long-term sustainability impact

Overall, incubators act as indirect facilitators of green education, relying on external partnerships and practical exposure, but lack consistent frameworks and sector-specific educational strategies.

1.2.2. Category B: Startup Founders

Section: Experience with Green Education

Question: B4: How have you experienced green education or sustainability training at the incubator?

Question: B.5. Which topics or sessions were most useful or relevant to your startup?

Illustration: Word Cloud

Figure 27 Word cloud 6 Experience with Green Education



The source: developed by ourselves by Nuagedumots.co

Table 11 Word Frequency Classification

keywords	Frequency	Percentage
General Exposure	16	34.7%
Sustainability Awareness	15	32.5%
Business Skills	10	21.5%
Sector-Specific Content	5	10.8%

The source: developed by ourselves

Analytical Commentary

Startup founders' responses suggest that their experience with green education has been informal and incidental rather than structured. Most reported exposure through general training sessions (34.7%) such as business courses, challenge-based programs, and exhibition participation. These created opportunities to reflect on sustainability without explicitly being branded as green education.

A strong portion of responses (32.5%) reflects a rising awareness of sustainability concepts, especially after contact with external experts (e.g., GIZ, industrial partners) or participation in programs like ASC and Orange Corners. Notions such as eco-design, circularity, and impact measurement were picked up indirectly rather than through dedicated sessions.

Business skills (21.5%)—particularly in ideation, financial planning, and pitching—were consistently highlighted as the most relevant and applicable, regardless of their environmental

focus. Meanwhile, sector-specific content (10.8%), such as insurance or renewable energy logistics, proved particularly impactful for a few specialized startups.

Overall, the findings point to a fragmented but influential educational experience, where sustainability is not explicitly taught but learned through exposure, reflection, and embedded ecosystem practices.

Section: Applying Sustainable Practices

Question: B.6. What sustainable practices have you implemented in your startup, and why?

Question: B.7. How has the incubator's support influenced your adoption of these practices?

Illustration: Word Cloud

Figure 28 Word cloud 7 Applying Sustainable Practices



The source: developed by ourselves by Nuagedumots.co

Table 12 Word Frequency Classification

keywords	Frequency	Percentage
Environmental Impact Reduction	16	44.6%
Incubator Influence	11	30.6%
Sustainability Strategy	9	25.1%

The source: developed by ourselves

Analytical Commentary

Founders demonstrated a strong commitment to reducing environmental impact (44.6%) through practices such as waste sorting, reusing water, minimizing plastic and energy use, and using recycled materials or agricultural by-products. These efforts indicate that many startups

are actively adopting eco-conscious operations, even in the absence of formal green metrics or KPIs.

Incubator influence (30.6%) was most often cited in terms of exposure to sustainability themes during pitching events or peer interactions. While the incubators didn't always offer structured green education, they played an indirect but pivotal role in motivating reflection and refining the environmental dimension of startup value propositions.

Sustainability strategies (25.1%) like circular economy, eco-innovation, and composting were frequently mentioned, though often informally integrated. This suggests an emerging but unstructured approach to embedding sustainability in business models.

Overall, the incubator acted more as an enabler of mindset shifts and visibility than a direct trainer, fostering a community where sustainable practices could be observed, discussed, and eventually adopted.

Section: Barriers and Challenges

Question: B.8. What were the main difficulties you faced in applying sustainable practices?

Question: B.9 What kinds of support (technical, financial, training) would have helped?

Illustration: Word Cloud

Figure 29 Word cloud 8 Barriers and Challenges



The source: developed by ourselves by Nuagedumots.co

Table 13 Word Frequency Classification

keywords	Frequency	Percentage
Financial Constraints	10	31.3%
Technical Support Needs	8	24.9%
Policy & Certification Gaps	7	21.9%
Ecosystem Awareness	5	15.5%
Strategic Collaboration	2	6.2%

The source: developed by ourselves

Analytical Commentary

Startup founders identified financial constraints (31.3%) as the dominant obstacle in applying sustainable practices. The costs associated with certification, validation, prototyping, and acquiring clean technologies remain unaffordable for most green startups in Algeria's underdeveloped ecosystem.

Next, founders emphasized the urgent need for technical support (24.9%), particularly in accessing expertise for lifecycle assessments, green technology integration, and strategic mentorship. These gaps prevent startups from translating sustainable ideas into operational standards.

Policy and certification issues (21.9%) were also heavily cited. Founders lamented the absence of national green certification standards, lack of enforcement, and the disconnect between regulatory frameworks and local supplier practices.

Issues related to ecosystem awareness (15.5%), especially poor communication of government programs, weak client eco-consciousness, and regional disparities—show that sustainable entrepreneurship is still not normalized across Algeria.

While strategic collaboration (6.2%) was mentioned less frequently, it is still considered a critical support mechanism for startups needing connection to industrial partners and market networks to scale sustainable solutions.

Section E: Enablers and Success Factors

Question: B.10. What helped you successfully implement sustainability practices?

Question: B.11. Have you seen benefits for your business from adopting these practices?

Illustration: Word Cloud

Figure 30 Word cloud 9 Enablers and Success Factors



The source: developed by ourselves by Nuagedumots.co

Table: Word Frequency Classification

Table 14 Word Frequency Classification

keywords	Frequency	Percentage
Business Outcomes	9	31.0%
External Mentorship	9	30.9%
Operational Resources	7	24.1%
Founder's Knowledge	4	13.7%

The source: developed by ourselves

Analytical Commentary

Responses show that business outcomes (31.0%) such as investor attention, strategic positioning, and early partnerships with eco-focused entities are increasingly tied to startups' sustainable orientation. While not all founders reported direct financial gains, many acknowledged that their green positioning improved credibility, visibility, and long-term potential.

Equally prominent is the role of external mentorship (30.9%). Collaborations with experts—especially from GIZ, multinational partners, or international incubators—played a critical role in helping founders refine their sustainability strategies and validate their products

Operational resources (24.1%) like access to eco-materials, labs, and value chain redesign tools were pivotal for translating sustainability intentions into technical execution. These resources, often unavailable locally, were obtained through international partnerships.

Finally, founders' own knowledge and awareness (13.7%) were recognized as essential enablers. A few participants cited academic backgrounds in agronomy or environmental science as key contributors to their understanding and implementation of sustainable practices.

Section F: Suggestions and Recommendations

Question: B.12. What suggestions would you make to improve the incubator's sustainability support?

Question: B.13. Would you recommend other startups participate in green education programs? Why?

Illustration: Word Cloud

Figure 31 Word cloud 10 Suggestions and Recommendations



The source: developed by ourselves by Nuagedumots.co

Table 15 Word Frequency Classification

keywords	Frequency	Percentage
Capacity Building	7	24.1%
Strategic Positioning	6	20.6%
Business Value	5	17.2%
Anticipating Regulation	4	13.7%
Customization & Contextualization	4	13.6%

The source: developed by ourselves

Analytical Commentary

Most suggestions from founders emphasized the need for capacity building (24.1%). This includes structured training, dedicated mentorship, and the development of practical resources

such as toolkits, workshops, and sustainability modules. These tools would help startups better integrate sustainability into their daily operations and growth strategies.

Founders also stressed strategic positioning (20.6%) as a motivator. Many viewed sustainability not just as a responsibility, but as a strategic asset that boosts their value proposition, supports impact-driven innovation, and aligns with evolving global trends

The theme of business value (17.2%) highlights how green positioning contributes to investor attraction, brand strength, and long-term competitive advantage. Even informal education is seen as crucial for future-proofing business models.

Some respondents highlighted the need to anticipate regulatory changes (13.7%). References to the Carbon Border Adjustment Mechanism (CBAM) and ESG compliance suggest that startups increasingly recognize the importance of aligning with international standards to remain competitive.

Lastly, customization and contextualization (13.6%) were mentioned. Founders encouraged sustainability education tailored to specific industries, such as finance, agtech, and insurtech, recommending sector-specific tools and applied frameworks

Category B: Startup Founders – Synthesis Summary

Startup founders reported limited access to formal green education, with most sustainability learning occurring through ecosystem exposure, peer influence, and external experts. While incubators rarely provided structured training, programs and pitching opportunities often triggered reflection and adaptation of sustainable practices.

Many startups adopted impactful eco-practices, ranging from waste reduction and circular design to low-carbon operations, despite facing serious barriers such as funding gaps, unclear regulations, and weak technical support. Founders emphasized the need for targeted mentoring, access to green certification pathways, and sector-specific resources to scale their environmental initiatives

Importantly, founders recognized the strategic value of sustainability, not only for environmental benefit but for improving brand image, investor appeal, and market positioning. They unanimously recommended formal green education programs, stressing that sustainability is no longer optional, but a critical success factor in both local and international markets.

1.2.3. Insights from Experts

To complement the interviews, brainstorming sessions were conducted with five experts from GIZ Algeria, environmental research institutions, corporate consultancy and private green incubator. This technique enabled collaborative reflection and revealed macro-level insights on sustainability education and entrepreneurship support in Algeria.

Table 16 Insights from Brainstorming on Green Entrepreneurship Education

Theme	Illustrative Quotes / Expert Ideas	Main Insight / Takeaway
1. Limited Awareness and Adoption	"Most companies don't know their obligations unless dealing with exports." "Green education is rare, informal, or improvised." "Founders focus more on survival than sustainability."	Green education is not embedded in startup operations. Awareness is limited and externally triggered, especially by international clients or partners.
2. Gaps in Pedagogical Structure	"No structured training—just ad hoc expert sessions." "There's no official curriculum or national framework." "Only large firms occasionally offer ISO or carbon assessment workshops."	The current educational offer is scattered and unstructured, with no institutionalized training model adapted to Algerian startup needs.
3. Barriers Faced by Startups	"Lack of internal expertise, resistance to change, unclear regulations." "Sustainability is often seen as abstract or costly." "There's no time or resources to prioritize green education."	Startups face technical, financial, and motivational barriers, and green priorities are delayed until business viability is secured.
4. Effective Practices and Methods	"Workshops like Climate Fresco and case-based bootcamps are effective." "Hands-on training and real-life startup problems work better than lectures." "Mentoring and storytelling enhance engagement."	Experts recommend experiential, problem-based, and context-specific approaches, with a strong emphasis on local examples and interactive formats.
5. Systemic and Institutional Needs	"We need a national roadmap, startup toolkits, and official green guides." "Public-private training programs and policy incentives would help." "Green education must be long-term, not project-based."	There's a call for national-level infrastructure: roadmaps, incentives, and certification schemes to formalize and scale green entrepreneurship education.
6. Drivers for Cultural Change	"Leadership commitment, internal ambassadors, and participatory governance are key." "Incentives, continuous training, and monitoring create long-term impact." "Green culture must evolve with tech and social expectations."	Sustainable culture needs top-down leadership, embedded values, employee incentives, and long-term strategies to integrate green education meaningfully.

The source: developed by ourselves

The brainstorming with sustainability experts revealed six core themes. Experts consistently described a lack of structured green education in Algeria's startup ecosystem, with most awareness coming from external influence or export demands. Training remains occasional and unstandardized, rarely aligned with local startup realities.

Experts noted that barriers such as funding, expertise, and time prevent startups from prioritizing sustainability early on. However, methods like interactive workshops, mentoring, and applied learning were seen as highly effective. To overcome these challenges, the panel advocated for institutional change: documented roadmaps, incubator incentives, and green toolkits.

Ultimately, building a green culture requires leadership, employee engagement, and participatory governance, backed by continuous support and policy alignment.

2. Results Discussion

2.1. Integration of Green Education in Private Incubators

The findings reveal that while incubators such as Leancubator demonstrate an awareness of green education principles, their integration remains informal and program-dependent rather than structured or strategic. This echoes the broader challenge identified by (Rosário & Raimundo, 2024), who stated that sustainability education in entrepreneurial contexts often lacks institutionalization and is treated as peripheral rather than core.

The incubator managers defined green education in terms consistent with UNESCO's (2018) ESD framework raising awareness, developing green skills, and embedding sustainability thinking. However, as observed in the thematic findings, activities remain fragmented and driven by external collaborations. These insights align with the literature on green incubators (Samuel Carvalho de Azevedo Marques et al., 2024), which acknowledges that while incubators are positioned to foster sustainability, most are still developing structured pedagogies.

The absence of a unified curriculum or continuous educational track in Algerian incubators supports (Yuan et al., 2023) observation that the ESD framework's application in the Global South is still in the early implementation stage, especially outside of formal education systems.

2.2. Pedagogical Approaches and Green Skills Development

The pedagogical methods used by incubators, such as workshops, expert talks, and thematic challenges, fall under experiential and problem-based learning, which are widely recognized in ESD literature for their effectiveness (Álvarez-Vanegas et al., 2024; Cavadas & Linhares, 2022). However, these approaches lack consistent follow-up or assessment mechanisms, limiting their long-term impact on startup behavior.

Green education remains more reactive than proactive. While some startups integrate sustainability tools, this tends to occur late in their development. This reflects the “knowledge–action gap” frequently cited in green education research (Barth et al., 2015; Hanisch & Eirdosh, 2023).

Experts also highlighted the limited use of interactive or participatory pedagogies (Demssie et al., 2023; Rooney-Varga et al., 2018). This finding suggests a missed opportunity, as these methods have been shown to build competencies like systems thinking and reflective learning (Onyeaka & Akinsemolu, 2025).

2.3. Impact of Green Education on Startup Practices

Although most startup founders reported only indirect or informal exposure to green education, many have adopted sustainable practices (such as using recycled materials or minimizing energy consumption). These outcomes, while encouraging, are not always linked to incubator training, but often to personal values, external exposure, or technical necessity.

This finding supports the argument made by (Selmane et al., 2025) that green startup practices are often self-initiated, and that founders' prior knowledge and intrinsic motivations remain key determinants of sustainability adoption. However, without structured green skills development or support frameworks, startups struggle with implementation, echoing challenges described by (Badjeena et al., 2024; Makki et al., 2020), particularly in the Algerian context.

2.4. Barriers and Levers to Green Education and Practices

The main barriers identified across all respondent groups include:

- Lack of structured green education.
- Financial constraints.
- Limited technical expertise.
- Time and resource pressures.
- Unclear regulatory frameworks.

These align with well-documented barriers in the literature (Kato & Arinaitwe, 2024; Lee et al., 2025) and reinforce the findings from the expert brainstorming, where the absence of institutional incentives and policy clarity were repeatedly emphasized.

On the other hand, successful green education efforts were often enabled by:

- International partnerships.
- Peer learning and mentoring.
- Integration of sustainability into pitch criteria and product design.

These levers correspond with enablers discussed by (Diana Ailyn, 2024; Rosário & Raimundo, 2024), who underscore the role of incubators as not just support platforms but change agents capable of embedding sustainability within startups' operational DNA.

2.5. Need for Institutionalization and Strategic Policy Support

The synthesis of interviews and expert inputs makes it clear that green education remains largely non-institutionalized in Algerian private incubators. Despite isolated successes, the lack of structured roadmaps, guidelines, and incubator mandates hinders progress.

Experts called for dedicated curricula, handbooks, and sustainability programs, recommendations that align with global best practices and support from well-known organizations.

This calls for a transition from ad hoc, externally supported programs to internally driven, systematically designed incubator models, equipped with pedagogical tools, impact measurement methods, and aligned with national sustainability agendas.

CONCLUSION

Conclusion

This thesis set out to explore the role of private green incubators in Algeria in promoting sustainable practices among startups, with a particular focus on the case of Leancubator. The central objective was to examine how green education is integrated into incubation programs, how startup founders internalize and apply sustainability principles, and what systemic barriers or enablers shape this integration. By situating the study within the frameworks of Education for Sustainable Development (ESD), green entrepreneurship, and sustainability transitions, the research sought to bridge the gap between theory and practice in the emerging field of sustainable incubation.

Employing a qualitative research design, the study collected data through structured and semi-structured interviews with incubator staff, startup founders complemented by document analysis and expert brainstorming sessions. The findings reveal that while the notion of sustainability holds increasing significance within Leancubator's discourse and activities, green education remains largely informal, fragmented, and dependent on external collaborations. There is no fully institutionalized or strategic framework guiding how sustainability knowledge and skills are transmitted to incubated startups.

Instead, sustainability-oriented learning tends to emerge through isolated initiatives such as thematic events, participation in innovation challenges like Startup10 and the Algeria Startup Challenge (ASC), or through collaborations with international partners like GIZ. These interventions, while valuable, are typically ad hoc, project-based, and contingent upon available funding and expertise. The absence of an internal sustainability expert or a formal green education curriculum limits the continuity, depth, and consistency of green knowledge transfer within the incubation journey.

Nevertheless, the study highlights that these informal mechanisms, particularly mentoring and experiential learning, do align with established pedagogical approaches in ESD, such as problem-based learning, systems thinking, and reflective learning. These methods, when effectively facilitated, contribute to raising awareness and fostering critical thinking about environmental and social challenges. Several startups incubated by Leancubator have begun to integrate sustainability into their business models, demonstrating eco-innovation, resource efficiency, and socially responsible strategies. However, the extent and quality of this integration remain highly variable and often reactive rather than proactive.

On a theoretical level, this research contributes to academic discourse by demonstrating that the principles of ESD are not only relevant but also adaptable to entrepreneurial contexts. It confirms that education for sustainability can and should be embedded into startup support systems. The findings validate the relevance of experiential and transformative learning approaches, as well as behavioral change theories, in nurturing green entrepreneurship. Moreover, the study provides insight into how pedagogical models traditionally used in formal education settings can be effectively repurposed within the informal, fast-paced environment of business incubation.

From a practical standpoint, this study underscores the significant yet underutilized potential of green incubators to serve as educational agents for sustainability. Private incubators like Leancubator are uniquely positioned to shape the mindsets and practices of early-stage entrepreneurs, offering a fertile ground for cultivating sustainability competencies. However, to realize this potential, a shift is needed from sporadic, externally driven initiatives toward a more structured, coherent, and strategic approach to green education.

Formalizing green education within incubation programs would entail developing tailored sustainability curricula, integrating green skill-building modules into core activities, and institutionalizing partnerships with academic institutions, sustainability experts, and policy actors. In addition, implementing tools to assess the acquisition of sustainability competencies and measuring the environmental and social outcomes of incubated startups would provide clearer evidence of impact and areas for improvement.

Leancubator, as the host organization for this study, offered a privileged lens through which to examine the operational realities, opportunities, and challenges of fostering sustainability within Algeria's startup ecosystem. The active participation of its management team, program coordinators, and affiliated entrepreneurs enriched the research by grounding theoretical concepts in concrete experiences. Their openness, critical reflections, and shared aspirations for a more sustainable innovation landscape contributed to making this thesis both analytically rigorous and contextually relevant.

However, this research is not without limitations. As a single-case study focusing on a specific incubator in a particular national context, the findings may not be generalizable to all incubation programs in Algeria or other countries. The study's scope was also limited in terms of capturing long-term impacts, as the sustainability trajectories of startups post-incubation were not assessed. Furthermore, the qualitative design, while well-suited for capturing depth

and nuance, does not provide quantifiable measures of environmental performance or educational outcomes.

Future research could address these limitations by conducting comparative studies across multiple green incubators in different regions, or by employing longitudinal methodologies that track the development of sustainability practices over time. Investigating how digital tools, blended learning, or online sustainability training platforms can complement in-person incubation would also be valuable. There is a growing need for the development of standardized indicators and assessment frameworks to evaluate sustainability learning outcomes and measure green impact at the startup level.

In conclusion, this thesis demonstrates that initiatives like Leancubator are making meaningful progress toward integrating sustainability into the entrepreneurial ecosystem in Algeria. However, the institutionalization of green education within incubation remains a work in progress. Strengthening pedagogical frameworks, investing in internal sustainability expertise, and aligning incubator programs with national development priorities and international sustainability agendas are essential next steps. By doing so, incubators can play a transformative role not only in supporting innovative startups, but also in shaping a new generation of environmentally responsible and socially conscious entrepreneurs, capable of addressing the complex challenges of the 21st century.

BIBLIOGRAPHY

Bibliography

Journal Articles

1. Abo-Khalil, A. G. (2024). Integrating sustainability into higher education challenges and opportunities for universities worldwide. *Heliyon*, 10(9), e29946. <https://doi.org/10.1016/j.heliyon.2024.e29946>
2. Al Mamun, A., Hayat, N., Mohiuddin, M., Salameh, A. A., Ali, M. H., & Zainol, N. R. (2022). Modelling the significance of value-belief-norm theory in predicting workplace energy conservation behaviour. *Frontiers in Energy Research*, 10. <https://doi.org/10.3389/fenrg.2022.940595>
3. Álvarez-Vanegas, A., Ramani, S. V., & Volante, L. (2024). Service-Learning as a niche innovation in higher education for sustainability. *Frontiers in Education*, 9. <https://doi.org/10.3389/feduc.2024.1291669>
4. Anne, V., & Phil, P. (2021). Principles for a Sustainable Circular Economy. Sustainability in Production and Consumption. <https://doi.org/10.1016/j.spc.2021.02.018>
5. Ayers, J., Bryant, J., & Missimer, M. (2020). The Use of Reflective Pedagogies in Sustainability Leadership Education—A Case Study. *Sustainability*, 12(16). <https://doi.org/10.3390/su12176726>
6. Badjeena, B. P., Ali, E., Wonyra, K. O., & Tamou, K. (2024). Green entrepreneurship: Opportunities and challenges for the transition to a circular economy in Togo, West Africa. *World Development Sustainability*, 5, 100181. <https://doi.org/10.1016/j.wds.2024.100181>
7. Barbero, J. L., Casillas, J. C., & Wright, M. (2014). Do different types of incubators produce different types of innovations? *The Journal of Technology Transfer*. <https://doi.org/10.1007/s10961-013-9308-9>
8. Barrows, H. S. (1986). A taxonomy of problem-based learning methods. *Medical Education*, 20(6), 481–486. <https://doi.org/10.1111/j.1365-2923.1986.tb01386.x>
9. Barth, M., & Rieckmann, M. (2012). Academic staff development as a catalyst for curriculum change towards education for sustainable development: An output perspective. *Journal of Cleaner Production*, 26, 28–36. <https://doi.org/10.1016/j.jclepro.2011.12.011>

10. Belloum, Y., & Khemili, F. (2024). Sustainability-oriented Incubators: An Overview. *مجلة العلوم الإدارية والمالية*, 8(1), 34–46.
11. Bonfanti, A., Mion, G., Vigolo, V., & Crescenzo, V. D. (2025). Business incubators as a driver of sustainable entrepreneurship development: Evidence from the Italian experience. *International Journal of Entrepreneurial Behavior & Research*, ahead-of-print. <https://doi.org/10.1108/IJEBR-05-2024-0500>
12. Boufarha, M., & Djeddi, A. (2024). Business Incubators As An Innovative Mechanism To Support Startups In Algeria. *مجلة الرسالة للدراسات والبحوث الإنسانية*, 9(2), 134–144.
13. Bourn, D., & Soysal, N. (2021). Transformative Learning and Pedagogical Approaches in Education for Sustainable Development: Are Initial Teacher Education Programmes in England and Turkey Ready for Creating Agents of Change for Sustainability? *Sustainability*, 13(16). <https://doi.org/10.3390/su13168973>
14. Bowen, G. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, 9(2). <https://doi.org/10.3316/QRJ0902027>
15. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>
16. Byron, K. (2012). Creative reflections on brainstorming. *London Review of Education*, 10(2). <https://doi.org/10.1080/14748460.2012.691284>
17. Chen, C., Shahbaz, P., & Haq, S. ul. (2025). Transforming students' green behavior through environmental education: The impact of institutional practices and policies. *Frontiers in Psychology*, 15, 1499781. <https://doi.org/10.3389/fpsyg.2024.1499781>
18. Cohen, B., & Winn, M. I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. *Journal of Business Venturing*, 22(1), 29–49. <https://doi.org/10.1016/j.jbusvent.2004.12.001>
19. Demssie, Y. N., Biemans, H. J. A., Wesselink, R., & Mulder, M. (2023). Fostering students' systems thinking competence for sustainability by using multiple real-world learning approaches. *Environmental Education Research*, 29(2), 261–286.
20. Demssie, Y. N., Biemans, H. J. A., Wesselink, R., & Mulder, M. (2023). Fostering students' systems thinking competence for sustainability by using multiple real-world learning approaches. *Environmental Education Research*, 29(2), 261–286. <https://doi.org/10.1080/13504622.2022.2141692>
21. D'Escoffier, L. N., Guerra, A., & Braga, M. (2024). Problem-Based Learning and Engineering Education for Sustainability: Where we are and where could we go? *ResearchGate*. <https://doi.org/10.54337/ojs.jpblhe.v12i1.7799>

22. Diana Ailyn. (2024). Green accelerators and incubators and their role in scaling green startups.
ResearchGate.
https://www.researchgate.net/publication/382028207_Green_accelerators_and_incubators_and_their_role_in_scaling_green_startups
23. Ely, A. V. (2018). Experiential learning in "innovation for sustainability": An evaluation of teaching and learning activities (TLAs) in an international masters course. *International Journal of Sustainability in Higher Education*, 19(7), 1204–1219.
<https://doi.org/10.1108/IJSHE-08-2017-0141>
24. Fleming, T. (2018). Mezirow and the theory of transformative learning. *ResearchGate*.
https://www.researchgate.net/publication/325117850_Mezirow_and_the_theory_of_transformative_learning
25. Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. *Journal of Cleaner Production*, 198, 401–416.
<https://doi.org/10.1016/j.jclepro.2018.06.240>
26. Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, 16(1), 15–31. <https://doi.org/10.1177/1094428112452151>
27. Grosseck, G., Țiru, L. G., & Bran, R. A. (2019). Education for Sustainable Development: Evolution and Perspectives: A Bibliometric Review of Research, 1992–2018. *Sustainability*, 11(21), Article 21. <https://doi.org/10.3390/su11216136>
28. Hanisch, S., & Eirdosh, D. (2023). Behavioral Science and Education for Sustainable Development: Towards Metacognitive Competency. *Sustainability*, 15(9), Article 9. <https://doi.org/10.3390/su15097413>
29. Harvey, M., Walkerden, G., Semple, A., McLachlan, K., Lloyd, K., & Bosanquet, A. (2025). Reflecting on reflective practice: Issues, possibilities and guidance principles. *Higher Education Research & Development*, 0(0), 1–9.
<https://doi.org/10.1080/07294360.2025.2463517>
30. Henry, M., Bauwens, T., Hekkert, M. P., & Kirchherr, J. (2019). A Typology of Circular Start-Ups: An Analysis of 128 Circular Business Models. *ResearchGate*.
<https://doi.org/10.1016/j.jclepro.2019.118528>
31. Idowu, O. E. (2017). Positivism versus Interpretivism: Fire-war on the Methodological Approach in the Study of Organisational Culture. *International Journal of Human Resource Studies*, 6(4), Article 4. <https://doi.org/10.5296/ijhrs.v6i4.10403>

32. Jia, L., Tianhong, L., & Yuan, L. (2023). Optimizing Higher Education for Sustainable Development. *Optimizing Higher Education for Sustainable Development*. <https://encyclopedia.pub/entry/47106>
33. Jung, J., Ko, H., & Kim, Y. J. (2025). How Do Startups Drive Innovations Towards Sustainability? *Sustainability*, 17(4), Article 4. <https://doi.org/10.3390/su17041693>
34. Karadayi, T., Yazici, S., & Omur, G. A. (2025). Climate Change and Entrepreneurship: A Review and Research Agenda. *ResearchGate*. <https://doi.org/10.1002/joe.22281>
35. Kato, K., & Arinaitwe, J. (2024). Green Entrepreneurship and Sustainable Business Practices: A Case Study of Eco-friendly Startups. *ResearchGate*. https://www.researchgate.net/publication/385205100_Green_Entrepreneurship_and_Sustainable_Business_Practices_A_Case_Study_of_Eco-friendly_Startups_in
36. Kelly, K. (2012). The Batavia Industrial Center: The Hatching of the World's First Business Incubator. *ResearchGate*. https://www.researchgate.net/publication/290579070_The_Batavia_Industrial_Center_The_Hatching_of_the_World's_First_Business_Incubator
37. Kirkwood, J., & Walton, S. (2010). What motivates ecopreneurs to start businesses? *International Journal of Entrepreneurial Behavior & Research*, 16(3), 204–228. <https://doi.org/10.1108/13552551011042799>
38. Klaus, F., & Irina, T. (2020). Impacts of promoting sustainable entrepreneurship in generic business plan competitions. *ResearchGate*. <https://doi.org/10.1016/j.jclepro.2020.122076>
39. Kollmuss, A., & Agyeman, J. (2025). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239–260. <https://doi.org/10.1080/13504620220145401>
40. Lamperti, S., Courrent, J.-M., & Sammut, S. (2025). Sustainability orientation in business Incubators: Empirical Evidence from France. *Journal of Business Research*, 194, 115377. <https://doi.org/10.1016/j.jbusres.2025.115377>
41. Lee, K., Roh, T., Kim, J., Park, S., & Bae, Y. (2025). Unpacking sustainability in start-ups: A systematic review and research agenda. *Discover Sustainability*, 6(1), 218. <https://doi.org/10.1007/s43621-025-01070-7>
42. Linda, B., & Klaus, F. (2015). Green start-ups – a new typology for sustainable entrepreneurship and innovation research. *ResearchGate*. https://doi.org/10.24840/2183-0606_003.003_0009

43. Lorelli, S. Nowell, Jill, M. Norris, Deborah, E. W., & Nancy, J. M. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. <https://journals.sagepub.com/doi/full/10.1177/1609406917733847>
44. Makki, A. A., Alidrisi, H., Iqbal, A., & Al-Sasi, B. O. (2020). Barriers to Green Entrepreneurship: An ISM-Based Investigation. *Journal of Risk and Financial Management*, 13(11), Article 11. <https://doi.org/10.3390/jrfm13110249>
45. Marcos-Sánchez, R., Ferrández, D., & Morón, C. (2022). Systems Thinking for Sustainability Education in Building and Business Administration and Management Degrees. *Sustainability*, 14(19), Article 19. <https://doi.org/10.3390/su141911812>
46. Mohammed, A., Namreen, A. V. A., & Prasad Mahale. (2024). Green Entrepreneurship Education: Fostering Sustainable Innovation in Business Management Programs. *ResearchGate*. <https://doi.org/10.56726/IRJMETs49188>
47. Montanari, S., Agostini, E., & Francesconi, D. (2023). Are We Talking about Green Skills or Sustainability Competences? A Scoping Review Using Scientometric Analysis of Two Apparently Similar Topics in the Field of Sustainability. *Sustainability*, 15(19), Article 19. <https://doi.org/10.3390/su151914142>
48. Murphy, L. R., Daly, S. R., & Seifert, C. M. (2023). Idea characteristics arising from individual brainstorming and design heuristics ideation methods. *International Journal of Technology and Design Education*, 33(2), 337–378. <https://doi.org/10.1007/s10798-021-09723-0>
49. Neumann, T. (2023). Are greener start-ups of superior quality? The impact of environmental orientation on innovativeness, growth orientation, and international orientation. *Journal of Innovation and Entrepreneurship*, 12(1), 60. <https://doi.org/10.1186/s13731-023-00330-y>
50. Nicholls, D. (2009). Qualitative research: Part two - Methodologies. *International Journal of Therapy and Rehabilitation*, 16(11), 586–592. <https://doi.org/10.12968/ijtr.2009.16.11.44939>
51. Ockwell, D., Whitmarsh, L., & O'Neill, S. (2009). Reorienting Climate Change Communication for Effective Mitigation: Forcing People to be Green or Fostering Grass-Roots Engagement? *Science Communication*, 30(3), 305–327. <https://doi.org/10.1177/1075547008328969>
52. O'Grady, M. (2023). Transformative education for sustainable development: A faculty perspective. *Environment, Development and Sustainability*. <https://doi.org/10.1007/s10668-023-03609-y>

53. Onyeaka, H., & Akinsemolu, A. A. (2025). Advancing green education in MENA region: Challenges, opportunities and best practices. *Sustainable Development*, 33(1), 1354–1365. <https://doi.org/10.1002/sd.3182>
54. Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5), 533–544. <https://doi.org/10.1007/s10488-013-0528-y>
55. Palinkas, L. A., Sarah, M. H., Carla, A. G., Jennifer, P. W., Naihua, D., & Kimberly, H. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Administration and Policy in Mental Health and Mental Health Services Research*. <https://doi.org/10.1007/s10488-013-0528-y>
56. Patricia, F., Gene, E. fusch, & Lawrence, R. N. (2018). Denzin's Paradigm Shift: Revisiting Triangulation in Qualitative Research. *ResearchGate*. <https://doi.org/10.5590/JOSC.2018.10.1.02>
57. Pervin, N., & Mokhtar, M. (2022). The Interpretivist Research Paradigm: A Subjective Notion of a Social Context. *International Journal of Academic Research in Progressive Education and Development*, 11(2), Pages 419-428. <https://doi.org/10.6007/IJARPED/v11-i2/12938>
58. Petri, J. M., de Francisco, A. C., Martins de Souza, A., de Lima, J. D., & Trojan, F. (2025). How Do Start-Ups Develop Circular Business Models? A Systematic Literature Review. *Sustainability*, 17(3), Article 3. <https://doi.org/10.3390/su17031246>
59. Ponelis, S. R. (2015). Using Interpretive Qualitative Case Studies for Exploratory Research in Doctoral Studies: A Case of Information Systems Research in Small and Medium Enterprises. *International Journal of Doctoral Studies*, 10, 535–550.
60. Redman, A., & Wiek, A. (2021). Competencies for Advancing Transformations Towards Sustainability. *Frontiers in Education*, 6. <https://doi.org/10.3389/educ.2021.785163>
61. Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, 4(2), 155–169. <https://doi.org/10.1007/BF01405730>
62. Rooney-Varga, J. N., Serman, J. D., Fracassi, E., Franck, T., Kapmeier, F., Kurker, V., Johnston, E., Jones, A. P., & Rath, K. (2018). Combining role-play with interactive simulation to motivate informed climate action: Evidence from the World Climate

- simulation. *PLOS ONE*, 13(8), e0202877.
<https://doi.org/10.1371/journal.pone.0202877>
63. Rosário, A. T., & Raimundo, R. (2024). Sustainable Entrepreneurship Education: A Systematic Bibliometric Literature Review. *Sustainability*, 16(2), Article 2.
<https://doi.org/10.3390/su16020784>
 64. Ruslin, R., Seapudin, M., & Firdiansyah, A. (2022). Semi-structured Interview: A Methodological Reflection on the Development of a Qualitative Research Instrument in Educational Studies. <https://doi.org/10.9790/7388-1201052229>
 65. Samuel, M., Catherine, N., & Joy, J. (2018). Business Incubators- The Missing Link to Small Business Survival. *ResearchGate*.
https://www.researchgate.net/publication/330777083_Business_Incubators-The_Missing_Link_to_Small_Business_Survival
 66. Samuel Carvalho de Azevedo Marques, Hugo Saba, Ingrid Winkler, & Aloísio S. Nascimento Filho. (2024). Business Incubators and Sustainability: A Literature Review. *ResearchGate*. <https://doi.org/10.22161/ijaers.99.51>
 67. Selmane, K., Chatter, C., & Salmi, S. (2025). Ecologization and Its Socioeconomic Implications: Exploring the Influence of Environmental Values on Students' Attitudes Toward Green Entrepreneurship. *SocioEconomic Challenges*, 9(1), 130–142.
[https://doi.org/10.21272/sec.9\(1\).130-142.2025](https://doi.org/10.21272/sec.9(1).130-142.2025)
 68. Stern, P. C. (2000). Toward a Coherent Theory of Environmentally Significant Behavior.
 69. Stokes, J. M., & Craig, C. D. (2022). Critical Reflection as Online Educators.
<https://doi.org/10.51357/CBVY1270>
 70. Tang, K. H. D. (2022). A model of behavioral climate change education for higher educational institutions. *Environmental Advances*, 9, 100305.
 71. Thomas, D. R. (2006). A General Inductive Approach for Analyzing Qualitative Evaluation Data. *American Journal of Evaluation*, 27(2), 237–246.
<https://doi.org/10.1177/1098214005283748>
 72. Tingström, J., Swanström, L., & Karlsson, R. (2006). Sustainability management in product development projects – the ABB experience. *Journal of Cleaner Production*, 14(15), 1377–1385. <https://doi.org/10.1016/j.jclepro.2005.11.027>
 73. Valdes-Ramirez, D., de Armas Jacomino, L., Monroy, R., & Zavala, G. (2024). Assessing sustainability competencies in contemporary STEM higher education: A

- data-driven analysis at Tecnológico de Monterrey. *Frontiers in Education*, 9. <https://doi.org/10.3389/feduc.2024.1415755>
74. Walsh, G. (2019). Exploring technology business incubators and their business incubation models: Case studies from China. *The Journal of Technology Transfer*. <https://doi.org/10.1007/S10961-019-09759-4>
 75. Wendy, S. (2014). Exploration of an Emerging Sustainable Business Model: The B Corp Model. *ResearchGate*. <https://doi.org/10.5840/iabsproc20142530>
 76. Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: A reference framework for academic program development. *Sustainability Science*, 6(2), 203–218. <https://doi.org/10.1007/s11625-011-0132-6>
 77. Wisdom, C. O. (2024). Adapting Theories of Pro-environmental Behaviours to Environmental Activism: A Review of Relevant Theoretical Frameworks. *ResearchGate*. <https://doi.org/10.52589/AJSSHR-QV4MGOXG>
 78. Yuan, L., Tianhong, L., & Jia, L. (2023). Optimizing Higher Education for Sustainable Development. <https://encyclopedia.pub/entry/47106>
 79. Zahrani, A. A. (2022). Promoting sustainable entrepreneurship in training and education: The role of entrepreneurial culture. *Frontiers in Environmental Science*, 10. <https://doi.org/10.3389/fenvs.2022.963549>

Books

1. Barth, M., Michelsen, G., Rieckmann, M., & Thomas, I. (2015). *Routledge Handbook of Higher Education for Sustainable Development*. Routledge.
2. Berg, B. L., & Lune, H. (2017). *Qualitative research methods for the social sciences* (Ninth edition). Pearson.
3. Donald A. Schon. (1987). *The Reflective Practitioner: How Professionals Think In Action*. https://www.researchgate.net/publication/242371022_The_Reflective_Practitioner_How_Professionals_Think_In_Action
4. K. Denzin, N. (2001). *Interpretive Interactionism*. SAGE Publications, Inc. <https://doi.org/10.4135/9781412984591>

Chapters in Edited Books

1. Barth, M., & Rieckmann, M. (2016). State of the Art in Research on Higher Education for Sustainable Development. In M. Barth, G. Michelsen, M. Rieckmann, & I. Thomas (Eds.), *Routledge Handbook of Higher Education for Sustainable Development*. https://www.researchgate.net/publication/283572415_State_of_the_Art_in_Research_on_Higher_Education_for_Sustainable_Development
2. Cavadas, B., & Linhares, E. (2022). Using a Problem-Based Learning Approach to Develop Sustainability Competencies in Higher Education Students. In W. Leal Filho, A. M. Azul, F. Doni, & A. L. Salvia (Eds.), *Handbook of Sustainability Science in the Future: Policies, Technologies and Education by 2050* (pp. 1–28). Springer International Publishing. https://doi.org/10.1007/978-3-030-68074-9_86-1
3. Domańska, A. (2023). Green Entrepreneurship. In R. Brinkmann (Ed.), *The Palgrave Handbook of Global Sustainability* (pp. 1835–1850). Springer International Publishing. https://doi.org/10.1007/978-3-031-01949-4_113
4. Qudrat-Ullah, H. (2024). Systems Thinking and Sustainability Education. In *Systems Thinking for Sustainability Education in Business Schools* (pp. 11–30). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-61077-6_2
5. Saari, U. A., & Joensuu-Salo, S. (2019). Green Entrepreneurship. In W. Leal Filho, A. M. Azul, L. Brandli, P. G. Özuyar, & T. Wall (Eds.), *Responsible Consumption and Production* (pp. 1–11). Springer International Publishing. https://doi.org/10.1007/978-3-319-71062-4_6-1
6. Schwandt, T. (2000). Three epistemological stances for qualitative inquiry: Interpretivism, hermeneutics, and social constructionism. In *Handbook of Qualitative Research*. <https://www.uky.edu/~addesa01/documents/Schwandt.pdf>
7. Sivapalan, S., & Speight, S. (2019). Role of Education for Sustainable Development. In W. Leal Filho (Ed.), *Encyclopedia of Sustainability in Higher Education* (pp. 1423–1428). Springer International Publishing. https://doi.org/10.1007/978-3-030-11352-0_28

Research Methodology Sources

1. Adissu, K., Kenenisa, L., & Biniam, G. A. (2022). A Comparative Review of Qualitative Research: A Guide to Design and Implementation and Implementation. https://www.researchgate.net/publication/362387090_A_Comparative_Review_of_Qualitative_Research_A_Guide_to_Design_and_Implementation_and_Implementation
2. Alharahsheh, H. H., & Pius, A. (2020). A Review of key paradigms: Positivism VS interpretivism. *Global Academic Journal of Humanities and Social Sciences*, 2(1).
3. Braun, V., & Clark, V. (2006). Using thematic analysis in psychology. https://www.researchgate.net/publication/235356393_Using_thematic_analysis_in_psychology
4. Creswell, J. W., & Cheryl, N. P. (2018). Qualitative Inquiry and Research Design, Choosing Among Five Approaches. <https://uk.sagepub.com/en-gb/eur/qualitative-inquiry-and-research-design/book266033>
5. George, T. (2022, January 27). Structured Interview | Definition, Guide & Examples. Scribbr. <https://www.scribbr.com/methodology/structured-interview/>
6. Nasrin, P., & Mahani, M. (2022). The Interpretivist Research Paradigm: A Subjective Notion of a Social Context. https://www.researchgate.net/publication/360180378_The_Interpretivist_Research_Paradigm_A_Subjective_Notion_of_a_Social_Context

Reports and Institutional Publications

1. APRI. (2024). Green technology and youth employment in Africa: A transformative opportunity. <https://afripoli.org/green-technology-and-youth-employment-in-africa-a-transformative-opportunity>
2. CEDAW. (1980). United Nations: Convention on the Elimination of All Forms of Discrimination Against Women. *International Legal Materials*, 19(1), 33–45. <https://doi.org/10.1017/S0020782900043448>
3. CEDEFOP. (2010). Skills for green jobs Developing a low-carbon economy depends on improving existing skills rather than specialised green skills.
4. Cedefop – European Centre for the Development of Vocational Training. (2012). Green skills and environmental awareness in vocational education and training. Publications Office. <https://data.europa.eu/doi/10.2801/78825>

5. GIZ. (2019). GIZ-green-inclusive-business-toolbox-2019.pdf. <https://www.enterprise-development.org/wp-content/uploads/GIZ-green-inclusive-business-toolbox-2019.pdf>
6. Moberg, K., & Emilie, K. H. (2021). Sustainable entrepreneurship, A study of how the term is understood and implemented in Danish universities. Danish Foundation for Entrepreneurship. <https://undervisningsportalen.imgix.net/k1hl441s/forside-sustainable-entrepreneurship-merged.pdf>
7. Mühle, C., Berrones-Flemmig, C. N., & Hattula, C. (2024). Sustainability in start-ups: A literature review. IU Discussion Papers - Business & Management, Article 3 (February 2024). <https://ideas.repec.org/p/zbw/iubhbm/284392.html>
8. OECD. (2022). Policies to Support Green Entrepreneurship: Building a Hub for Green Entrepreneurship in Denmark. OECD. <https://doi.org/10.1787/e92b1946-en>
9. OECD & European Centre for the Development of Vocational Training. (2014). Greener Skills and Jobs. OECD. <https://doi.org/10.1787/9789264208704-en>
10. REDOUANE, A., & MIGHRI, Z. (2022). The Role of University Business Incubators in Supporting Entrepreneurship in Algeria Case Study of Business Incubator Eloued University. Scribd. <https://www.scribd.com/document/856802045/The-Role-of-University-Business-Incubators-in-Supporting-Entrepreneurship-in-Algeria-Case-Study-of-Business-Incubator-Eloued-University>
11. UNESCO. (2024). Education for sustainable development: What you need to know | UNESCO. <https://www.unesco.org/en/sustainable-development/education/need-know>
12. United Nations. (2015). The Paris Agreement | UNFCCC. <https://unfccc.int/process-and-meetings/the-paris-agreement>

Theses and Dissertations

1. Chloe Hartmann. (2024). Exploring the potential of business incubators in fostering sustainability transitions.
2. Dutra, A. (n.d.). Critical Pedagogy for a Sustainable Future.
3. Johansson, & Reetta, H. (2024). Integration of Environmental Sustainability in Startups Business Models, A qualitative study on startup companies in the clean

technology industry in Sweden. <https://www.diva-portal.org/smash/get/diva2:1932814/FULLTEXT01.pdf>

Web Sources or Blog Articles

1. Alessandro, G., & Rosa, G. (2006). Business Incubators and New Venture Creation: Assessing Different Incubating Programmes. ResearchGate. Retrieved 2025-05-17 17:26:12.
https://www.researchgate.net/publication/228316606_Business_Incubators_and_New_Venture_Creation_Assessing_Different_Incubating_Programmes
2. Brainstorming. (2025). In Wikipedia. Retrieved 2025-05-16 19:23:19
<https://en.wikipedia.org/w/index.php?title=Brainstorming&oldid=1288781186>
3. Charlotte, N. (n.d.). Interpretivism Paradigm & Research Philosophy. Retrieved 2025-05-15 17:51:00, from <https://www.simplypsychology.org/interpretivism-paradigm.html>. <https://doi.org/10.1080/13504622.2022.2141692>
4. EDJO, M.(2023). Algeria Cuts Taxes, Introduces Exemptions to Spur Digital Innovation. Retrieved 2025-05-17 00:51:10 <https://www.wearetech.africa/en/fils-uk/news/tech/algeria-cuts-taxes-introduces-exemptions-to-spur-digital-innovation>
5. FasterCapital. (n.d.). The Rise Of Green Entrepreneurship—FasterCapital. Retrieved 2025-05-17 18:03:46, from <https://fastercapital.com/topics/the-rise-of-green-entrepreneurship.html>
6. Green Entrepreneurship | SpringerLink. (n.d.). Retrieved 2025-05-15 17:36:51, from https://link.springer.com/referenceworkentry/10.1007/978-3-319-71062-4_6-1
7. Sidali, L. M. (2024, July 18). Plus de 14 000 auto-entrepreneurs recensés en Algérie, annonce Yacine Oualid—Le Chiffre d'Affaires. Retrieved 2025-05-17 00:54:07
<https://lechiffredaffaires.dz/plus-de-14-000-auto-entrepreneurs-recenses-en-algerie-annonce-yacine-oualid/>
8. Startup Ecosystem of Algiers | StartupBlink. (n.d.). Retrieved 2025-05-17 01:04:39, from <https://www.startupblink.com/startup-ecosystem/algiers-dz>
9. Tbilisi+35. (2012, August 31). Global Education Magazine. Retrieved 2025-05-12 20:49:46 <https://globaleducationmagazine.com/tbilisi35/>

10. What are the definitions, origins and measurement of circular economy? (n.d.).
FutureLearn. Retrieved 2025-05-17 16:24:08, from
<https://www.futurelearn.com/info/blog>

APPENDIX

SURVEY GUIDE

Appendix A: Survey Guide

1. French Version:

Guide d'entretien

Titre de l'étude :

L'éducation verte et l'adoption de pratiques durables dans les incubateurs et startups en Algérie

Groupe A : Incubateurs — Managers et Équipe

Section A : Informations générales

- Pouvez-vous vous présenter et décrire votre rôle au sein de l'incubateur ?
- Depuis combien de temps travaillez-vous dans cet incubateur ?
- Pouvez-vous décrire brièvement les programmes principaux de l'incubateur et ses secteurs d'activité ?

Section B : Intégration de l'éducation verte (RQ1)

- Comment l'éducation verte est-elle définie et comprise dans votre incubateur ?
- Quels types de formation ou de sensibilisation à la durabilité proposez-vous aux startups ?
- Qui est responsable de l'organisation de ces activités (équipe interne, formateurs externes) ?
- À quelle fréquence ces activités ont-elles lieu, et sont-elles obligatoires ?

Section C : Adoption de pratiques durables (RQ2)

- Comment soutenez-vous les startups dans l'adoption de pratiques durables ?
- Pouvez-vous donner des exemples concrets de startups qui ont réussi à mettre en œuvre des pratiques vertes grâce à votre accompagnement ?

Section D : Obstacles et défis (RQ3)

- Quels sont les principaux défis que vous rencontrez pour promouvoir l'éducation verte et la durabilité ?
- Faites-vous face à des obstacles techniques, financiers ou organisationnels ?

- Recevez-vous des soutiens externes (partenaires, institutions, ONG) ?

Section E : Facteurs de succès et leviers (RQ4)

- Quels facteurs ont facilité la réussite de vos initiatives en matière d'éducation verte ?
- Avez-vous constaté des changements dans la culture ou les attitudes des startups suite à ces initiatives ?

Section F : Recommandations et perspectives

- Quelles améliorations suggèreriez-vous pour renforcer les programmes d'éducation verte dans votre incubateur ?
- Recommanderiez-vous ce type de programme à d'autres incubateurs ? Pourquoi ?
- Auriez-vous un exemple de réussite ou une histoire marquante à partager ?

Groupe B : Startups accompagnées par l'incubateur

Section A : Informations générales

- Pouvez-vous vous présenter et décrire votre rôle au sein de la startup ?
- Depuis combien de temps êtes-vous accompagné par l'incubateur ?
- Pouvez-vous décrire brièvement l'activité principale de votre startup ?

Section B : Expérience de l'éducation verte (RQ1)

- Quelle a été votre expérience des formations ou sensibilisations liées à la durabilité proposées par l'incubateur ?
- Quels sujets ou sessions vous ont semblé les plus utiles et pertinents pour votre startup ?

Section C : Mise en œuvre de pratiques durables (RQ2)

- Quelles pratiques durables avez-vous mises en place au sein de votre startup ?
- Comment l'incubateur vous a-t-il aidé ou inspiré à les adopter ?

Section D : Obstacles et défis (RQ3)

- Quelles ont été les principales difficultés rencontrées pour appliquer des pratiques durables ?
- Quelles formes de soutien supplémentaire (technique, financier, accompagnement) auraient pu vous aider ?

Section E : Facteurs de succès et leviers (RQ4)

- Qu'est-ce qui a facilité la mise en œuvre des pratiques durables dans votre startup ?
- Quels bénéfices avez-vous constatés (économiques, environnementaux, image de marque) ?

Section F : Recommandations et perspectives

- Quelles recommandations feriez-vous pour améliorer l'accompagnement à la durabilité dans l'incubateur ?
- Conseilleriez-vous à d'autres startups de suivre ces programmes ? Pourquoi ?
- Auriez-vous un témoignage ou un exemple concret à partager ?

2. English Version:

Title of the study:

Green Education and the Adoption of Sustainable Practices in Algerian Incubators and Startups

Target groups:

- Incubator Managers and Staff (Category A)
- Startup founders (Category B)

Introduction to read to participants

- **Objective:** To explore how green education is integrated into incubators and how it supports startups in adopting sustainable practices, while identifying key barriers and enablers.
- **Confidentiality:** All responses will remain confidential and anonymized; they will be used solely for academic purposes.

- **Consent:** Verbal or written consent will be requested before starting the interview, including permission for audio recording to ensure accurate transcription.

Category A: Incubator Managers and Staff

Section A: General Information

- A.1. Please introduce yourself and describe your role in the incubator.
- A.2. How long have you been working at the incubator?
- A.3. Can you briefly describe the incubator's main programs and sectors of focus?

Section B: Green Education Integration (RQ1 & RQ2)

- A.4. How is green education defined and understood within the incubator?
- A.5. What types of training or awareness activities on sustainability are offered to startups?
- A.6. Who is responsible for organizing or delivering these activities? Internal staff or external trainers?
- A.7. How often are these initiatives conducted, and are they mandatory?

Section C: Supporting Sustainable Practices (RQ1)

- A.8. How does the incubator support startups in adopting sustainable practices?
- A.9. Do you think green education has influenced the startups' sustainability actions? If yes, how?

Section D: Barriers and Challenges (RQ3)

- A.10. What are the main challenges you face in promoting sustainability and green education?
- A.11. Are there technical, financial, or organizational barriers?
- A.12. Have you received external support from institutions, NGOs, or international programs?

Section E: Enablers and Success Factors (RQ4)

- A.13. What factors have helped make your green education initiatives successful?
- A.14. Have you observed changes in the incubator's culture or the startups' attitudes as a result?

Section F: Suggestions and Recommendations

- A.15. What improvements would you suggest to strengthen green education at the incubator?

A.16. Would you recommend other incubators adopt similar sustainability programs? Why?

A.17. Is there a specific success story or example you would like to share?

Category B: Startup Team Members

Section A: General Information

B.1. Please introduce yourself and describe your role in the startup.

B.2. How long have you been engaged with the incubator?

B.3. Can you briefly describe your startup and its activities?

Section B: Experience with Green Education (RQ1 & RQ2)

B.4. How have you experienced green education or sustainability training at the incubator?

B.5. Which topics or sessions were most useful or relevant to your startup?

Section C: Applying Sustainable Practices (RQ1)

B.6. What sustainable practices have you implemented in your startup, and why?

B.7. How has the incubator's support influenced your adoption of these practices?

Section D: Barriers and Challenges (RQ3)

B.8. What were the main difficulties you faced in applying sustainable practices?

B.9. What kinds of support (technical, financial, training) would have helped?

Section E: Enablers and Success Factors (RQ4)

B.10. What helped you successfully implement sustainability practices?

B.11. Have you seen benefits for your business from adopting these practices?

Section F: Suggestions and Recommendations

B.12. What suggestions would you make to improve the incubator's sustainability support?

B.13. Would you recommend other startups participate in green education programs? Why?

B.14. Is there a particular example or experience you would like to share?

Thematic Grid

Thematic Area (RQ)	Sub-theme	Indicators (Interview Questions)	Incubators (A)	Startups (B)
RQ1: Green Education Integration	Definition and understanding of green education	How green education is defined and perceived	A.4	B.4
	Types of training and topics covered	Types of sustainability topics and training received	A.5	B.5
	Delivery methods and responsibilities	Who delivers the training, how, and frequency	A.6, A.7	B.4, B.5
RQ2: Adoption of Sustainable Practices	Sustainable practices supported or adopted	Sustainable practices implemented internally or externally	A.8, A.9	B.6, B.7
	Influence of green education on behavior	How education affected startup operations and practices	A.9	B.7, B.6
RQ3: Barriers and Challenges	Internal organizational barriers	Challenges in delivering or applying sustainability initiatives	A.10, A.11	B.8, B.9
	Technical and financial constraints	Financial, technical, or logistical obstacles	A.11	B.9
	External or institutional support received	Support from partners, networks, or institutions	A.12	B.10
RQ4: Enablers and Success Factors	Success factors and enabling conditions	Internal and external factors supporting sustainability success	A.13, A.14	B.11, B.12
	Cultural or organizational shifts	Changes in team motivation, organizational culture	A.14	B.12

Exploratory: Recommendations and Future Directions	Suggested improvements and Recommendations for scaling and policy	Suggestions to improve programs, successful examples Recommendations for other incubators, startups,	A.16, A.17,	B.14
---	---	---	-------------	------